

Christoph Bode, Rainer Dietrich
Future Narratives

Narrating Futures

Edited by
Christoph Bode

Volume 1

Christoph Bode, Rainer Dietrich
(with material by Jeffrey Kranhold)

Future Narratives



Theory, Poetics, and Media-Historical Moment

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Preface and Acknowledgements

The “Narrating Futures (NAFU)” project was funded through an Advanced Investigator Grant of the European Research Council. The funding period was April 1, 2009 through March 31, 2012. My co-researchers during all this time were Sebastian Domsch, Jeffrey Kranhold, Felicitas Meifert, Kathleen ‘Katie’ Singles, and Sabine Schenk.

The fundamental idea of “Narrating Futures” is a very simple one: as a rule, narratives have events as their minimal units. But there is a certain, hitherto undiscovered corpus of narratives that have, in addition to events, one special feature, indeed *differentia specifica*, that other narratives don’t have: they have nodes. A node is a situation that allows for more than one continuation. The simplest kind of node is a bifurcation, but most nodes have more than just two continuations. If a narrative has at least one node, then we call it a ‘Future Narrative’ (FN), in contradistinction to narratives that have ‘only’ events – they are ‘Past Narratives’ (PN). So the definition of a FN is a purely technical one: if a narrative has a least one node, it’s in – if not, it’s out.

One of the resulting differences between FNs and PNs is that, whereas PNs are uni-linear, FNs are, by definition, multi-linear. One of the exciting aspects of FNs is that the concept cuts across all media boundaries: you find FNs in printed books, in movies, in games, or in computer simulations. Another exciting aspect is that it bridges the fiction-/non-fiction divide; or, if I may switch my metaphors: FNs can be found on both sides of the fence.

From a narratological point of view, the problem with FNs is that practically all the narratology we have is derived from the corpus of Past Narratives. The NAFU research project promised to address this situation and – given enough money and three years’ time – to come up with a general and abstract theory and poetics of FNs. This is what this first volume of the *Narrating Futures* series purports to offer.

At the same time, while we were confident and unwavering in our optimism that such a general theory of FNs could be sketched, we also saw the need to delineate concretely how FNs are refracted through the different media. So our drive was directed both towards abstraction and towards the concrete, for we could not help but notice that FNs, while still one corpus, are also media-sensitive to a considerable degree.

That is why volume 1 is followed and complemented by volumes 2 through 5, which show, respectively, how FNs ‘work’ in print and digiture, in film and new visual media, in computer and online games, and, in volume 5, how the subgenre of alternate histories (novels of the ‘what if?’ kind) is theoretically and practically

related to FNs (some alternate history novels are FNs, and some FNs are alternate histories – but the full story is a bit more complex).

As we were working through masses of material, we realized that the media-theoretical order of this series also reflects a media-historical dimension. There is something in the sequence of ‘printed book – movie – interactive visual medium – complex electronic game’ that suggests, if not an evolution or teleology, at least a discernible trend towards the possibility of ever greater orchestration of FNs and of an increase of what we have come to call ‘nodal power’, that is, the degree of openness that any nodal situation offers. We felt that this had to be addressed especially in a media-historical sketch towards the end of volume 1, because it would have been systematically displaced in any of the following four volumes.

That is why volume 1 appears as it does: part one, written by me, offers a first blueprint of a theory and a poetics of FNs. True to the claim that if, in spite of all differences in appearance, the corpus of FNs is defined by one exclusive feature, viz. that a FN has at least one node, it should be possible to offer a formal, most abstract description of how a FN ‘works’ in general, of what the architecture of FNs looks like. This is what is attempted in part two of this volume, which was written by Rainer Dietrich on the basis of material left by Jeffrey Kranhold. The relation of these two parts can be characterized as follows: whereas part one is a narrative, part two is an abstraction based on Mathematical Graph Theory. Part three, written again by me, is the media-historical sketch just mentioned. It offers a tentative explanation of the curious fact that, although all the necessary ingredients for the full-scale emergence of FNs seem to have appeared between 1660 and 1720, it still took the corpus of FNs another 250 years or so to materialize and take off and then, all of a sudden, bloom and mushroom into the dominating corpus it now is. For it is easy to see that it is not only the future that belongs to FNs – it’s already here: *the present is the period of FNs, for we are increasingly thinking in terms of possibility, contingency, openness, multiple paths, tipping points and feedbacks, and this simply cannot be communicated in a uni-linear form.*

In the course of more than three years, one incurs many debts of gratitude. My first words of thanks go to Angelos Chaniotis, formerly of All Souls, Oxford, now at the Princeton Institute for Advanced Study, for encouraging me to go for an ERC Advanced Investigator Grant. Without him, no NAFU. Next in line are the six anonymous reviewers for the ERC, who gave me 7.9 out of 8 for my research proposal and personal research profile. I felt understood and appreciated.

NAFU has been a truly collaborative effort. We knew so little. We explored largely unmapped territory, because – hey! – that’s what research should be all about. I learnt so much. I wish to thank all of my research team for this unique experience, and Rainer Dietrich for coming to the rescue when help was sorely needed.

Over a period of more than just the 36 months of the funding period, we had dozens and dozens of most inspirational conversations with interested colleagues and enthusiastic supporters. It is impossible to mention all by name, but allow me to single out at least a few and assure the rest: none of you is forgotten. The contributions of Espen Aarseth, Marie-Laure Ryan, and Cornel Zwierlein have been invaluable: thank you so much for your time, your questions and comments, especially when they were critical – for we needed that kind of feedback, too. Thanks also to Andreas Blüml, whose enthusiasm and support was exceptional.

Some colleagues invited me to give early presentations of our research. They include Mark Bruhn of Regis University, Denver, CO; Andrew Johnston of the Freie Universität Berlin; and Jeffrey Cox and Jill Heydt-Stevenson of the University of Colorado, Boulder. An introductory talk and discussion were also given, fairly early on, at LMU's *Center for Advanced Studies*, which also hosted a wind-up one-day conference in March 2012, during which our research results were first given to the public, with valuable external contributions by Espen Aarseth and Cornel Zwierlein.

I was honoured and intrigued to find the interest of two of the biggest insurance companies in the world, Allianz and Munich Re, and I should like to deeply thank Dr. Volker Deville, Executive Vice President of the former, and Dr. Michael Menhart, Head of Economic Research of the latter, as well as Dr. Christian Lahnstein, also Munich Re, specialist for analyzing fundamental issues relating to the topic of social influences on liability and insurance: the hours I spent with all three of them were unusually productive and illuminating. Most of all I liked their surprise at the fact that a literary studies man should be interested in these matters.

My sojourn at the *Potsdam Institute for Climate Impact Research* (PIK) in November 2011 was one of the most transformative experiences during the time of this research project. It wasn't so much the experience of giving a lecture under the grand cupola of the old, historic observatory on the *Telegrafenberg* to an unexpectedly captivated audience of climatologists, mathematicians, physicians, geographers, philosophers, media experts and the like, as the intense interest they expressed in innumerable group and face-to-face discussions, which sometimes extended until well after sunset. After all, the talk I gave was only my entrance ticket – I had come to *learn from them*, and I was rewarded beyond the wildest expectations. I should like to thank the director of the PIK, Prof. Hans Joachim Schellnhuber, for all the support and engaging discussions; Dr. Jörg Pietsch, Dietmar Gibietz, who proudly introduced me to the holy of holies, Dr. Veronika Huber, Margret Boysen, Dr. Valeria Jana Schwanitz, Prof. Jürgen Kropp, Heike Munderloh, Heiko Martens, Dr. Bernd Hezel, Christiane Hütter (greetings to

the Egg!), Michael Flechsig, Mareike Schodder, Prof. Stefan Rahmstorf, Dr. Katja Frieler, Dr. Andrey Ganopolski and Dr. Armin Haas. But most of all I should like to thank Eva Rahner for organizing it all and for flexibly adjusting my schedule whenever new demands for interviews and encounters were filed. It almost felt like a homecoming.

Another magic location, this time for the whole NAFU research group, was the Seminar Abtei Frauenwörth on Frauenchiemsee, where we spent two immensely intensive weekends in the seclusion of a convent, which helped us to decisively hone our concepts and coordinate our approaches. More importantly, Frauenchiemsee really gave us a new sense of purpose and welded us together as a group. I am particularly indebted to Sister Scholastica for being such a wonderful host and for conversations that went beyond the mundane and secular.

Meanwhile, back home at LMU Munich, I should like to mention in particular Dr. Brigitte Weiss-Brummer, head of LMU's unit for international research funding, and her team: her help in getting NAFU going and support in sorting out problems with other units of the administration of LMU was invaluable, as was the steadfast support of the vice-chancellor of LMU Munich, Dr. Christoph Mülke, whose interventions will not be forgotten. Thanks also to Klaus Held, the librarian of our departmental library, who did not tire of ordering and signing in books that sometimes had very little relation to Eng. Lit., but who did not mind.

Down in the mines, the NAFU research team were helped by student assistants, who not only procured, copied, and scanned material, but who, before long, took part in our discussions, read our drafts, commented and corrected us – in short, were every inch a part of the collective effort. Their names are: Lorenz Beyer, Tarek Khodr, Claudia Köpfer, Anna Kunde, Lilian Loke, Eva Monning, Sandra Steinke, Barbara Tautz, and Maj Wenk-Wolff. We are more than grateful to all of you, but special thanks go to Sophia Hager and Isabel Schneider for the proofreading of volume 1, to Chrissy Fleps for her work on the index, and to Heidrun Patzak for her meticulous proofreading of all five volumes.

Since the NAFU research project received no support from the central administration of its host institution in the actual project management and its financial management, all this was exclusively left to and carried out by the Principal Investigator himself and by his secretary, Doris Haseidl. If there is one person without whom the whole project could not have been run, this person is Doris Haseidl, who, with her unflinching optimism, pragmatism, and superhuman radiance, more than once proved the mainstay of the entire venture. I cannot thank her enough.

Our editors at Walter de Gruyter were Dr. Manuela Gerlof and Christina Riesenweber. It is true that the NAFU team would have preferred, parallel to the publication in book form, an open-access publication of our own NAFU Wiki, which

served us so well as a research team forum in the process of our research – there would have been less of a contradiction between what ‘Narrating Futures’ is all about and the form of its presentation, and we would have loved to invite the interested public to ‘play on’ what we started. But there are, as of now, certain irresolvable conflicts of interest between academic publishers and the researchers (besides, our Wiki would have needed a radical overhaul, for which we simply did not have the time). In full recognition of the advantages of publishing with a renowned academic publisher and without reservation, we therefore opted for this format, knowing full well that the future holds more dynamic forms of sharing and exploring and adding to knowledge. The care taken of this publishing project at de Gruyter has been absolutely professional. I have never regretted to cooperate with them ever since Dr. Gerlof contacted me because she had heard of the NAFU project.

Originally this preface had two endings, an ironic and a sentimental one. I’ve scrapped the first. The remaining one is this: as many times before, my deepest gratitude goes to my family, to my wife for 25 years and steady partner for 35, Helga Doerks-Bode, and our children Jenny, Andreas, and Benjamin. In whichever version of the tale of my life, they are the ones that make a difference – and give meaning to it.

Christoph Bode

1 The Theory and Poetics of Future Narratives: A Narrative

The future is already here – it's just not very evenly distributed.
William Gibson

1.1 Future Narratives: A New Kind of Narrative

‘Narrating Futures’ is about a new, hitherto unidentified kind of narrative. The fact of its discovery is exciting in itself, but no less exciting is the key feature this new kind of narrative displays: it does not only *thematize* openness, indeterminacy, virtuality, and the idea that every ‘now’ contains a multitude of possible continuations. No, it goes beyond this by actually *staging* the fact that the future is a space of yet unrealized potentiality, or, technically speaking, a ‘possibility space’ (cf. Boyd 122) – and by allowing the reader/player to enter situations that fork into different branches and to actually *experience* that ‘what happens next’ may well depend upon us, upon our decisions, our actions, our values and motivations.

It might therefore be said that these narratives *preserve and contain* what can be regarded as defining features of future time, namely that it is yet undecided, open, and multiple, and that it has not yet crystallized into actuality. It is by virtue of their capability to do exactly this – to preserve the future *as future* – that these narratives are here called ‘Future Narratives’.

It is clear from the above that Future Narratives mark a fundamental and radical break away from traditional narratives. Most, though not all, narratives we know are concerned with past events, with something that has already happened – whether in reality or purportedly, i.e. in fiction. Such past narratives endow events with meaning by discursively aligning them with other events, thereby suggesting a meaningful story. It could be argued, and indeed it has been argued, that this is actually the main reason why humanity has *narratives* in the first place: they are *meaning-creating devices*, they make sense out of life, the universe, and everything. Past narratives are backward-looking processing practices (or pretend to be) and they mostly aim at a reduction of otherwise worrying or confusing complexity (although there is a fascinating sub-class of past narratives that aims at exactly the opposite).

By way of contrast, Future Narratives do not operate with ‘events’ as their minimal units. Rather, their minimal unit is at least one situation that allows for more than one continuation. We call this a ‘nodal situation’, or a ‘node’, for short.

Between these nodes (if a Future Narrative has more than one node) or before and after a node we still find events, linked with each other in normal narrative procedure (whatever may be called ‘normal’), but they are not what defines a Future Narrative as Future Narrative. That is the node. The node is what Future Narratives have – and other kinds of narrative do not have. If they can produce a node, they’re welcome to the club. But only if. A node is the *differentia specifica* of a Future Narrative.

The break away from past narratives that Future Narratives constitute is so radical that it might well be asked whether Future Narratives are still narratives. This question will be addressed in due time and it will be discussed with great seriousness, because it is a legitimate question. But the answer – and this will not surprise you since you know the title of this volume and the title of this series – will be in the affirmative. Our idea of ‘narrative’ in general is largely based on our knowledge of past narratives – understandably so, since that is the kind of narrative most familiar to us. But they are not the only ones. There’s a new kid in town. And what is more: this kid has been lurking there for quite a while now. The kid’s no stranger.

Why then do I say that this is a new, hitherto unidentified kind of narrative? Because, up until now, Future Narratives have never been identified as *a corpus in its own right*, as a class of narratives that is constituted and defined by one feature that, in contrast to all other kinds of narrative, they hold in common and that pertains to them alone: *nodes*. They contain situations that allow for more than one continuation; and by ‘contain’ we mean: they do not only *mention* such situations, but they *present* them, they *stage* them, so that you can enter them and *act* (except for in an interesting borderline case, which later on will help us hone our concepts and terminology).

You can find such narratives in print, you can find them in movies, you can find them in computer and online games, you find them in sophisticated simulations of complex real-life processes, in scenarios used by insurance companies and world climate change experts, by peak oil aficionados, politicians, and communicators. They are everywhere. They cut across all media and genre boundaries, they cut across the dividing line between fact and fiction, between the actual and the virtual. As I said: *they are everywhere*.

Why then is it that they have never been identified, up until now? One reason may well be that, exactly because they can be found practically everywhere, we have not seen them as *one corpus*, but only in their different manifestations. Fooled by their protean forms, deluded by conventional media and genre demarcations, stuck with the fiction-/non-fiction divide, we have not seen the enormous *spread* of Future Narratives, their awesome ubiquity. Our compartmentalisation of reality has backfired on us and we haven’t seen the wood for all

the trees. Camouflaged through their widely differing appearances – in books, in films, in games, in computer based simulations, in policy scenarios, etc. – Future Narratives have so far escaped detection and identification. That’s all over now. We have identified a new class, or set, of narratives that cuts across all media and genres as well as across the fiction-/non-fiction line. Their underlying principle is, in fact, very simple: what they have in common is that they operate with nodes, rather than with events only. We define them thus – and we call them: *Future Narratives*.

This new class of narratives and this new field of inquiry are therefore constituted by us. *As a class of objects of inquiry*, Future Narratives did not exist before they were identified as such. That is normal procedure. To be sure, as phenomena in the real world, they have been with us for quite a while. Everybody knows them in one manifestation or another. Yet no one has seen them as a class of their own before – what is more: as a class of discursive practices that is about to transform our society in absolutely unprecedented ways. For we are beginning to see a major sea change in the way we think of ourselves, of our past, of our options, our potential, of our futures, in the way we feel and experience the glorious and dreadful openness of existence. In whatever measure, Future Narratives are always about how we see ourselves in relation not to ‘things as they are’, but in relation to *things to come* – *in relation to things that are not (yet), in relation to what is in a state of becoming* (if indeed that can be called a ‘state’). We have crossed this threshold – it is happening already. Out there. It’s a fact. Surely not because this writer has identified a new kind of narrative. That claim would be presumptuous and ridiculous. Rather: the fact that in recent decades this phenomenon has gained such force and magnitude was the material precondition for the identification of its core element, the one feature that it has in all of its forms – *nodes*, not events, as basic units.

This – *and* some simple ideas and beliefs, like that one should not be deceived by appearances; that behind variety we can find simplicity; that to be a radical scientist means to go to the root of the matter, to arrive, by way of radical abstraction, at the deep structure that is underlying the plenitude of different forms; that a deep understanding of underlying structures will eventually filter into new applications; finally and fundamentally, that often what appears to be different can, in fact, be shown to be fundamentally *the same*. Which is, after all, what an *identification* is.

1.2 What Narratives Do for You

Up until now, it has been comparatively safe to say, ‘We speak of narration when at least two events are linked together in a language’ (note that this definition is wide enough to include, for example, the visual language of movies; basically, any sign sequence that can be read as conforming to a message-code dialectics [and this seems already implied in ‘sign sequence’] can be addressed as happening ‘in a language’) – ‘at least two’ because the mere statement of an isolated fact is not yet a narrative; and ‘linked together’ because the mere statement of two unconnected facts doesn’t constitute a narrative either. Narrative is the linguistic and mental linking of events (cf. Bode, *Novel* 10–14).

Note, too, how this does not differentiate between the tenses in which a narrative is told. It is a good thing that it doesn’t. For basically it does not matter whether the narrator (or any narrative instance believed to be the ‘source’ of the narrative) is reporting events that happened a long time ago or events that are happening right now – nor, for that matter, whether these events are real or fictional: as long as narrators link events in and through their discourse, they are narrating. (By the way: that is why they are called ‘narrators’.)

And in a way, it is still comparatively safe to say that narrative is the *linking of* (at least two) *events*. For Future Narratives, or FNs for short, do that as well. After all, that is why they are called *narratives*. But FNs go beyond that in *adding* nodes. And that is a total game-changer. Why? To answer this, we have to step back a bit and inspect and review, on a very fundamental level, how and to what end narratives other than FNs actually work.

The prime reason why they work so amazingly well is that it is ridiculously simple to link two events and give them a semblance of coherence, a semblance of cause-and-effect nexus. Often, the mere indication of a *temporal* sequence – first this, then that – is enough to trigger the idea that maybe this sequence is not only a coincidence, but that the two events are causally related. In fact, as David Hume argued, that is how the (illusionary) idea of causality is formed in the first place: we observe an event following upon another with sufficient frequency and then conclude – without any logical legitimacy – that the two are connected by necessity, as cause and effect: an unwarranted assumption, which, however, seems to have had some survival value for our species.

Narratives play on this software of ours, but with a vengeance: it suffices that they mention two events *only once* and, if need be, in their purely temporal relation only, and we already jump at the conclusion that there must be a connection between them: ‘The king died, and just a few days later the queen died too.’ Immediately we speculate: ‘Was it of grief? Had they caught the same fatal virus? Were they poisoned, only she was given a smaller dose?’ *How* we actually fill

out what the narrative does not say doesn't matter. What matters is that, almost automatically, we provide the linkage the narrative itself withholds. The inverse proof of this is that it is extremely difficult to come up with two events described in successive sentences or clauses that do *not*, in one way or another, suggest a narrative. So, in narrative the causal connections between the events need not be explicitly stated at all: it's enough for them to be implicit, to be possible, to be plausible. That is extremely important, since it suggests that a large part of the essential narrative labour of connecting can be delegated to and be carried out by the reader, who will readily respond even to the smallest signal. As Brian Boyd put it. "We are not *taught* narrative. Rather, narrative reflects our mode of understanding events [...]" (131). "[W]e will interpret something as story if we can" (137). One must bear in mind that this mechanism of ours kicks in *whenever* we are given the raw material of a narrative – this is decidedly *not* a phenomenon of extremely experimental avant-garde fiction with an unusually high number of 'gaps of indeterminacy' (Wolfgang Iser). On the contrary, we practice this every day in everyday communication. And that is why it must also be borne in mind that, when we say 'narration is the linguistic and mental linking of events', it is always, invariably, and necessarily so the reader or listener who takes over that part of the job. *For future use this should be written in stone: it is always already the reader or listener who eventually makes a story out of what is 'only' discourse.* If that is kept in mind, it will save us a lot of trouble and eliminate many terminological quibbles and quarrels and prevent nasty theoretical wars when we come to the question, Who then is it that 'makes' the stories in Future Narratives?

Among other things, humans are story-telling animals. Indeed, we are absolutely hooked on narratives. We see them wherever we can, we respond to the slightest suggestion (like patients in a Rorschach test, who are shown an abstract ink blot and are asked to interpret what they see). We do what our software allows us, indeed forces us to do: we seek possible links, patterns, connections, and *Gestalten*: we seek meaning.

For *meaning* is exactly the stuff that *is produced* when two events are linked to each other. Two isolated, unconnected events do not have any meaning whatsoever. Two linked events have meaning. The meaning resides *in the connection*, and rightly so: because it is there that narrative energy was invested – in the bridge, in the binding power that connects those two points, like the cohesive power that binds atoms to form a molecule.

And we *need* meaning – we could not live without it. Like bees their honey, we produce it ourselves. Only some people feel more comfortable with the idea that *the* meaning is 'really' there, solid and given from somewhere (above?) – as if a meaning produced by other humans or, *horribile dictu*, a meaning produced by themselves, were somehow an inferior kind of meaning, a second-hand variety.

There is a certain timidity or lack of confidence in their own power. For the sake of these souls, our civilization provides all sorts of mechanisms to veil the fact that meaning is what is spun out of narratives. Well, whatever works.

For others, the very idea that meaning is something that is discursively created by linking events to each other and not something that resides in an event itself seems counter-intuitive. This is understandable. In everyday parlance we say, 'This was very important for me', or 'This opened my eyes', or 'Our holiday in Denmark was simply the best so far' – that is, we constantly seem to attribute meaning and value to events *as such*. But we do this by either eclipsing the relational manner of such value attributions (the best, compared to what? in which respect?), or, as I just did, by quoting these phrases *out of context*. *In context*, all these propositions would have been part of a narrative and *why* such and such was important to me would at least have been suggested, if not made explicit; *why* such and such was an eye-opener for me can only be communicated, if there is a relation to something that went on before; etc.

So it makes sense: the meaning of something resides not in itself but is the result of how it is related to something else. That is the most abstract way of putting it, but at the same time, if you think of 'related' in the sense of 'told', it is also the most concrete way of saying how meaning comes into this world. It is by narration.

This is also true for the meaning of incontestable historical facts. And it is very important that I really mean *incontestable facts* – my argument is not about borderline cases or dubious and controversial cases. It is not about how difficult it is to know the past, how hard it is to know what *really* happened, since there are so many conflicting reports or all is filtered only through more or less reliable documents, and so on and so forth. That is all true, but the example for my case is not the controversial fact, but the non-controversial fact – say, that Christopher Columbus discovered America on October 12, 1492. That fact is non-controversial, even if you point out that the Vikings discovered it long before Christopher Columbus or that the people who lived there before Columbus *and* before the Vikings sure must have discovered the place in some way. And this fact is true no matter whether you believe it is cause for celebration or for deep shame because of all that followed this discovery (a platitude, of course: the fact that you evaluate an historical event presupposes that you believe it).

Which brings me to the point: the *meaning* of the historical fact does not reside in the event itself, it is a matter of its emplotment in a specific narrative that links the event to what went on before and after. In doing this, historians can take recourse to certain established narrative conventions or genres and arrange the events (in themselves unchanged and untampered with!) in differing patterns – to quote the historian Hayden White:

[A]ny given set of real events can be emplotted in a number of ways, can bear the weight of being told as any number of different kinds of stories. Since no given set or sequence of real events is *intrinsically* tragic, comic, farcical, and so on, but can be constructed as such only by the imposition of the structure of a given story or type on the events, it is the choice of the story type and its imposition upon the events that endow them with meaning [emphasis added]. (44)

It is difficult for some to accept, but nevertheless true that a fact – *as fact* (think: Christopher Columbus discovered America on October 12, 1492) – can remain unchanged, though its *meaning* differs radically, depending on in which kind of narrative it is embedded. Its meaning is no attribute (quality or property) of the event. Rather, its meaning is something that is *conferred upon it* in narration.

I would say this is true of all narratives, whether fictional or non-fictional, whether they are past narratives or narratives that try to capture what is going on right now, this very moment. Just two brief examples to work against our *déformation professionnelle*, or professional bias, that ‘narrative’ automatically has to mean fiction and has to mean *past* narrative. Say, a friend tells you about his recent vacations. The very moment he tells you about his trip and sojourn, about the highlights and disappointments, about the hotel and whom he met and what the weather was like, he makes sense out of his experience, he gives it a meaning (before he eventually closes by summarizing, ‘Our holiday in Denmark was simply the best we’ve ever had.’). In telling you about it (particularly so when he tells this for the very first time), he processes his experience into a narrative – he preserves his experience in this form, safely pickled. There are some strong indications that *already while* experiencing what he would later tell you he was experiencing whatever he did in the form of a narrative, as he was connecting one experience to what went on before, forming it into a meaningful, coherent whole, often modelled on the blueprint of former processings of experience (either by himself or by somebody else). Some people’s stories remain remarkably constant over time. The meaning of X does not change for them as years go by. Is that a good thing? Or should that worry us? With others, their stories change shape all the time. Should *that* worry us? Maybe only if they change the facts as well, and not only their emplotment.

Narratives are all-pervasive. We need them, because they produce the nutrient solution in which we exist – as beings that are absolutely dependent upon meaning and purpose, upon sense and direction. It is a good environment for us that saturates us with stories, or, more precisely: that gives us both the raw material *and* the cultural, discursive techniques and the instruments to produce what we so urgently need: meaning. What we, in turn, bring to this cultural environment is this our need – and the skills and predisposition to satisfy and quench

that need. It is a demand-side economy, but the good news is that, with regard to meaning production, we are the masters of this universe, because we have this machine that transforms otherwise meaningless raw material into meaningful sequences: narration. Linking past to present and putting all that is grist to its mill into a perspective – which means: relating it to somebody for whom *a* linked to *b* means this or that – narration is not only “the principal way in which our species organizes its understanding of time” (Abbott 3), it is also the basis for our sense of identity, both as individuals and as members of a civilization (and as such also as a species).

Narrative is the way in which we make sense of the world – we’re hardwired that way. There was a time when child psychologists believed pre-school children could not follow extended narrative. This has changed:

At three and four and five, children may not be able to follow complicated plots and subplots. But the narrative form, psychologists now believe, is absolutely central to them. ‘It’s the only way they have of organizing the world, or organizing experience,’ Jerome Bruner, a psychologist at New York University, says. ‘They are not able to bring *theories* that organize things in terms of cause and effect and relationships, so they turn things into *stories*, and when they try to make sense of their life they use the *storied* version of their experience as the basis for further reflection. (Gladwell, *Tipping Point* 118, emphases added)

Small wonder then that ‘narrative’ has been proffered as a new foundational concept for the Humanities: after all, it encompasses all the meaning-producing and meaning-processing and meaning-transforming practices we know. It is therefore a very strong candidate for the palm of MVP in the game of all historical sciences (which includes, of course, the history of sciences).

But in case this sounds a bit too complacent: if indeed narrative can be regarded as the transformation of actual or imminent contingency into the semblance of (narrational) necessity, then this production and establishment of meaning always, and inevitably so, takes place against the backdrop of the possibility of sheer meaninglessness, over an abyss of futility and of the absurd – most prominently so if the possibility of failure or breakdown in the production of meaning becomes thematic and is thereby being foregrounded. The disquieting quality of much contemporary fiction is due to the fact that all too obviously it lays bare the mechanisms of meaning-production, shows its instruments, and points to the precarious business of making sense of it all, even and particularly so in a fictional microcosm.

But to shift from the existential level to the more mundane and quotidian, and from past to present narratives: imagine a football reporter on the radio. It is a live reportage. He reports what he sees. The slight delay of a couple of seconds should not hinder us from saying: he tries to narrate events while they’re happen-

ing. Anything else would be splitting hairs. Not only as our reporter pauses and summarizes does he give shape to his story – already as he describes the moves of one team against the other, the passes, shots and counter-attacks, he fabricates a story. The crazy thing is that he himself does not know how it will end. That's part of the excitement – of his and of ours. And what form or meaning his narrative will take or attain, respectively, will depend not only on his skills as a live reporter, but also on his partisanship: one reporter's tragedy is another's triumph (even if, and that is the point, the facts of the match should be non-controversial – which they rarely are).

What happens – and we are slowly approaching the future now – when somebody tries to tell neither what has already happened nor what is happening right now, but the future? Not like a fortune-teller who reveals events that are (purportedly) pre-destined and pre-determined, not like some latter-day Nostradamus, but like somebody who imagines a future and tries to tell us a story about what is not (yet), about things as they could be, about events as they might possibly occur.

1.3 Approaching the Future I: Great Shock – Utopian Tales No Future Narratives!

When you mention Narrating Futures (NAFU), a great many people suppose that we are looking at utopian novels. We are not. And the reason is very simple: in general, utopian novels do not qualify as FNs.

Let us take a look at the beginning of what is probably one of the most disconcerting (negative) utopias of the twentieth century, George Orwell's *Nineteen Eighty-Four*:

It was a bright cold day in April, and the clocks were striking thirteen. Winston Smith, his chin nuzzled into his breast in an effort to escape the vile wind, slipped quickly through the glass doors of Victory Mansions, though not quickly enough to prevent a swirl of gritty dust from entering along with him.

The hallway smelt of boiled cabbage and old rag mats. At one end of it a coloured poster, too large for indoor display, had been tacked to the wall. It depicted simply an enormous face, more than a metre wide: the face of a man of about forty-five, with a heavy black moustache and ruggedly handsome features. Winston made for the stairs. It was no use trying the lift. Even at the best of times it was seldom working, and at present the electric current was cut off during daylight hours. It was part of the economy drive in preparation for Hate Week. The flat was seven flights up, and Winston, who was thirty-nine and had a varicose ulcer above his right ankle, went slowly, resting several times on the way. On each landing, opposite the lift-shaft, the poster with the enormous face gazed from the wall. It was one of those pic-

tures which are so contrived that the eyes follow you about when you move. BIG BROTHER IS WATCHING YOU, the caption beneath it ran. (5)

Grammatically, this is a common or garden past narrative: we are told, in retrospect, that this and that happened. Event follows upon event. And all descriptions are in the past tense, too. Now one might object, and many will, that later in the novel we learn that all this is set in 1984 (the clocks striking thirteen are already a hint that this is either in another country or in another time), a year that, when the novel was originally published (1949), was in the future and that its author wanted to warn about certain tendencies in mid-twentieth-century politics that might eventually lead to such a nightmare state. This is all true, but totally beside the point – which is: this is simply a past narrative whose temporal point of telling has been projected into the future, and from that point in the future it works like any regular past narrative. None of its parameters is changed in any way.

Or take *Nineteen Eighty-Four*'s rival dystopia, Aldous Huxley's *Brave New World* – here is its opening:

A squat grey building of only thirty-four storeys. Over the main entrance the words, CENTRAL LONDON HATCHERY AND CONDITIONING CENTRE, and, in a shield, the World State's motto, COMMUNITY, IDENTITY, STABILITY.

The enormous room on the ground floor faced towards the north. Cold for all the summer beyond the panes, for all the tropical heat of the room itself, a harsh thin light glared through the windows, hungrily seeking some draped lay figure, some pallid shape of academic goose-flesh, but finding only the glass and nickel and bleakly shining porcelain of a laboratory. Wintriness responded to wintriness. The overalls of the workers were white, their hands gloved with a pale corpse-coloured rubber. The light was frozen, dead, a ghost. Only from the yellow barrels of the microscopes did it borrow a certain rich and living substance, lying along the polished tubes like butter, streak after luscious streak in long recession down the work tables.

'And this', said the Director opening the door, 'is the Fertilizing Room.' (15)

In spite of the virtual absence of action from these opening paragraphs, the few temporal indicators we have all point to the fact that this, again, is a narrative about past events. True, the story is set in the year 632 After Ford (which is 2540 A.D.) and the narrator even makes an effort to link this future period to ours by describing a fictional historical 'bridge': after the disastrous 'Nine Years War', so we learn, Christianity, Liberalism, and Democracy – which, as forces of the past, all stood against the necessary abolishment of the nuclear family, against the establishment of large-scale hypnopaedia and against a bio-chemically induced

caste system – lost their influence as compulsory consumption was introduced: “[T]here was the conscription of consumption. [...] Every man, woman and child compelled to consume so much a year. In the interests of industry.” (49) The growing resistance of the populace – “The sole result [...] conscientious objection on an enormous scale. Anything not to consume. Back to nature [...] Back to culture. Yes, actually to culture. You can’t consume much if you sit still and read books.” (49) – was then broken by brutal force and violence: in the interest of consumerism and a stable society “simple lifers” and “culture freaks” were shot and gassed. But then the soft, non-violent totalitarianism of *Brave New World* was discovered to be a much more efficient way of controlling everybody – people were eventually made *to love* their servitude and mental slavery. As one of *Brave New World*’s slogans has it: “But everybody is happy!”

Undoubtedly, this is a great novel that hasn’t lost its power and impact and topicality – but grammatically and narratologically it is definitely not a FN. It is a past narrative throughout. One event that is supposed to have happened is linked to another that is supposed to have happened, and so on and so forth. To say this is not a critique, it’s a simple statement of fact. And it is important to state this fact, *not* because we are possessive about territory and dogmatic about upholding a definition of FNs that, after all, nobody *has* to subscribe to. This is not some terminological stubbornness – it is quite simply about a certain distinctive *quality* that these utopian novels do *not* have, viz. the quality of being able to present *in their form* the future as still open and undecided, as variable and multiple. This, utopian novels decidedly do not do. The basic form of utopian narrative is nothing but the narration of a future which has already happened – and therefore grammatically as well as narratologically the narrative of a(n) (imagined) *past*. They present the future as *past* space: closed, determined, with uni-linear action. This is a totally different game from FNs. It’s the old game. There are no nodes here. And that is why here essential aspects of future time are not preserved and its defining potentiality is not staged and is not prepared in such a way that it can be experienced.

And, by the way, that is why against the will of their authors, these negative utopias exude such a depressing air of determinism: not a few readers of *Nineteen Eighty-Four* and *Brave New World* come away from their reading with the inescapable feeling that this ‘future’ development is somehow inevitable, that nothing can be done about it – when, quite on the contrary, Orwell’s and Huxley’s impulse was to shake people into action. Well, you cannot easily have it both ways: to give your tale the semblance of suffocating inevitability (which they both have to an overpowering degree) and to signal that this is by no means inevitable. Past narratives are very good for the former, but less so for the latter.

They fail to achieve the latter goal to the same degree that they portray the future as a foregone conclusion.

It is often said that utopian novels tell you more about the time in which they were written than about the future. That is most certainly true, but my objection (if objection it is) is much more fundamental: in simply using the tools of Past Narratives to capture the future, these novels miss and deny what distinguishes the future from the past – namely that it has *not yet* crystallized into one single actuality. Utopian novels are Past Narratives shot into future space – that doesn't make them Future Narratives in any serious sense (just like *Mickey Mouse* is not a zoological treatise). If in telling the future, the key aspects of future time are not preserved, then, strictly speaking, the future *as future* is not told. Nothing could be more obvious, I think.

If, then, the deep reason for the failure to capture the future as future – which is, after all, a dimension of time that is *special* – is, at least in part, a grammatical one, what about narratives that are set in the present tense and that try to capture the exact point in time where potentiality is fed through the needle's eye of the present and thereby solidifies into actuality? Is that not as close as you can get to the future, if one defines 'future' as 'time yet to come', which, by that very definition, we can never touch, let alone inhabit anyhow?

1.4 Approaching the Future II: The Unbearable Gravity of the Present

If the distance between the events that are reported and the point in time when the reporting takes place is radically reduced, the action is shifted towards that line at which future time is converted into past time – the meridian of narrative: the present. And the closer you move towards that line, the more likely it is that funny or eerie things will happen.

Take, for example, a diary novel with daily entries. In William Golding's *Rites of Passage* young Mr. Talbot keeps such a diary while on a passage to Australia. One day, he is invited to have a glass of wine with the first lieutenant and Talbot, obviously flattered, ends his entry after having received the invitation with these words: "It is not the Captain, of course—but the next best thing. Come! We are beginning to move in society!" (45) In the following entry we read: "I proceeded to the passenger saloon to keep my *rendez-vous* with the first lieutenant only to find that his invitation had been extended to every passenger in this part of the vessel and was no more than a kind of short preliminary to dinner!" (46)

So, this kind of ‘writing to the moment’ is a fine source of irony, as one time after another our presumptions about the future are exposed as what they are: presumptuous. Every new entry is potentially the correction of the previous one.

Or take the epistolary novel – also a subgenre that obviously has the great advantage of being able to realistically create the illusion that the telling, or writing down, of the events follows upon their heels, so that all the dreadful consequences of a long distance between act and reflection (Did I feel so *then*? Or is it a retrospective projection? Did I know this at the time – or only later?) are kept to a minimum. As one of Henry Fielding’s letter writers can report in *Shamela*: “Oh! I feel an emotion even while I am relating this”. (4–5)

But the disadvantages are equally obvious: with some of the wristbreaker epistolary novels of the eighteenth century, like, for example, Samuel Richardson’s *Clarissa*, it is easy to calculate that the letter writers could not possibly have experienced all they were reporting because they were so busy writing letters all the time. So much for the realistic effect of ‘writing to the moment’. Fielding exploits this contradiction by having his eponymous heroine Shamela write a letter while she is in bed with her mistress, Mrs. Jervis: “Mrs. Jervis and I are just in bed, and the door unlocked; if my master should come—Odsbobs! I hear him just coming in at the door. You see I write in the present tense, as Parson Williams says. Well, he is in bed between us, we both shaming a sleep; he steals his hand into my bosom, which I, as if in my sleep, press close to me with mine, and then pretend to awake.” (12) As I said: funny or weird things occur when we approach the meridian of the present.

This gets a bit more relaxed when the medium of such a present-ness – a diary, a letter – is not thematized but tacitly presupposed, like some recording device. There are novels that consist mainly of the scenic (re-)presentation of dialogues – rightly are they therefore called dialogue novels. Henry Green’s *Nothing* or Ivy Compton-Burnett’s *Mother and Son* with a 80–85%, or 90–95% respectively, share of dialogue are good cases in point. There even are novels that almost exclusively consist of dialogue. Here is an excerpt from Gabriel Josipovici’s *Now*:

- I’m tired, Licia says.
- Nobody’s tired at your age, Sam says.
- I’m tired.
- At my age you’ve got a right to be tired, Sam says. Not at your age.
- What has right to do with it?
- It’s not natural.
- Leave her alone Dad, Freddy says.
- Nobody’s tired at her age, Sam says. Are you tired?
- Sure.
- All the time?

- Most of the time.
- That’s because you work too hard.
- No I don’t, Freddy says.
- But what does she do? Sam says. I’ll tell you what she does. She does nothing. That’s why she’s tired. That’s why she thinks she’s tired. If she got a job like everyone else she wouldn’t have time to feel tired.
- Let it go Dad, Freddy says.
- The laburnum’s in flower, Nina says.
- If you’ve got something to do you don’t have time to feel tired, Sam says.
- I can see it from my window, Nina says. Quite suddenly, it’s all in flower.
- If she hadn’t given up her job she wouldn’t feel so tired, Sam says.
- Let it go Dad, Freddy says.
- You can’t see it from here, Nina says. But you can from my window.
- You’ve got a lovely view from your window, Julie says.
- I look right down on it, Nina says. If my arms were just a bit longer I could lean out and touch it.
- At least if you got up at a normal time you wouldn’t feel so tired, Sam says to his daughter.
- I’m too tired to get up at a normal time, Licia says. (1)

This isn’t 100 percent dialogue because of the odd “Licia says” or “Sam says” that is thrown in – these *inquit* forms are, strictly speaking, outside the dialogue, of course. They point, but only in a very rudimentary way, to an instance that mediates the conversation. But the overall effect of this combination of dialogue plus present tense *inquit* forms is one of alienation, of ‘making strange’, of disorientation. Which goes to show that we love our reality cooked and prepared, not in the raw. The aesthetic motivation for this alienating effect is easy to see: readers here have to supply, deduce and imagine the whole surround of the dialogue – in contrast to texts that are truly mediated by a narrator, i.e., in which the dialogue is embedded and commented upon; but also in contrast to a dramatic performance, which would usually give us considerably more information than the mere dialogue. As a matter of course the author wrote the novel *like that*, but *within* this fictional world there is no authority that has ‘processed’ or ‘edited’ the material, separating the important bits from the less important, selecting and assessing their relevance. Of course, adding “Licia says” or “Sam says” hardly amounts to any ‘processing’ of the dialogue – those phrases only serve to identify the present speaker, nothing else, and they are introduced especially when the interjection is simply too short for the reader to be able to identify a ‘voice’, by, say, a repeated turn of phrase or by the telling register a character characteristically uses.

The absence of any editing – or, more precisely, the fabrication of the semblance of the absence of any editing – provides an alluring challenge for the reader. But does this kind of narrative ever cross the meridian of the present?

Obviously, it doesn't. Illusion: recorded as spoken, *now*. We are *here, this very moment* – but that is all there is to it.

Incidentally (or not so incidentally), the same is true for movies that come across as being conspicuously un-edited. That may be surprising, for don't movies – except when they operate with distancing devices like voice-over or graphic captions ('1789 – all Paris is in turmoil!') – always only show what 'is happening right now'? Is that not what they have in common with drama? But it is movies like *Blair Witch Project* or *Paranormal Activity* that expose how 'naturally' and easily we perceive the deeply mediated Hollywood aesthetics as unmediated, as giving us sheer presence. Take away all the trappings and workings of undercover and subcutaneous editing, introduce a handheld video camera with blurred, out-of-focus images, weird, unmotivated cuts, or a static camera that is supposed to record the antics of a *poltergeist* at night, and immediately you get the impression of unmediated, unselected presence – of *now*. The effect is eerie. It is definitely not a coincidence that both paradigmatic movies are about phenomena of the supernatural. (Purportedly *unmediated presence* has something uncanny about it, particularly so when it is refracted in a medium and institution that normally signals a *foregrounding* of mediatedness (literary texts, movies, or whatever is placed in the context of a museum).

We are *here, this very moment* – that is all there is to it. To return to the art form of the novel: the same is true for all other novels that are told in the present tense, like Muriel Spark's *The Driver's Seat*, J.M. Coetzee's *Waiting for the Barbarians* or Walker Percy's *The Moviegoer*. They all create a thrilling *immediacy* by recreating an aspect of the present that is indeed essential: *we do not yet know whether this or that will be important*. We are overwhelmed by all the data that keep flowing in, by that onslaught of the present – we are, perhaps, borne down by the unbearable gravity or heaviness of the present moment. Because time alone will show what was relevant and what wasn't. So, these narratives – and mark that I am not talking about narratives that in some passages and for dramatic effect make use of a historic present –, while not being FNs, shed a revealing light upon a significant narratological phenomenon: the closer time of action and time of telling approach each other (until they eventually coincide), the less an essential part of narrative *mediation* will have been carried out already – namely the filtering and selection of events, their accentuation and evaluation. These recorded events seem 'in the raw', they have not been processed and weighted, and they do not yet mean anything concretely and definitively because they are *only* arranged *chronologically*, in their mere sequence and order, as everything that happens 'now', but they are *not yet linked by narrative*. Right: *they do not yet have a meaning*.

We've been there before and have only returned to this spot from a different direction: these events have not yet taken on any specific meaning because

nobody has taken the trouble to solidify them into a meaningful sequence. They are not yet linked in any meaningful way. I appreciate that very much. It lays bare the mechanics of meaning conferral (by leaving it largely to the reader, which should not be cause for complaint). It also explains why many people do in fact prefer Past Narratives: they *can* give us a toned-down version of immediacy (as we lose ourselves in a book), and yet everything is at the same time so nicely prepared and laid out for us – so completely different from *life*, in fact, where few things come ready-packed and labelled.

By way of contrast, and with respect to narrating futures, present-tense novels reveal something far more fundamental: just like past narratives, they're just not the sort of vehicle that allows you to negotiate, to cross over and overcome that *barrier* that separates the future from the past: the present. Locked in this time capsule – the present moment –, all one can ever do in this kind of narrative is to watch (and record) how actuality emerges – *right now!* – while that which is *not yet* seems forever without our reach.

A body's velocity can never be higher than the speed of light. For, as it approaches the speed of light, its mass increases incredibly and forever hinders it from surpassing that limit. Therefore, the speed of light is an absolute constant in our universe. The unbearable gravity of the present moment in all our doomed attempts to 'get at' the future by crossing that line can be seen as an analogical reminder: it can't be done. Not this way. There must be other ways – and there are.

1.5 Capturing the Openness of the Moment: Some Basics About Nodes as Building Blocks of Future Narratives

We defined Future Narratives (FNs) as narratives that have at least one nodal situation or node. A node – just to remind you – is a situation that allows for more than one continuation. 'At least one node' and 'more than one continuation' are obviously *minimal* requirements or conditions. In actual fact, most FN's will have a plenitude of nodes and many nodes will not just display a *bi-furcation*, but allow a *spread of continuations*.¹ But if not even these minimal conditions are met, we evidently don't have a FN or a node, respectively. And once they *are* met, we have a proper FN at hand – and immediately one of the major differences between a Past Narrative and a Future Narrative catches the eye: as a rule, non-FNs are *uni-linear*. They tell you how one thing led to another. FN's never are. They always and

¹ Interestingly enough, the move from "Either/Or → Multiple Option" was identified by John Naisbitt as one of the ten megatrends transforming our lives in his classic study of 1982 (cf. chapter 10 of Naisbitt).

inevitably – because *by definition* – show that one thing *or another* may follow from this particular situation here, from the node we’re looking at. Invariably, FNs are *multi-linear*.

In most FNs it depends upon *you* which of the different potential continuations is realized. *In most* – not in all. Before long, we shall look at some nodes that do not require or allow your choice to trigger off the realization of one of its possible continuations. Note how the basic definitions of FN and of node do not include elements like ‘choice’ or ‘agency’. It is for very good reasons that they don’t.

But since in most FNs the continuation does depend upon you, let us look at a very simple example of this kind of FN: a children’s book of the Choose-Your-Own-Adventure-type. Such books are subdivided into sections, and at the end of almost every section you are offered a choice about the continuation and given an alternative of the kind: You want this? Go to page 17! You want that? Go to page 23! In my example, *Der Tempel des Schreckens* by ‘THiLO’ (an obvious pseudonym), the introductory text is sufficiently sensational: “In this book, you are the hero! Time again your decisions are asked for on the following pages. How this adventure continues depends on the way that you choose. So consider thoroughly, make your decision, and then continue to read on the page that is indicated. And be careful – in this adventure, any mistake could mean the end!” (9, my translation)

The book is about how you and your comrades Hektor and Theo are transported to sixteenth-century Central America, to the Aztec empire, which is teeming with high-octane warriors and Aztec priests intent upon human sacrifice – hence ‘the temple of horror’. (Keep in mind that ‘*Future Narrative*’ denotes a *structural* feature – ‘has nodes as basic elements’ –, not the historical time in which it is set. Many FN are set in the historical past, while conversely, as we have seen, many utopian tales, set in future time, are technically speaking *Past Narratives*.)

Now, simple as the example of *Der Tempel des Schreckens* may be, it already gives us the key features of a FN: first of all, it has nodes. The book spans 121 pages and is subdivided into 66 units. But not every unit ends in a node. For example, on page 22 the only instruction reads, “You run down the volcano. (→ 32)”, or on page 23, “Looking crestfallen, you continue on the road. (→ 36).” So, only one continuation is possible. There are 14 of these *non-nodals*, that have only one continuation, which leaves us with 52 regular nodes, and all of them offer only alternatives, that is, *bi-furcations*, not three or more options. Still, that is enough to create an exciting degree of openness. (And the series’ claim – or is it the subtitle? –, “1001 Abenteuer”, is true on both counts and comparatively

modest, because even 2 to the power of 10 – which is 10 generations of bifurcating nodes – already gives you more than a thousand different continuations.)

Second, sometimes you are offered choice with information, sometimes not. That is, sometimes some indication as to the possible consequences of your choice is given, sometimes any such information is withheld. It is obvious that when it is withheld, your choice is nothing but a gamble. On page 21, for example, you and your friends have to flee a wild puma and the only escape, or so the text says, is to enter an old temple in the jungle, which is gruesomely decorated with hundreds of skulls – curiously enough, the text does not intimate why pumas should be afraid of human skulls or why else they should not continue their chase into a temple. Whatever: “You take the entrance to the right. (→ 63)”, “You take the entrance to the left. (→ 28).” Chances are there will be different continuations depending on your choice, but since you do not know remotely what they are, it doesn’t really matter which entrance you take, or, more precisely: in retrospect it is likely to have mattered, but this plays no role now, in your choice. It’s a mere gamble.

More often, some information is given as to the possible consequences of your choices or, more interestingly, about the pros and cons of the alternative you are given. Thus on page 33, you and your friends must get back to Tenochtitlan – either as quickly as possible or as safely as possible, for that is not the same. If you take the highroad, you get there fairly quickly, but you’re also fully visible, in open view, which is dangerous since you’re still being pursued. If on the contrary you run through the jungle, you will probably remain undetected, but it will take you far longer. And who knows what dangers may lurk there? Are you happy to take a risk? Or would you rather play it safe? But where is the greater risk? So your choosing implies a thematization of your priorities and preferences, of your assessments, a weighing of your values.

But more than a mere thematization of weighing, FNs are a powerful means to *stage* evaluations, assessments and decision processes involving a choice between values, goals, means and ends – because the continuation depends on exactly this choice being *made*. (It would be tempting to say, Otherwise nothing happens. Tempting, but not true. Because there are FNs where something happens because you do not decide to do this or that or anything – as time runs out, something will happen that is not the consequence of your choice, but the consequence of not taking any action whatsoever.)

If some information is given about the possible consequences of either option (we’re still in the simple mode of *bi*-furcations), this information could, of course, be either reliable or misleading. I am not aware that *Der Tempel des Schreckens* contains any misleading information and that is a good thing, because it is a book for children and too much reality at an early age can be detrimental. But in

general, clues are sometimes enigmatic, hermetic, and teasing, in other instances even downright oracle-like (which is, after all, close to misleading, although here the victim alone is to blame for any ‘misreading’ of the oracle). The extent and reliability of information about the potential continuations contained in a nodal situation are a crucial factor in the profile that any node has – too important, in fact, to be merely noted in passing. We’ll return to this point. Suffice it here to say that the more information you have and the more *reliable* information you have about the outcomes of your respective choices, the more the relationship between a node and its following event resembles a linear causal relationship; *and* the more a FN composed of such nodes, in spite of offering multi-linearity, will give you openness in a very reduced state only, as two (or three or more) *predictable and linear* continuations. It would still be a FN, of course, but one in which the *space* of possibilities would not be fully unfolded, since this kind of FN would only extend definite, distinct and knowable *lines* through the cone of future time, not really corridors of possibility.

It appears that in particular ethical puzzles and dilemma-like nodal situations conform to this type, since the seeming lack of uncertainty about the outcomes of your choices (a *given* in these moral exempla) has to be compensated for by the seriousness of the conflict of values and preferences in choosing one above the other. Decisions under certainty (as Decision Theorists would say) are only interesting insofar as the conflict can be located elsewhere. That is what ‘under certainty’ implies.

When I said earlier on, ‘Chances are there will be different continuations...’, I was being cautious. Because – and that is the third feature of FNs that we can learn from *Der Tempel des Schreckens* – sometimes different choices may lead to the same outcome, although you could immediately ask, What does ‘same’ mean here? On page 58 and on page 59 you are in two entirely different situations (not only because you arrived there from page 31 and page 36, respectively, to give only the two last legs), but in both these situations you are uni-linearly directed to page 34.

This is most instructive, because it points to the necessity, when conceptualizing FNs, of differentiating between the objective structure of a FN – its *architecture* – on the one hand and any concrete and particular path or *run* through that structure on the other. Because evidently it makes a very big difference whether you arrived on page 34 by way of 31 and 58 or by way of 36 and 59. These are completely different narratives in the most basic sense. At the same time, however, it cannot be denied that whatever can be found on page 34 (and on page 35, because they constitute a unit – and a nodal one at that) remains *the same*, no matter in which way you reached it.

I quite like the metaphorical terminology of ‘architecture’ and ‘run’, because it is so self-evident. Think of an old mansion with many different rooms and corridors, on different floors. All of these rooms have at least one door and the corridors more than one. There are staircases and maybe there is an elevator. That is the structure that allows you to go from here to there – and back again. While you’re exploring the mansion, you find there are different ways in which you can enter or leave one particular room (or maybe there is only one), and the *order* in which you explore these rooms may be determined by the structure or not (if you can only reach room 7 through 6, then that is the only way to get there...). But whatever your individual path or run through this mansion is, it is in the first place something that this architecture allows you to do. We are interested in *the architecture* of FNs, in what *the structure* allows you to do. To say this is not to deny that what you actually *experience* while being engaged in a FN is always and invariably your concrete *run* through this structure. But that is not what we are focussing on. We are focussing on *FNs as the conditions of the possibility of such run-throughs*. We’re looking at what and why they allow you to do this or that and at whatever non-FNs *don’t* allow you to do – viz. to go from here to there or there; all within that given structure, within the architecture of that mansion.

So when notating the ‘floor plan’ of *Der Tempel des Schreckens*, it is essential to note *both* that there is a unit on pages 34 and 35 that results in a node *and* that you can arrive at this node from two different directions (true, you have different histories in your baggage when you arrive there from either here or there, and in FNs other than *Der Tempel des Schreckens* this may well be of great import – here it isn’t). The experience of openness, of ‘being in’ a node, has to be prepared. We’re interested exactly in the *setting-up* of such situations, in the features they display, in what they have to offer. Before any actualizations, we’re interested in the *potential* that a nodal structure has to offer, *objectively* and regardless of any concrete realizations. For now, we take down floor plans rather than flow charts of individual movements. But we take down floor plans as *enabling structures* for particular movements.

Does it make any sense in this context to speak of ‘mock nodes’? Not much, it seems. If a situation allows for more than one continuation, it’s a node. Period. It is implied in this definition that these continuations would have to be *different* from each other. Why else speak of continuations, in the plural? But if both these continuations *at a later stage* converge towards the same situation, that starting situation would still be a *real* node and not a ‘mock’ node, because it did, after all, allow for more than one continuation. It did make a difference at the time. In other words: whichever situation can be continued along at least two different paths is a node, no matter what these paths do later on. There are only nodes and non-nodes. Both from an ‘architectural’ point of view and from the point of view

of a run-through there is no such thing as a mock node. It is either this or that. Still, we'll come back to this.

What else can we learn from the mapping of *Der Tempel des Schreckens* (a fairly impressive spreadsheet of which has been excluded from the following pages, for reasons of space)? The book has six different endings, a happy one that begins on page 119 and five premature endings of the not quite so happy “Your path ends here!” kind (in one you end up as a mummified scarecrow – of course, not really you, but only ‘you’). The happy ending is foregrounded and privileged as the ‘real’ one, not only because it is at the end of the book, but also because it includes a return to the twentieth-century museum in which the whole adventure trip began.

However, the mapping of this FN reveals yet another feature that has nothing to do with its profile. Rather, it is a feature that gives us a glimpse into the process of its composition: in that unpublished mapping you can see that particularly in the first third of the book the reader is sent on conspicuously long-distance trips (measured in number of pages s/he has to turn over or skip), whereas in the middle section of the book we have a phenomenon that occurs nowhere else but here, between pages 42 and 64: the reader is ‘sent back’ (measured, of course, only against the frame of reference of the book’s page numbers). This pattern allows a guess at the method of composition. First, it seems, more remote parts of the narrative were stitched together, then the intervening spaces were filled up, as it were, sometimes in such a way that the direction of the reader’s movement had to be reversed. This is only a conjecture and it tells you nothing about the *type* of FN we’re dealing with (only about its possible production). Note that this is not about ‘going back’ in the story-world; if not measured against the frame of reference of the page numbers, there is no ‘going back’ at all – all your movements are uni-directional. But it is an interesting instance of how sometimes time is mapped into space and how a process leaves a pattern in materiality that allows you to read the history of that materiality, the temporality of space (much like reading a geological formation) – hopefully in an accurate way. But this is only *en passant*.

1.6 *Run Lola Run* – Only a Pre-Cursor?

We have looked at FNs that involve choice, now what about FNs in which the continuation does not depend on the reader’s/viewer’s/user’s decision? Take the paradigmatic case of *Run Lola Run*. This movie has a nodal situation because at one point it returns to a scene we have seen before and continues it in a different way. And then it jumps back again and continues it in yet another way. Is that really a nodal situation, although the viewer cannot influence the course of

events? (And remember, only *if* that's a node, *Run Lola Run* can be classified as a full-blown FN, and not just as some curious half-developed precursor).

The short answer is that, of course, that's a node. Nodes are situations that *allow* for more than one continuation. *Run Lola Run* even *gives* you three different continuations, which is proof – is it not? – that it *allows* them (which is the weaker condition).

The long answer is also that that's a node and that consequently *Run Lola Run* is a FN, because this movie and others of its type, like Krzysztof Kieslowski's *Blind Chance* or *Sliding Doors*, do not only thematize different continuations (as when a character muses, 'Oh, I could have done this or that', or, 'Had I only...'), but they actually *show or stage* these different continuations. It is true that different from FNs that involve choice on the reader's/viewer's/user's side, here you can only *watch* somebody *else* acting in this *or that* way, and that is undeniably a major difference. But a *defining* difference it is not.

What makes us think, when we watch a movie of the *Run Lola Run* type, that we're looking at *different* continuations anyway? The simple answer to this seemingly foolish question is that we just *know* whether something is the same – is identical, a simple *repeat* – or different. A more sophisticated answer to the same question would be that we need, first, a point in time, a situation, that we've recognizably been at (been in, respectively) before and then at least two continuations from there that are *mutually exclusive*. Like in *Blind Chance*: the protagonist either misses his train or he catches it.

But, wait a minute, 'mutually exclusive' from which point of view? 'Mutually exclusive' with regard to which frame of reference? Obviously, not on the level of you and the movie, because you *are* offered various continuations. So, 'mutually exclusive' from the logic of the story world? It would seem so. You either catch your train or you miss it – you cannot have it both ways. Only that some FN movies play with the idea that you could, possibly, have it both ways. At the end of *Sliding Doors*, for example, there is a slight indication that the two different 'worlds' which have evolved from the movie's one nodal situation are, after all, permeable to each other, that the reality of one continuation is 'seeping through' (if ever so slightly, and only in one point) into the other one (clue: it's when the Gwyneth Paltrow character suddenly knows the correct answer to 'You know what the Monty Pythons always say?' It is, 'Nobody expects the Spanish Inquisition.'). Or in *Run Lola Run*, when Lola in the second continuation knows how to release the safety catch of a pistol – something she had *learnt* in the first continuation).

That is an interesting teaser – but it does, of course, only work on the viewer's assumption that basically and as a rule the two continuations of this character's life are different, and different in the strong sense of 'mutually exclusive'. In other

words: if we had the impression that all we see could be accommodated *in one and the same storyline*, then we'd never even think of the possibility that we're dealing with *different* continuations. It's as easy as that and almost tautological: it is the internal incompatibility of different strands that directs our attention to the fact that this must be a multi-linear FN. If we don't run into that difficulty, we process what we see according to the default position: it's uni-linear and not mutually exclusive.

If continuations must be mutually exclusive to be even registered as 'different', does a character *in the narrative* have to know about the "hell of a universe next door", to invoke e.e.cummings? Quite the contrary. Often characters that you watch in a FN movie initially have no idea that they also exist in other continuations. That is part of their operating within a realist paradigm. We all can muse, Oh, I could have done this or that, but we do it all within this one continuation in which we happen to find ourselves presently. Though there's nothing in art that you cannot do. And if a character realizes s/he exists in different continuations, then s/he simply steps out of the realist paradigm. In *Groundhog Day*, the point of the whole movie is that the Bill Murray character *does* know that at the end of the day he'll be sent back again – and get the chance to learn, to pursue other, more favourable continuations. He *knows* them to be *different* – that's the whole point. Even in *his* world, they are mutually exclusive, only that there – different from ours – he can go back again (no, he *must*...) and play through other options. It is, if you will, a FN movie about a character who finds himself in a FN world. The fact that he learns this is *the* defining feature of this movie. But in general, characters in FN movies or in any FNs, for that matter, *do not have to have* an awareness of their existence in parallel or loop-like continuations. Often, they haven't. Increasingly now, they have. All depends on what a FN movie is aiming at.

And, of course, the moment a rule is established as a rule, it can be broken – to great effect. So, in *Blind Chance* you are made to believe that the decisive point is whether the protagonist misses his train or catches it. For this seems to make all the difference between continuations 1 and 2 (he either becomes a secret police informant or a member of the underground opposition in Communist Poland). But then he misses his train for a second time (it is still *the same* node) and you get a third continuation, which signals – or does it? – that missing the train or not was not, after all, the decisive factor for the further course of his life, but that, of course, *other* branchings are always possible once a continuation contained in a node has been realized, in the sense of actualized. The implication being, I suppose, that life is a *series* of nodal situations and that there is never the *one* moment of existential decision. Or is there?

1.7 The Road Not Taken

THE ROAD NOT TAKEN

Two roads diverged in a yellow wood,
 And sorry I could not travel both
 And be one traveler, long I stood
 And looked down one as far as I could
 To where it bent in the undergrowth; 5

Then took the other, as just as fair,
 And having perhaps the better claim,
 Because it was grassy and wanted wear;
 Though as for that the passing there
 Had worn them really about the same, 10

And both that morning equally lay
 In leaves no step had trodden black.
 Oh, I kept the first for another day!
 Yet knowing how way leads on to way,
 I doubted if I should ever come back. 15

I shall be telling this with a sigh
 Somewhere ages and ages hence:
 Two roads diverged in a wood, and I—
 I took the one less traveled by,
 And that has made all the difference. 20

This is a typical Robert Frost poem (105) because, like “Stopping by Woods on a Snowy Evening” or “Mending Fences”, it gives you a ‘real-life-’ story that, at the same time, signals it is ‘really’ about something else, that its true meaning is not identical with its literal meaning. OK, it’s a poem.

Here, the possibility that this is *not* only about two roads in the wood but about life in general is hinted at by the foregrounding of uni-directionality. “I kept the first for another day!” still roots us firmly in the literal universe, in everyday life – but “Yet knowing how way leads on to way” points to the fact that in life you can’t go back, you can’t “travel both / And be *one* traveler.” In life, you cannot revisit a node, because a node is not just a place, it is a *situation* – “And that has made all the difference.”

I leave aside all other fine details, like for example that initially the difference between the two roads seems negligible and is indeed obliterated by the traveler’s choice (“Though as for that, the passing there / Had really worn them about the same”), and still the fact that he took the road less traveled by (true, it is the gender of the poet that lets us assume the speaker here is male, too – an unfounded assumption) characterizes the traveller as a person and in a way

defines him as a character, again: “And that has made all the difference.” (But note also that the rhyme scheme partly underscores and partly undercuts this message by setting two rhymes against each other, three *a* rhymes against two *b* rhymes, which is a win by the narrowest of margins in a ‘best of five’ series, not a big difference, though a noticeable imbalance; but the second *b* rhyme arrives only at the end of the fifth and final line of each stanza, so the difference in scores is actually narrowed towards the end. How big is the difference in “all the difference” really, when all is said and done?)

My point is that “The Road Not Taken” is ‘really’ about the irreversibility of decisions in life – not in the sense that you cannot try and make good, try and make amends for your mistakes (you can and you should, I think), but in the sense that you cannot go back and go down the other road and make the first continuation ‘unhappen’. But you can – and that’s the point of it – you *can* in most FNs. That is one of the reasons why we are attracted to them. If life can be regarded as a series of innumerable nodes, then one major attraction of some FNs (though not of all) is that you can do exactly what you can’t do in real life: you can go back again. You can realize a different option. Sometimes within the course of the very same game, sometimes only by playing a new run in the game. But you can. The *reversibility* of decisions, necessarily based on the *retrievability* and *iterability* of situations, marks out FNs of this kind as *sanction-free arenas of possible behaviours*. That is why, in this respect, such FNs are like games. But mark: *in this respect; such; like*.

1.8 Doing the Shuffle: Lola Runs Again, Books in Boxes, and Slatted Pages

FNs do not necessarily imply choice *for you*: if you watch *Run Lola Run* in a movie theatre, you can only see the continuations in the order in which the director put them together. However, if you have the DVD of the same movie, you can arrange the sequence at your will, watch the second continuation first, then the third, finally the second – no matter what your motivations may be (maybe just aesthetic and intellectual curiosity: you want to know whether it makes any difference if you watch the continuations in a reshuffled order), the transposition into another medium now allows you to do that, puts you in a different position as an agent and generates a different kind of FN. As some of the constraints of the material medium are left behind, the user gains new degrees of freedom – and the result is a different kind of ballgame.

Perhaps nowhere are the constraints of the material medium for FNs more acutely felt than in the form of a printed and bound book. Take, for instance, John

Fowles's novel *The French Lieutenant's Woman*. The novel has three endings, which are produced by two nodes. The first ending comes in the forty-fourth of 61 chapters, the second in chapter 60 and the third in chapter 61, at the beginning of which the narrator-figure puts back his pocket-watch by 15 minutes – we're back in the node and then the alternative ending unfolds.

If most readers could not take the first ending quite seriously, this was maybe less because of its boring and uninspired conventionality (marriage to a painfully superficial, but rich girl) than because of the simple fact that everyone could see there were still a hundred pages to follow. How could this then have been the 'real' ending? To the degree, this is, of course, also true of the third ending in its relation to the second – the mere fact that this third ending comes last privileges this unhappy, 'existentialist' ending, which shows the male protagonist alone and forsaken, not happily reunited with the love of his life and their common daughter (as is the case in the second ending).

Once you have identified the three endings, you can, of course, re-read them in any order you want, just like no one *forces* you to read the chapters of any novel in the arranged sequence. But the point is that in a bound book of fiction (poetry anthologies are certainly a different matter) the default position is that you *do* – you accept the sequence in which the parts of the novel have been arranged by its author. You *can* do anything with a book – but what the book as a material structure 'asks' you to do in this culture, in which the proper processing of such sign complexes is strongly conventionalized, is to read the bound book from the beginning to its end, left to right, top to bottom, page after page, line after line – unless it signals otherwise.

And, as *The French Lieutenant's Woman* shows, even if a novel points to the possibility of diverging paths – yes: *The French Lieutenant's Woman* is a FN! –, then the medium of the bound book doesn't exactly support and endorse the free choice of options. There is something in the *materiality of the medium* and in the cultural conventions of its handling that, while it doesn't exactly hinder you from reshuffling the sequence, doesn't exactly encourage you to do so or facilitate what it hints at either.

In the same year (1969) that saw the publication of *The French Lieutenant's Woman*, B.S. Johnson published *The Unfortunates*. The novel comes in a box and on the inside of its lid you read the following instructions:

This novel has twenty-seven sections, temporarily held together by a removable wrapper.

Apart from its first and last sections (which are marked as such) the other twenty-five sections are intended to be read in random order.

If readers prefer not to accept the random order in which they receive the novel, then they may re-arrange the sections into any other random order before reading.²

The sections come in varying length (between the third of a page and 12 pages bound together). Given the instructions, this book presents you with 24 nodal situations, because after having read the first section you can pick from 25 of the non-arranged ones; after that, from 24, and so on until after your 24th choice (between the two remaining ones) there is only one left over – one, plus the final, 27th section, which is seeded again. So this box offers 25! (25 factorial) different paths through its material.

The non-arrangement of *The Unfortunates* is even thematically motivated: the novel is about a football reporter who travels to Nottingham to cover a match and who is overwhelmed, when he leaves the train station, by memories of his friend Tony, who died two years ago, of cancer. Comments B.S. Johnson: “In this way the whole novel reflected the randomness of the material: it was itself a physical tangible metaphor for randomness and the nature of cancer.” (“Introduction” 163) Note how the author does not claim that the point of this experiment is to give you a multitude of different reading experiences. Quite the contrary, his message is that *it doesn’t matter* in which order you read the sections in the box. But, of course, that is only authorial intention and nobody is forced to accept it as a pronouncement *ex cathedra*. The structure of the book invites you to shuffle the 25 intermediate sections of *The Unfortunates*, and once again this new freedom of the user is gained by an intentional tampering with the material form of the bound book, whose restraints are partially removed.

The Unfortunates had a less well-known, but more radical precursor in Marc Saporta’s *Composition No. 1* (1962). As Tom Uglow explains in the 2011 re-issue:

Presented in a box, the loose leaf novel is 150 unnumbered pages, each consisting of a strand of self-sufficient narrative which, when ‘shuffled’ by the reader, forms the story. Most often, it is the previous reader who has decided the order you read it in, as the instinct not to manipulate the ‘deck’ is almost overwhelming. There is nothing as disconcerting as the sensation of holding a loose sheaf of papers, with no numbers, no chapters, with a hundred and fifty beginnings and a hundred and forty nine endings. (unnumbered page, of course)

² Hidden on the side of the inside of the lid, we read: “I will tell you in three words what the book is. – It is a history. – A history! of who? what? where? when? Don’t hurry yourself – It is a history-book, Sir (which may possibly recommend it to the world) of what passes in a man’s own mind.” A nod to *The Unfortunates*’ spiritual godfather, Laurence Sterne’s *Tristram Shandy*, for it is an (unacknowledged) quote from that very novel.

Although *Composition No. 1* is now also available in digital form, Uglow insists on the media-historical uniqueness of the book of unbound sheaves of paper in a box:

This new edition of Saporta's work in both digital and physical form throws a warm light on this future. The physical edition of *Composition No. 1* is an object to be held, owned and loved. The digital edition is to be read, pushed, shared, discarded, and reinvented.

One can only agree: a book that strives to be not a book is something different from a book that is no longer a book. If the medium is the message, then the message of the digital version of *Composition No. 1* is different from its printed-on-paper original. We shall return, at a later stage, to what we call the *media-sensitivity* of FNs, or, to reverse the relationship of media and FNs, to the degree of openness, readiness and ease with which different media lend themselves to the mediation of FNs.

What next, after unbound sheets? Slatted pages. In 1961, Raymond Queneau gave the world *Cent mille milliards de poèmes*, wonderfully re-published in a bilingual edition, *Hunderttausend Milliarden Gedichte*, by Zweitausendeins in 1984. This is how Raymond Queneau himself explains the working of his "machine for the production of poems" (my translation), which allows everyone to create a hundred thousand billions sonnets and that gives us reading matter for almost 200 million years, if you read without any break:

Dieses kleine Werk, das ich ersonnen und verwirklicht habe und das jedermann erlaubt, nach Belieben Hunderttausend Milliarden Sonette zu bilden – alle regelgerecht natürlich –, ist eher von dem Kinderbuch mit dem Titel „Têtes Folles“ inspiriert als von den surrealistischen Spielen der Art „Cadavre exquis“. Es ist alles in allem so etwas wie eine Maschine zur Herstellung von Gedichten, in begrenzter Anzahl jedoch. Allerdings verschafft diese Zahl, obschon begrenzt, Lektüre für fast zweihundert Millionen Jahre (wenn man rund um die Uhr liest). Da sich die Dinge nun einmal so verhalten und jeder Vers auf einer Lamelle steht, ist leicht einzusehen, dass der Leser 10 hoch 14 verschiedene Sonette bilden kann, das heißt Hunderttausend Milliarden. Um für die Skeptiker genauer zu sein: mit jedem Vers (zehn an der Zahl) kann er zehn verschiedene zweite Verse in Übereinstimmung bringen; es gibt also hundert verschiedene Kombinationen der beiden ersten Verse; wenn man den dritten hinzufügt, wird es tausend geben, und für die zehn vollständigen Sonette aus vierzehn Versen hat man also das oben genannte Ergebnis. Wenn man 45 Sekunden zum Lesen eines Sonettes und 15 Sekunden zum Umblättern der Lamellen rechnet, 8 Stunden pro Tag, 200 Tage pro Jahr, hat man für mehr als eine Million Jahrtausende zu lesen, und wenn man 365 Tage im Jahr den ganzen Tag über liest, für 190 258 751 Jahre, ohne die gequetschten, die Schaltjahre und andere Kleinigkeiten in Betracht zu ziehen. Wie Lautréamont so schön gesagt hat, die Poesie soll von allen gemacht werden, nicht von einem. (n.p.)

The mathematics behind this is very simple: every first line can be combined with any second line and any such combination with any third line, and so on and so forth. So the total number of sonnets contained in this volume is 10 to the power of 14, or a hundred thousand billion. Reading time per sonnet is set at 45 seconds, the assemblage of the individual lines into a new sonnet at 15 seconds. As mentioned before, if you allow yourself no rest, you can read on for almost two hundred million years; if you read only for eight hours per day and for 200 days per year only, it will, however, last for a billion years. Peak book? No way.

By the way, the rules Queneau gave himself for the composition of his ten original sonnets are fairly strict – and they have to be: e.g., only if the grammatical structure of any, say, seventh line is identical, can the combinatorial outcomes make sense. The restrictions on the author-as-composer are the precondition for the freedom of the reader-as-composer. The same is true, with a vengeance, for the formidable translator of Raymond Queneau’s original, Ludwig Harig, a master of his art.

Since *Run Lola Run* as a movie doesn’t involve choice on the viewer’s part, but on DVD it does; since *the French Lieutenant’s Woman* offers choice, but doesn’t exactly encourage the shuffling of continuations; and since *The Unfortunates*, *Composition No. 1*, and *Cent mille milliards de poèmes* allow and encourage re-shuffling, although no information is given as to what the outcomes of your choices will be – you just look for yourself, it’s a gamble –, we can, by way of an interim summary, sketch a classificatory tree that identifies, on the basis of yes-no-bifurcations, different types of FNs (cf. Fig. 1.1, page 30).

Rudimentary as this graph is – it gives you only the roughest of classifications, and does not differentiate, for example, between a *The French Lieutenant’s Woman*-type of FN and a *Composition No. 1*-type of FN –, it seems to indicate at least three insights:

- 1 *It is possible to represent a classification of FNs in such a way that it represents itself a FN with at least four nodes (or within the class of FNs itself, with at least three nodes – which, admittedly, is not yet much, but one could think of further bifurcations, of course).*
- 2 *It seems that in each node the realization of at least one continuation enables a new level of engagement or activation on the part of the reader/player/viewer (I’m more engaged if I have choice rather than none; I’m more engaged if my choice is/can be based on information – which would have to be assessed, evaluated, weighted, especially if it looks unreliable, which gives us a further level – rather than on a mere toss of a coin.)*
- 3 *But if we think in terms of ‘freedom to operate’ or ‘exploration of possibilities’, then there seems to be no necessary correlation between the number of activated levels on the one hand and the degrees of operating space gained thereby on the other.*

(The combinatorial art of Raymond Queneau works *without information*, which means you do not know beforehand what the consequences of choosing no. 7 over no. 10 for the second line of your sonnet will be – and yet one could not argue seriously that if you had information, this would increase your freedom to operate. On the contrary, one could argue that exactly this freedom to operate would be *restricted*, because then you would have to compare the consequences. In this case, an inverse relationship between engagement and uninformed exploration of possibilities seems to be implied.)

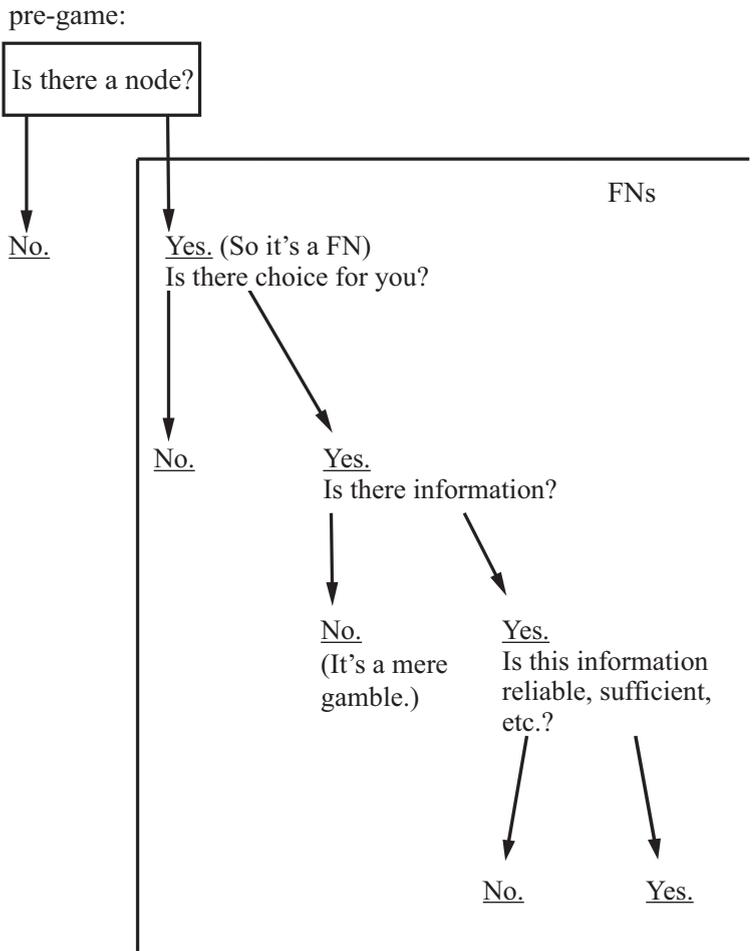


Fig. 1.1: A first classification of FNs.

Since all but one class in this classification of FNs offers choice, it might be wise to look briefly into what Mathematical Decision Theory and Game Theory can possibly contribute to the theory of FNs. Although the fact that *more* information and more *reliable* information about the consequences of your options seems to *narrow* the openness of nodal situations should alert us to the possibility that the target area of Decision Theory and Game Theory may not be absolutely identical or coextensive with that of a theory of nodal situations in FNs.

1.9 Decision (Choice) Theory and Game Theory, in Relation to FNs

Decision Theory is a tool used to assess whether a person's decision under given circumstances is the best or optimal decision – whether it is *rational*. Insofar as Decision Theory can also tell you what under given circumstances would be the best or optimal decision (no matter what people actually do), it is normative or *prescriptive*.

If, however, it turns its interest to how decision makers actually behave, it becomes *descriptive* and turns into a subdivision of empirical economics, empirical psychology, empirical sociology, empirical political science, and so on. It registers, for example, that, curiously enough, in our society people in general prefer playing lotteries that offer enormous prizes but with a very low probability to playing lotteries that offer you more modest wins, though with a far higher probability. Normative Decision Theory can tell you why this is not rational – which, by the way, also shows that descriptive and normative Decision Theory can and indeed often do, go hand in hand. Descriptive Decision Theory will also tell you that (and possibly why) a higher number of options may lead to poorer decisions in many people – or to no decision being made at all.³ (Again, 'poorer' means that you have a normative idea as to what would have been the optimal decision; and if you take exception to the fact that no action whatsoever is taken, you obviously subscribe to the philosophy that *in any case* action is better than inaction – a value judgement that may well stand to reason.)

In contrast to descriptive Decision Theory, normative Decision Theory presupposes a perfectly rational human being, or *homo oeconomicus*. This curious, ideal type of rational man is equipped

³ Cf. Schwartz. Schwartz speaks of "choice as a burden" (217) or even the "tyranny" of choice (2). The political implications of an inability to choose, especially in a situation in which many options are given, which, however, do not make much of a difference, should be obvious.

- a) with certain desires in regard to the outcomes of his choice, which desires are called *rational desires*;
- b) with certain assumptions about the state of the world in which s/he finds herself/himself, which assumptions are called *rational beliefs*; and finally
- c) with the default position that s/he behaves in such a way that the outcomes of her/his choice are always maximized – measured against her/his rational desires, of course. Such behaviour Decision Theorists call *rational behaviour*.

Since the objective of this set-up is clearly to model an ideal choice situation, it makes sense to also assume, at least initially, that the decision maker is fully informed and able to exactly calculate the varying outcomes of her/his decisions against her/his goals and preferences. In short, *homo oeconomicus* is modelled on the image of her/his maker: ‘rational man’ is a perfect Decision Theorist.

It is, of course, perfectly possible (and indeed it is done in Decision Theory) to relax the requirements of perfect information and to factor in uncertainty instead, just as it is possible to no longer presuppose the full rational perspicuity and transparency of preferences, goals, and desires and to operate instead, e.g., with “fuzzy aspiration levels” (cf. Lopes and Oden 286–313), that is, with preferences that may change with choice context and may not even be fully revealed to the decision makers themselves. (Again, it is obvious that *homo oeconomicus* is the absurd and totally unrealistic abstraction of a man who fully knows and understands himself – but that is what the modelling of an ideal decision maker *has* to presuppose.)

Especially the factoring in of uncertainty (‘choice under uncertainty’) makes Decision Theory so much more interesting and non-trivial (in the non-mathematical sense of the word). Under uncertainty, you have to first identify all possible outcomes, then attribute values to them (positive or negative ones), then calculate the objective probability of their individual occurrence (that is where uncertainty comes in, in order to be domesticated) and finally multiply these values for individual outcomes with their probability, so that you arrive at a numerical ranking of your options that will tell you, for instance, that it is not very wise to play that lottery with extremely unlikely mega-jackpots.

No matter whether you supplement this very old procedure with calculations using concepts like ‘utility function’ or ‘subjective probability’ (a mathematical probability reflecting knowledge, whereas chance is represented as ‘objective probability’) or a ‘family of plausible beliefs’, the objective of this kind of calculus invariably remains the same: viz., to identify ‘best’ choices (and to prove why, if a different option was realized, that course of action was *inconsistent* with the deci-

sion maker's professed rational desires and rational beliefs, with her/his express preferences and goals).⁴

Likewise, if what is *my* best choice depends on another person's move (which may be either obvious or hidden from me, in which latter case I would have to calculate the probability and the aggregate values of possible outcome of her/his different courses of action – always presupposing, of course, that my opponent is a perfectly rational being), then we move into Game Theory (from the point of view of Game Theory, many situations inspected by or constructed by Decision Theory can simply be seen as one-player games) – but still the objective remains constant, as can be seen from this sketch of contexts in which 'choice' can occur:

Choice involves selecting one or more items from a menu. It is explored in four contexts: that of certainty, where all items are definite; that of uncertainty, where items involve chance, either with or without given probabilities; that of strategy, where two persons' individual choices are interdependent; and that of group choice, where a number of people must choose collectively. Attitudes to risk arise in the context of uncertainty and have implications in the context of strategy. (Allingham 10)

⁴ It would seem at first sight that these strictures do not apply, if you substitute Decision Theory with some kind of Bayesian probability theory: Bayesians define probability in terms of a willingness to bet, which is a pragmatic quantity for situations in which decision makers have a basic understanding of the situation, but lack the data upon which rational decisions would usually be based. Thus collapsing subjective assessment prior to the decision and the actual decision making into one, Bayesians are not interested in the possible discrepancy between professed rational desires and rational beliefs on the one hand and actual choices on the other, but rather in the difference between assumed probabilities (to repeat: defined as a willingness to bet) and actual outcomes. While Bayesian approaches generally appeal to the NAFU research group, since they factor in such behavioural possibilities as a readiness to learn (by way of the concept of Bayesian Learning, which gives a mathematical algorithm for updating subjective probabilities), creativity, etc., and since, at the same time, they try to tackle the old problem of how to model uncertainty, we feel that highly original theories like the 'Bayesian Risk Management' of Armin Haas of the Potsdam Institute for Climate Impact Research (PIK) (unpublished paper of January 21, 2009) address, understandably, the position of a decision maker in a situation of uncertainty (with regard to an unknowable future), but they do not describe the virtual set-up of simulated situations of uncertainty in FN structures – which, however, is what we are interested in. In other words: while Bayesian Risk Management focuses on decision situations that demand reasonable action in absence of (personal) certainty, NAFU is exclusively interested in the virtual setting-up of such situations, not in the adequacy of any behaviour displayed in such situations. *In that respect*, and in that respect only, traditional Decision Theory and Bayesian approaches are equally discardable for our purposes. But we gratefully acknowledge the enormous intellectual stimulus of the input so generously provided by Dr. Haas. For a brief assessment of Bayes' historical role, cf. Bernstein 129–133.

The focus is always on the *reasonableness* of a person's actions under given circumstances – reasonableness mathematically calculated and measured against perspicuous preferences, transparent desires and articulated goals. In identifying best choices, straightforward solutions, and optimal strategies, normative Decision Theory can also identify inconsistencies in the actions taken by actual decision makers. It can help you to choose wisely – if you can put a number to your desires and beliefs.

What does that mean for the analysis of FNs? It would seem that Decision Theory, concerned as it is with a calculation of – given certain preferences, objectives, assumptions, attitudes towards risk and assessments of probability – how 'rational' a certain choice, action or behaviour is (calculated with, respectively measured against, these quantified parameters), is not quite as helpful as one should think in the pursuit of a description and an explanation of *the architecture* of FNs and of the 'inner life', the profile of a given node. Focussing on the relationship between statements and actions (Do they match and correspond or do they diverge? Is a taken course of action, given certain declared preferences and assumed probabilities, 'rational', or isn't it?), the object of Decision Theory lies by definition *outside* the narratological focus of NAFU, which is on *the structural given* of nodes and FNs and on the possibilities they offer or open up, not on individual behaviour – the *runs* of a game – or the agreement or disparity between declarations and actions.

On the other hand, one should not rule out, of course, that Decision Theory can be called in later again to formally describe situations that call for a weighing of options against a background of objectives and evaluations; or in order to understand the *production logic* on the game designer's side, when a specific game constantly calls up decision situations of a very particular or even peculiar kind. To give another example, it would seem that any sort of *backcasting* (in contrast to *forecasting* this assumes *one* desirable future state of things and then sketches alternative routes by which this state can possibly be reached from the present situation) would have to invoke Decision Theory again to provide us with a calculus for the formal weighting of such alternative routes with regard to feasibility and 'rationality'. As it stands, we can put Decision Theory on the backburner for a while.

How, then, about Game Theory? Mathematical Game Theory can help you find the 'best' strategy (which can be either pure or mixed) for playing games whose nature is known. This is particularly helpful if the best strategy is one that most people would spontaneously reject as harmful or indifferent – that is, if what is objectively advisable seems counterintuitive to most people.

The most popular example of a game for which Game Theory advises a strategy that is intuitively rejected by most is the so-called *Monty Hall Problem*

(Monty Hall being the name of the host of a quiz show), to readers outside the Anglophone world probably known as the *Ziegenproblem*. This is the way it is presented in Mark Haddon's novel *The Curious Incident of the Dog in the Night-time* (if you think the style is, well curious – that is only because the text is written by Christopher, the first-person narrator of the book, who is 15 and suffering from Asperger's syndrome: he loves numbers and logic and truth and has no place for feelings and intuitions and metaphorical language, or for jokes, for that matter):

There used to be a column called **Ask Marilyn** in a magazine called **Parade** in America. And this column was written by Marilyn vos Savant and in the magazine it said that she had the highest IQ in the world in the **Guinness Book of World Records Hall of Fame**. And in the column she answered maths questions sent in by readers. And in September 1990 this question was sent in by Craig F. Whitaker of Columbia, Maryland (but it is not what is called a direct quote because I have made it simpler and easier to understand).

You are on a game show on television. On this game show the idea is to win a car as a prize. The game show host shows you three doors. He says that there is a car behind one of the doors and there are goats behind the other two doors. He asks you to pick a door. You pick a door but the door is not opened. Then the game show host opens one of the doors you didn't pick to show a goat (because he knows what is behind the doors). Then he says that you have one final chance to change your mind before the doors are opened and you get a car or a goat. So he asks you if you want to change your mind and pick the other unopened door instead. What should you do?

Marilyn vos Savant said that you should always change and pick the final door because the chances are 2 in 3 that there will be a car behind that door.

But if you use your intuition you think that chance is 50:50 because you think there is an equal chance that the car is behind any door. (Haddon 78–79)

I taught this text in class and most students agreed that changing would not enhance your chances: it would not matter. They were not alone:

Lots of people wrote to the magazine to say that Marilyn vos Savant was wrong, even when she explained very carefully why she was right. 92% of the letters she got about the problem said that she was wrong and lots of these were from mathematicians and scientists.

[...]

But Marilyn vos Savant was right. And here are 2 ways you can show this.

Firstly you can do it by maths like this

Let the doors be called X, Y and Z.

Let C_X be the event that the car is behind door X and so on.

Let H_X be the event that the host opens door X and so on.

Supposing that you choose door X, the possibility that you win a car if you then switch your choice is given by the following formula:

$$\begin{aligned} & P(H_Z \wedge C_Y) + P(H_Y \wedge C_Z) \\ &= P(C_Y) \cdot P(H_Z|C_Y) + P(C_Z) \cdot P(H_Y|C_Z) \\ &= (\frac{1}{3} \cdot 1) + (\frac{1}{3} \cdot 1) = \frac{2}{3} \end{aligned}$$

The second way you can work it out is by making a picture of all the possible outcomes like this (Haddon 79, 80–82)

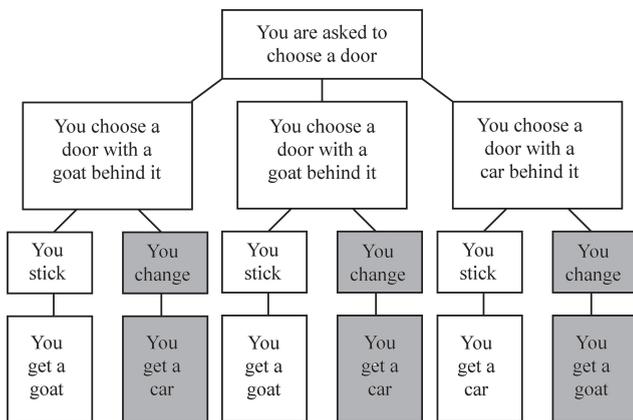


Fig. 1.2: The Monty Hall Problem.

Of course, this isn't the final word on Christopher's problem, but it is the final word on the *Monty Hall Problem*. Game Theory is good for you because it increases your chances of winning a car.

But though Game Theory can help you find the best strategy for playing games whose nature is known, it is not necessary to identify the nature of the game – that is done before Game Theory begins its task. Whether you have to decide under certainty or under uncertainty, whether your choice involves probability and risk, whether it's a two-person zero-sum game, a two-person non-zero sum non-cooperative game, a two-person cooperative game or an n-person game – all that can be established *before* the calculation begins. You may use the established game-theoretical terminology (as I just did), but you do not strictly *need* it for the identification of the nature of these games. ('My gain is your loss' is a perfectly adequate non-technical description of a zero-sum game and 'Let us keep this ping-pong ball in the air for as long as possible' is a perfectly under-

standable instruction for a game whose best strategy is not to play risky and unreachable balls.)

The distinction is a vital one with regard to a possible application of game Theory to FNs, in particular to the identification and classification of different types of FNs. This is maybe best illustrated by what Game Theory has to say about the famous *Prisoner's Dilemma*. Here is the problem, as delineated on Wikipedia (accessed 15/6/09):

Two suspects are arrested by the police. The police have insufficient evidence for a conviction, and, having separated both prisoners, visit each of them to offer the same deal. If one testifies (defects from the other) for the prosecution against the other and the other remains silent (cooperates with the other), the betrayer goes free and the silent accomplice receives the full 10-year sentence. If both remain silent, both prisoners are sentenced to only six months in jail for a minor charge. If each betrays the other, each receives a five-year sentence. Each prisoner must choose to betray the other or to remain silent. Each one is assured that the other would not know about the betrayal before the end of the investigation. How should the prisoners act?

Game Theory will tell you that in this situation cooperating is strictly dominated by defecting (or betraying the other), since *no matter* what the other player does, you will *always* gain a greater payoff (= less time in prison) by betraying him. Hence: “[A]ll rational players will play defect.” (Ibid.)

The reasoning goes like this: if the other betrays me, I will get ten years in prison, if I do not betray him, but only five years, if I betray him as well. So, under this condition, it is better in both cases to betray (five years instead of ten). This, however, is also the best strategy if the other chooses not to betray me: if I betray him, I get no prison sentence whatsoever, against six months on a minor charge if I don't. So 'betray', or 'defect', is the best strategy *in every case*.

Now, the paradox of the *Prisoner's Dilemma* consists in the fact that “rational choice leads the two players to both play defect, even though each player's individual reward would be greater if they both played cooperatively.” (Ibid.) How is that? If each of the two players is rational and betrays the other (which is the best strategy under all circumstances), then each of them gets five years in prison. Had they preferred to choose irrationally and kept their mouths shut, both would only have received a sentence of six months. So, after rational choice ('betray!') they're worse off than after silent cooperation, which is branded as 'irrational'. In other words: Game Theory can indicate how to maximize your payoff under *any* circumstances ('betray!'), but that strategy will not necessarily lead to an optimal solution, since each player would be better off if they cooperated. (What does that say about the concept of 'rational' that is used in Game Theory?)

Game Theorists like Ken Binmore would deny that there is any paradox here, arguing that we have a perfect ‘Nash equilibrium’ here, which means both “players are simultaneously making a best reply to the strategy choices of the other[]” (14, cf. 18) – and that’s that. Systematically ignoring the fact that in the Prisoner’s Dilemma ‘best reply’ leads to a sub-optimal solution, Binmore has a theory about people who, in spite of mathematical proof, claim it would be rational to cooperate (that is, not betray), when it is, in fact, only rational to betray: “They want to believe that human beings are essentially nice.” (82)

Yet, in his own explanation of the *Prisoner’s Dilemma* – in which he insists there is no paradox of rationality involved – he hints at what lies at the core of the matter and what is so disconcerting to others:

A whole generation of scholars swallowed the line that the Prisoner’s Dilemma embodies the essence of the problem of human cooperation. They therefore set themselves the hopeless task of giving reasons why game theory’s resolution of this supposed ‘paradox of rationality’ is mistaken. [...] But game theorists think it just plain wrong that the Prisoner’s Dilemma captures what matters about human cooperation. On the contrary, it represents a situation in which the dice are as loaded against the emergence of cooperation as they could possibly be.

If the great game of life played by the human species were adequately modelled by the Prisoner’s Dilemma, we wouldn’t have evolved as social animals! We therefore see no more need to solve an invented paradox of rationality than to explain why people drown when thrown into Lake Michigan with their feet encased in concrete. No paradox of rationality exists. Rational players don’t cooperate in the Prisoner’s Dilemma because the conditions necessary for rational cooperation are absent. (18–19)

Or, to put it more briefly: the game of *Prisoner’s Dilemma* is, of course, *set up by the prosecution to make the suspects* – against whom the prosecution has only insufficient evidence! – *defect and betray each other*. That is the sole purpose of this game: to lead the suspects to a ‘rational’ choice that allows the prosecution to convict them *both* – even if both of them would be better off if they played ‘don’t betray’. It is a matter of *interest*. And this little game is played in the interest of those who set up the game in the first place – and who had the power to do so. And this shows. *It shows in the rules of the game*. Game Theory can only tell you how to play well by these unquestioned rules (which were made *against* you). If Binmore is right, Game Theory should never question the rules of the game, but only operate within the given frame. Maybe he is right. At least that is not what Game Theory was designed for. We shall come back to this in a moment.

Curiously enough, in empirical experiments some 40% of participants ‘irrationally’ played ‘cooperate’. If they were lucky enough to be coupled with another irrational person, they were both rewarded with only six months in prison instead

of five years. Well deserved, I should say. More interestingly, if the situation of the *Prisoner's Dilemma* is endlessly repeated – we speak of the *Iterated Prisoner's Dilemma*, or IPD – and different strategies, differing widely in complexity, initial hostility, capacity for forgiveness, etc., are sent competing against each other in a computer tournament (like in a computer chess tournament), so that we open up the possibility of a competitively-driven learning effect, then a 'cooperate' strategy could be shown to be evolutionary sustainable. What is more: *every time* it could be shown to *prevail* over more hostile and egocentric strategies (this is the message Robert Axelrod's groundbreaking study). It is true that they prevailed only by a slight margin (data generally contested by Binmore 21, 81), but it could be argued, as Axelrod did, that *evolution produces cooperation and altruism*, whereas self-interest-driven, 'greedy' strategies fall behind. Mark: in an environment whose conditions seem decidedly *hostile towards cooperation*, cooperation evolves, remains stable, and is robust against invasions, *if* there is a sufficiently large cluster of individuals cooperating and *if* the interaction is durable, that is, if there is always a second, third, and fourth time.⁵

In the long run, 'tit for tat' is *the* best strategy for iterated games and for repeated interaction over long periods of time (mind you: *empirical research* shows this, not Game Theory!): you start out playing 'dove', and only if your opponent does not respond in kind, you switch to 'hawk'. That is, you start out by being 'nice', and thereafter you copy in every move whatever your opponent does. If he plays 'dove' as well, you continue to play 'dove'. If he responds in a hawkish way, that is, if he does not honour your being nice, you change and retaliate – until by some learning effect he turns into a 'dove', which, however, seems unlikely if he plays according to the same strategy as you do. It would seem, therefore, that at first sight such games have an inbuilt tendency to deteriorate, because it is only a question of time until everybody plays 'hawk', since, if you adhere strictly to that rule, nobody can be retrieved from a 'hawk' position, whereas everybody can easily be toppled from a 'dove' position (Axelrod touches briefly on this, 186).

But not so. For, surprisingly, this is not true for *indefinite multi-player games*. As Axelrod has shown, 'tit for tat *with forgiveness*' comes out a winner every time; it is *the* most successful rule for sustainable social interaction. How is that? The

5 Cf. Axelrod 20, 126ff.. Axelrod's leading question is, "Under what conditions will cooperation emerge in a world of egoists without central authority?" (3), and he chose the *Prisoner's Dilemma exactly because* it seems to strongly favour defection: "The Prisoner's Dilemma is simply an abstract formulation of some very common and very interesting situations in which what is best for each person individually leads to mutual defection, whereas everyone would be better off with mutual cooperation." (9)

‘forgiveness’ rule, to repeat it, means that you do predictably retaliate for every defection – quickly and invariably so –, but after that, if your opponent does not persist in defecting, you immediately switch back to ‘nice’ again (as the ‘tit for tat’ programming command says: ‘Just copy whatever your opponent did on his last move.’). In other words: in the ‘tit for tat’ computer programme, ‘forgiveness’ is already contained, but ‘veiled’ in the command ‘only repeat your opponent’s last move, *forget about his history*’. The forgiveness of ‘tit for tat’ results from the fact that it has no memory that reaches further back than just one move.

It is the forgiveness of such a rule that reaps long-term profits, whereas exploitative, aggressive and sneaky strategies suffer from the echoes and amplifications of their former misdeeds (cf. Axelrod 36–47) – and all this evolves in a computer tournament whose rules do not in any way have an ethical bias...

Here is how Axelrod describes this best strategy and the reasons for its success in the indefinitely repeated *Prisoner’s Dilemma* game:

What accounts for TIT FOR TAT’s robust success is its combination of being nice, retaliatory, forgiving and clear. Its niceness prevents it from getting into unnecessary trouble. Its retaliation discourages the other side from persisting whenever defection is tried. Its forgiveness helps restore mutual cooperation. And its clarity makes it intelligible to the other player, thereby eliciting long-term cooperation. (54)

Or as Richard Dawkins called his BBC feature based on Axelrod’s work: *Nice Guys Finish First* (also a chapter in later editions of his seminal classic *The Selfish Gene*).

Again, Binmore does not buy the larger claims Axelrod makes for human cooperation (81, 136) based on these computer data (although Binmore’s objections do betray some ignorance of Axelrod’s data and of the rules of his computer tournaments; see, for example, Binmore’s insinuation that ‘tit for tat’ could not win against a more aggressive set of competitors or that it isn’t evolutionary stable).⁶ In any case, the “enthusiasm for TIT-FOR-TAT” with inbuilt forgiveness does not seem to survive, as Binmore will have it, because people “want to believe that human beings are essentially nice” (82), but simply because even computer programs ‘understand’ that it pays off to be nice, retaliatory, forgiving (in exactly that order!), and clear, just as more and more people understand that *everybody* is better off if everybody behaves. There’s even a name for it: civilization.

Another, even more blatant case where Game Theory tells you that people are more or less irrational is the so-called *Ultimatum Game*:

⁶ Cf. Binmore 81, 82. But see Axelrod parts II, 2, “The Success of TIT FOR TAT in Computer Tournaments” (27–54), and V, 9, “The Robustness of Reciprocity [against Invasion]” (169–191).

The Ultimatum Game is a primitive bargaining game in which a notional philanthropist has donated a sum of money for Alice and Bob to share if they can agree on how to divide it. The rules specify that Alice first makes a proposal to Bob on how to divide the money. He may accept or refuse. If he accepts, Alice's proposal is adopted. If he refuses, the game ends with both players getting nothing. (Binmore 47)

It is clear that even if Alice offered Bob only one penny out of a sum of 1,000 Pounds, intending to keep 999.99 Pounds to herself, it would be rational for him to accept this deal – because, if he didn't, he wouldn't get anything at all. After all, one penny is more than nothing. Betting on that, Alice should go for the jackpot and make Bob an immoral offer, Game Theorists will tell you, and they advise Bob to accept *any* offer she makes him.

Surprisingly for Game Theorists, in experiments most Alices go for a fifty-fifty split. And conversely, unfair splits like 75 : 25 are not accepted by Bobs more than half of the time – although they would still get a quarter of the overall sum, they prefer to get nothing at all if the offer looks so patently unfair. In other words: they are ready to incur significant losses, only to uphold some odd idea of 'fairness'.

I said repeatedly that Game Theory is good at helping you to find the best strategy for playing games *whose nature is known* – and I might add: whose rules you accept. It wasn't designed for, nor is it necessary for the identification of the nature of the game (let alone to criticize the ideological 'tilt' or bias of a game situation or, as in the *Prisoner's Dilemma*, the asymmetrical position assigned to its players by the game master). Its forte is to advise about strategies once you're in a game situation that you have chosen to be in or that you can't help but be in – that is, to advise about *responses* to a given challenge. Game Theory is not about the structure of the challenge, but about responses, which is decidedly *not* the same.

Game Theory *must* eclipse the framing of the game situation, its tilt and its bias, because it can only deal with what *under these circumstances* counts as rational and calculable. NAFU, on the contrary, is interested in exactly the framing of the concrete situation, is interested in *what sort of* position I'm assigned to in this or that FN. NAFU is interested exactly in what a particular node offers and in what it doesn't allow, in what profile it has, so that by differential analysis we eventually arrive at a typology of FNs. Game Theory can only tell you what to do once you meet such and such a challenge (short of overturning the game). It offers blueprints for 'best runs', *after* the specific architecture of a given FN has been established. It does not itself (nor is it intended to) establish or comment upon, let alone question that architecture.

A theory of FNs therefore has to focus on what Game Theory *doesn't* do and isn't expected to do: viz., to identify the different natures of the 'games' within the

corpus of FNs. And the ideal way to do that is to look at what's happening in the primal unit of any FN – in the node.

1.10 Into the Heart of the Matter: A Node's Interior Life – Character, Space, Time

If you analyze a traditional Past Narrative (PN, for short), say, a novel (cf. Bode, *The Novel*), it is established procedure to look at its most important parameters – such as character(s), space/place, and time – in order to parse the specific profile of that narrative. In how far is it reasonable to do the same with FNs?

Let us begin with 'characters': the most pressing questions with regard to characters are: Do they remain stable or do they change? Are they flat or rounded and complex? If they change, do they change predictably? If they change unpredictably, do they do so in a (retrospectively) credible way? (In E.M. Forster's words, Can they surprise us in a convincing way?) Or do they seem to act 'out of character' and in a totally chaotic way? Further: is a character's profile something that is just stated, by some narrative authority or other or is it dramatized in any way – can we 'watch' the character behave in such and such a way? (This is the old dichotomy of telling vs. showing, which goes back as far as Plato and Aristotle.) And: How does a character interact with other characters? Are they responsive to and mutually reflective of each other? And so on and so forth.

It seems all these questions (and a few more) can be meaningfully addressed to FNs and to nodal situations as well. Only: what exactly is 'character' in a FN? The safe and easy answer is, 'Anyone who find themselves in a nodal situation and consequently in a FN.' So, Theo and Hector in *Der Tempel des Schreckens* are characters in that FN. The fact that *you* decide *for them* how their adventure will continue should not worry us, because it doesn't eliminate them as characters in the FN, just like the fact that the scriptwriter of *Run Lola Run* has scripted and realized her continuations *for her* does not disqualify Lola from being a character in *Run Lola Run*. And what about *Cent mille milliards de poèmes*? There is no character, no agent, in a nodal situation *within* that book, but any reader of *Cent mille milliards de poèmes* is continuously in a series of nodal situations, just like any reader of *The Unfortunates* or *Composition No. 1* is (although there, for sure, you do find characters again within the FN, unlike in *Cent mille milliards de poèmes*). Therefore, 'character' in a FN is indeed anyone who find themselves in a FN, no matter whether the continuation depends on them or not (although – we've covered the ground before – it is obviously a major point of discrimination between different kinds of FNs whether it does depend upon them or not), *and*

there are FNs that have no characters at all in them but assign the role of decision maker to the reader or player.

Evidently, you can have trickle-down hierarchies of agents (outside and inside the FN) that trigger the realization of one of the possible continuations contained in a node. You *can* have, but it is by no means always the case. For example, Lola is a character in the prime nodal situation in *Run Lola Run*. If you watch the DVD of that movie, you are evidently in a nodal situation that allows you to shuffle the order of the different continuations that your ‘viewer’ node contains. You’re an agent on that level. But that doesn’t cancel out Lola as a character in *Run Lola Run*, whose options within the FN remain unaffected by your choice. There may be other constellations, though, in which your choice does affect the range or nature of options of the character within the FN, as, for instance, if the order of situations to which a character is exposed affects her/his abilities to cope with any given situation.

Having said that, we believe it would be confusing and, in fact, overextending the concept of ‘character’, if one used it to refer to anyone assembling a specific combination of sheets in *Composition No. 1*, let alone refer to her or him as ‘a character in that FN’. Yet, to be sure, often enough, particularly so in gameplay, the clear-cut distinction between ‘character’ and ‘player’/‘user’ etc. cannot be maintained, if ‘you’ find yourself *in* the FN *by means of* an avatar with whom you operate in a nodal situation in that virtual world. (Note that the “Du” in *Der Tempel des Schreckens* operates also as a kind of avatar, although as one with severely restricted possibilities.) Still, for propaedeutic purposes it makes sense to distinguish between reader/user on the one hand and character/avatar on the other – as long as we keep in mind that *any of these* can take over *the function of agent*. Note: this implies that, no matter *where* the agent is positioned – a character can, if you will, ‘delegate’ his agency to the reader/user, just like a reader/user can, in a given situation, only operate *through* a character –, invariably the impact of her/his actions/decisions etc. will relate to the ‘interior’ of a FN and realize one of the options contained in that structure. Obviously, when we’re looking at the interior life of just one node, what we’re interested in is exactly *the kind and the magnitude of agency* or leverage that is given to a character, or to ‘you as character’ (avatar), or to you as user/reader, by way of upward or downward delegation.

It may seem stubborn to cling to an old-fashioned category like ‘character’ when dealing with this newly evolving corpus of FNs. But to all intents and purposes it is not counterintuitive and certainly not stretching the concept too far to say that – going beyond the emotional identification with the protagonist of a novel or with some role played by a movie star – you ‘are’ that character in a FN and that all of the above questions can be meaningfully asked of you; mind you: of you *as that character*. How confining is that character for you? Does that role

allow you to do more things than you usually do? Or less? Does that role change? Can you ‘learn’ in that role? Can the characters modify themselves – or are they always only their own old selves? Can you change not only your acts, but your general behaviour as well? In sum: is there any *openness* in that character? If so, how much? And, to broaden the picture: is the overall line-up of characters in a nodal situation such that they form an interactive swarm, so that their aggregate spread in possible responses to pre-scripted challenges (all the others forming an *environment* of agents for me) contributes something to the multiple continuations scenario? Or doesn’t it?

When I said all of the above questions traditionally addressed to characters in PNs can also be meaningfully asked of characters in FNs (including the question, Is a character’s profile something you have been ‘told’ beforehand, because you happened to have compiled his/her strengths and weaknesses yourself, even before the game proper started; or is his/her profile something the player *learns* in the course of the play?), I did not explicitly mention the one decisive difference (although it was hinted at before), which is: in analyzing ‘character’ in a FN or in any particular nodal situation, what is of *prime*, indeed *overruling interest* to us is always in which way that character increases or detracts from the openness of a given situation (or is indifferent in that respect), that is, in how far his/her own ‘freedom of action’ is a factor that *increases the potentiality* of a situation (potentiality not as a function of the *number* of continuations of any given situation, but as the *difference* between – roughly, and only to keep things simple – the two most dissimilar of these continuations and the density of the ‘filling’ of that possibility space, the *Konsequenzen-* or *Ereignisraum*, that opens up between them. Think: the spectrum of evolutionary unfoldings still contained in a node).

Nobody hinders us from noting that this character here has a funny nose or that character there wears striped trousers. But in mapping what a nodal situation allows or doesn’t allow with regard to possible continuations, characters are *only* interesting under the aspect of, Do their possibilities contribute to and enhance the openness of the node – or don’t they? (Later on, in connection with the question, What does it mean to return to the ‘same’ situation?, we will have to differentiate between the potential a character has *in general*, on the one hand, and the degree to which s/he can realize this potential in a given, *concrete* visit to a nodal situation, on the other hand.)

If in mapping what a nodal situation allows or doesn’t allow characters are only interesting under the aspect of how much they contribute to the openness of the situation, the same is true for space, as an abstract concept, or the more concrete place, in the sense of ‘location’. (And remember that all that is said in this chapter refers to *all* FNs, regardless of the medial packaging in which they come – print, film, video, gameplay, whatever.) Is that space only the most neutral of

conditions of your moving about, so that you find yourself in a different room if you go through the door on the right, rather than pick the one on the left? Does it only mean that you see something different if you move your joystick to the left rather than to the right? Is that location just a scenic backdrop for what you do? Or is it navigable space, so that you can in fact explore it? Or is it even affected by your actions and decisions? Or, what is more, does it even change of its own accord? If so, randomly so? Or somehow predictably? Can you shrink in relation to your environment, like Alice when she disappears down the rabbit hole, or grow gigantically to Gargantuan or Gulliverian proportions? (Note that when it comes to *relations*, it is not always easy to decide whether the changes are due to something in the characters – Alice – or to something in the environment – Gulliver in Lilliput.) Do you get a different environment depending on your previous behaviour in a nodal situation? Would such changes be reversible? In the same game? Or only in a new run? Are you informed about the environmental consequences of your actions? Or do they belong to an unknowable future, maybe structured by probabilistic guesses? Do you have to make ethical choices? Is there a weighing of conflicting values involved? Obviously, all of these questions boil down to the one decisive question: *Do we have an interactive space?* Which is just a re-phrasing of that most basic of questions, *Does it contribute to the potentiality of the nodal situation? Is it a factor for its openness?*

Before I move on to ‘time’, allow me to briefly draw your attention to the circumstance that it is the change from *event* (the basic unit of PNs) to *node* (the basic unit of FNs) that brings the above decision aspects (informedness, feasibility, responsibility, sustainability, etc.) to the fore in the first place. The whole fact of being in a specific kind of space attains a totally new dimension if that space is not presented as sealed-off past – a time warp, if you will – but as something whose future development depends on certain things I do now or refrain from doing. The character-space relationship morphs into something that is a far cry from the regular, stable embeddedness in a given, unchangeable, or, if changeable, always-already uni-linearly transformed space. Interactive space in FNs (if it is interactive, that is...) is sphere of action with a vengeance.

One of the most important devices for the manipulation of the reader in PNs is the management of time in narrative discourse. The ratio of *narrative time* (roughly: the time it takes to tell or read a story) to *narrated time* (the period of time that is covered in the tale) is one of the key indicators of narrative relevance: in the modern European novel narrative time (a) is usually less than narrated time (b), so $a < b$, but scenic or dialogic passages approach an equivalence ($a = b$), and in passages where narrative speed slows down extremely, the description of an event can take much longer than the actual event itself ($a > b$). Throughout most novels, there is great variation in the relationship, or ratio, of narrative time

to narrated time, the variable and flexible narrative pacing (with compression or slow motion, or stills even) leading the reader through a discourse that is experienced as slowing down or accelerating, as the case may be.

Time in a FN, however, is an entirely different ball game. The time in a FN (no matter what its historical setting is) is always NOW, it is an eternal present: the reader/viewer/user is HERE right NOW in THIS nodal situation (and the chains of events between the nodes are also set in NOW). What's past is past and the future is just around the corner – as it always is. The distinction between narrative time and narrated time doesn't make any sense here, because this distinction only emerges with PNs, with narratives that are based on the *difference* between a NOW, in which the story is told or read and which can be measured as clockwork time, and a THEN, in which the story happened. This binary doesn't exist in FNs. There is only one time: here, now, present.

Having said that, one begins to wonder: What about printed textual FNs (not movies, not gameplay) that are told in the present tense (like *Der Tempel des Schreckens*): do they not display the same kind of discrepancy between the time it takes to read an episode and the time it takes for the action in the episode to unroll? Surely, there is a temporal compression when we read something like, 'Now you cross that river.' – and once we have two different time scales, a binary appears. It would be foolish to deny that. But the point is you cannot use this binary for any analytic purposes, because this type of narrative operates on the assumption that for the purposes of this discourse a should be equal to b . It isn't, of course, but the 'as if' pretence of this kind of narrative assumes that it is. It's a stillborn binary, if you will. Creators and readers of such narratives live in denial – that is what makes textual present-tense narrative possible (even if that narrative is not a FN). And since such narratives work on the assumption of a continuous $a = b$, it doesn't make any sense to say that the ratio of these two quantities would make an interesting analytic tool. It isn't.

Then what about games in which you may only proceed to the next dungeon or stage once you have solved a particular task here, in this node? No matter how long it takes you to solve this problem, whatever awaits you in the next room will, well, be waiting for you there. Your entering there will trigger off time in that place, a time that had been on hold as long as you were elsewhere. Does that challenge the 'always only NOW' hypothesis? I don't see how it could. Wherever you move, it is eternal present. 'Time on hold until you enter' is the game designer's default choice in setting up the architecture through which you can move. But with regard to the temporal position of the player it is *indifferent*, for: what happens if time is not put 'on hold' and you find you arrive too late at the new scene because you were too clumsy to solve the previous task quickly enough?

Nothing much. It just confirms the illusion that you are in a NOW (only now it's too late...).

The illusion of NOW is robust: even if you find yourself in a story-world in which a day is shrunk to only eight hours, as long as the characters do not move at triple speed, you are in an evenly, 'realistically' flowing temporal stream, in which, if I may change my metaphors, the potentiality of the future is perpetually fed through the needle's eye of the present moment to be transformed into the factuality of the past. And even if you are given the chance to re-visit a situation – the same place, later –, that 'later' is always NOW.

If time in a node is always NOW, how does that NOW relate to the situation's being a node? That one is easy. Time in a node is that point in time that allows for more than just one continuation and that, once any one of these continuations has been realized, transforms potentiality into actuality, and node into event. That point in time may be extended until such a transformation actually takes place (which is, of course, tautological). But only until then. Still, take your time. Unless, of course, you're in a situation where time is running out. In either case, all you have is NOW. And all that it contains.

How can one then conceptualize the relationship of these analytically separated aspects of a nodal situation – character(s), space/place, time – to the node itself? Are they lower-hierarchy elements of a node, like elementary particles are the building blocks of an atom, so a node would be 'made up' of these aspects and nothing else? Or are they additional, *accidental* aspects that are not themselves constitutive of a node, but could add to its profile? If so, how?

Summarizing all of the above, it is safe to say, I think, that there is a straightforward answer to all these questions: *A node is a situation that allows for more than one continuation.* We've said that before, and there is no reason to renege. 'Allowing for more than one continuation' is both a necessary and a sufficient condition. Full stop. And whatever contributes to a situation being a node and to the specificity of being open is part and parcel of that node. And all of the above-mentioned aspects – *if* they display any potential for *variance* – can contribute, to whichever degree, to the overall *nodal power* of a given node.

1.11 Nodal Power

Define 'nodal power'.

The degree to which a situation is open.

Which means conversely: the aspects of 'character', 'space/place', and 'time' are relevant to FNs only in so far as they add to the openness or potentiality of a node within a FN. They *may* all be rather insignificant in a concrete case, that

is, if they don't contribute anything substantial to that openness, or they *may* be quite relevant, if they do. It all depends. Still, all a situation has to do to count as the nucleus of a FN, that is, as a node, is to offer at least a *bifurcation*. To be sure, all the rest is more than just trappings and decoration, because you find it all *inside* the nodal situation and it does significantly define the nature of the node. But it doesn't make the node a node in the first place. That is exclusively what the 'allows for more than one continuation' does.

Note that by definition you can only speak of the *nodal power* of a *situation*, not of the nodal power of a whole FN. Nodal power accrues only to one particular node, and it is *measured in the differences in the possibility space constituted by the edges of its various continuations, until they reach their respective ends*.

This rule is necessary to avoid the paradoxical claim that the nodal power of the first node of a FN is exactly the same as, or identical with, that of the entire FN, since it contained all the potentiality of everything that followed from it. While such an idea may be appealing to a philosophical determinist, it is totally at odds with an approach which holds that causality is only the effect of a retrospective narrative ordering of events, which concept, therefore, cannot be applied projectively to situations whose continuation is still undecided. We'll return to that in a moment.

So, the continuations of a node extend only to their next nodes. And from then on, it's a new move, a new calculation of the nodal power contained in *that* situation. Which, of course, does not hinder you from calculating the sum total Σ of all nodal powers contained in all the nodal situations of a FN. Yet the unit is calibrated on a *situation* (a situation that allows for more than one continuation...). Under the temporal aspect of a run through a FN, this situation ends when its potential has morphed into actuality. From the perspective of the runner-through, events are dead nodes, and dead nodes do not have any nodal power any more. But the nodal power of that present, unresolved nodal situation, seen as something that the architecture of that particular FN offers in that particular scene, is, of course, something that can be ascertained exactly as an aspect of that very architectural structure. *It is the space of possibilities demarcated by the edges of its various continuations, until they reach their respective next nodes*. Once one of these continuations has been realized, there is no longer a *space of possibilities* – until a new node opens up a new one. But from an architectural point of view – which is the one that we are taking – you *can* map the roads not taken and all the differences they make (between them). Which differences are called nodal power, which is the degree of openness we are offered by a particular situation.

1.12 Varieties of Nodes

Nodes come in many different guises. There is, for example, a whole spectrum, or scale, of *obviousness*: some nodes are clearly flagged out as such – let’s call them *overt* – , others are not that clearly discernible as nodes – they’re *covert*. If an overt node is not recognized by a reader/viewer/user, then that’s of no interest to us, because that is a question of his or her perspicacity, attention span, cognition skills (or lack thereof), whatever. If, however, a real node is deliberately masked in the artefact of the FN, that is, if it is part of the set-up of the architecture that this second door should not be seen by an average ‘player’, so that it is only *later on* that one is informed there actually *was* a (hidden) bifurcation and you *could* have taken a different path, when you were led to believe there was only one, then that is obviously an entirely different kind of game (either one in which players are wilfully toyed with – or one in which their watchfulness, keenness, level of extrovert activity, etc. are stimulated: ‘You didn’t pick up that tool which would have been useful now? You didn’t know you could? Who told you you couldn’t?’ Yes, this sounds increasingly like something akin to Kafka’s gatekeeper parable...).

I’d refrain from calling those covert nodes ‘retrospective nodes’, because they’re not retrospective, but only retrospectively *realized*, just as I wouldn’t call nodes that offer you choice without information ‘blind nodes’ (as in ‘blind choice’ or ‘blind chance’), because it isn’t the node that is blind, just your choice that is – and we’ve already filed that type under ‘gamble’.

Sometimes nodes are flagged out all right, but they lack in specificity with regard to what exactly the reader/viewer/user is expected to do. A lack of prompts is usually read as an invitation to just play around – like in sandbox video games – or to explore the virtual space you happen to find yourself in or to simply explore the possibilities of your artefact. And rightly so. For example, in Mark Z. Danielewski’s *House of Leaves* we find, at first, only nodes as main text/footnote bifurcations, while later, roughly beginning with page 120 or so, the nodal situation manifests itself in the overall page structure: *House of Leaves* contains pages with different sections and ‘boxes’ of text, without any indication how or in what order the reader should encounter these. The whole page constitutes a nodal situation in which the reader is free to choose which text segments s/he wants to read in which order. Lack of specificity encourages roaming (for a more extended discussion of this see volume 2 of this series, Felicitas Meifert’s *Playing the Text, Performing the Future: Future Narratives in Print and Digiture*).

On rare occasions, it only *looks* as if a situation had more than one continuation, but these continuations are actually identical (like in the famous “Damned if you do”/“Damned of you don’t” cartoon by Gary Larson). You may, if you wish, call

that a ‘mock node’ or a ‘pseudo-node’ (yes, we’ve been here before), but the point is that (as always with ‘pseudo-’) such a pseudo-node is no node at all. Sorry, chap.

Another possible differentiation (in addition to overt vs. covert nodes) is that between nodes whose continuations have been fully scripted by the authors/scriptwriters/game designers of that FN (i.e., these continuations are already there in the artefact, before any one of them is realized by you) and nodes whose continuations are not. A quick mental run-through will tell you that most FNs have nodes of the former kind. Most, but not all. Imagine, for example, an experimental simulation of a car-crash or a meltdown in a nuclear power plant. You set up the experimental situation with certain parameters, and the reason why you do this is that you do *not* know exactly how this situation will develop from the word ‘go’. That defines the situation as a nodal situation, and that’s why you run the simulation in the first place. If the one ‘realized’ continuation were known to you, you wouldn’t run the experiment. Since you don’t know it, it cannot possibly have been scripted by you. (I leave aside the aspect that it is a *series* of simulations with varying parameters, or varying values of these parameters, that are used to fathom the full potentiality of a situation, although one could argue dogmatically that if you change the value of a parameter, or even an entire parameter, you are no longer in the ‘same’ situation and that consequently each starting position has only one particular outcome and that therefore your starting position isn’t a node at all. This is not only an unnecessarily restrictive idea of ‘same’, which is at odds with the experimenters’ pragmatic assumption that they do runs of basically the ‘same’ situation; it is also at odds with how extremely complex systems and non-linear processes behave – more of this in a moment and then again further down when we turn to weather forecasting and climate change scenarios.)

So, non-scripted continuations do exist, in reality as well as in FNs, and they’re very interesting and it is very useful to look at them. But for terminological clarity one should not call a node that has scripted *consequences* a ‘scripted node’ (for *every* node is scripted), as one shouldn’t call a node that has non-scripted continuations an ‘open node’ (for every node is open, or it wouldn’t be a node).

Finally, since lately literary historians have begun to talk of “novels before novels”, are there nodes before nodes, meaning: is it possible to make certain choices (which may have enormous consequences) even before the game proper begins? Of course, you can. If you assemble the fantasy figure you will be playing in a game and furnish it with certain strengths and weaknesses, capabilities and incapacities, then you’re in a nodal situation – *outside the game*, however. The fact that your decisions will have reverberations *in* the game (and possibly severely limit or gloriously enhance the power and spread of your responses to the game’s challenges) does not make that nodal a nodal of the game (just like a football player’s choice of studs may seriously affect the way he plays on that slip-

perly turf, but is in no way a part of the match itself, which begins when the referee blows his whistle for kick-off and lasts for 90 minutes, or so). Pre-match choices (if it is a game that offers such) originate in nodes, but these nodes are, well, distinctly *pre-match* nodes. (As Ludwig Wittgenstein once famously remarked, “Man kann eben nicht vor dem Anfang anfangen.”) It characterizes certain FNs that they have such nodes (as part of their pre-run set-up) and others that they don’t. I do not see why one shouldn’t simply call them ‘preparatory nodes’, for that is what they are – and keep in mind that such preparatory nodes are never inside a FN.

1.13 Interactivity

It seems to be one of the strongest appeals of FNs and indeed one of the prerequisites of most of them (though not of all – think of *Run Lola Run* as seen in a movie theatre) that they presuppose or even call for some kind of interactivity.

The relationship between a user and a medium can be called *interactive*, if the *interface of communication allows series of mutually dependent action-response exchanges* – or, to be philosophically correct, the *semblance* of such action-response patterns (which, by the way, also defines the difference between *interaction* [between subjects] and *interactivity* [between a subject and a medium]): I take action and tap on an icon on the touch screen – the touch screen responds – I make a new move or selection – to which, in turn, the medium responds. And so on and so forth. Evidently, the degree of interactivity significantly relies on the nature of the medium. It is non-existent in a bound book, but patently obvious in a touch screen.⁷

⁷ It might be objected that, to the degree that the handling of the interface of a touch screen is not only intuitive, but also simulates, analogously, the surface behaviour of a non-interactive medium, such medial responses could no longer be filed under ‘interactive’. While the objection is to be taken seriously, I do not think that it is therefore necessary to modify the definition of ‘interactivity’ just given. If I scroll and swipe the surface of my iPod nano or tablet computer or my Kindle, the medium responds by the visual semblance of a physical change (it *looks* as if I had turned a page) and allows me to respond to that, in turn. If a medium can do that, I call it interactive. By way of contrast, I do not think it is reasonable to say that, after I have turned the page of a real book, the book *responds* to that action by now offering me a new aspect of itself – indeed, I believe that to say so would be quite perverse: that ‘response’ is not any different from, but absolutely identical with what I just did to the book. I turned a page. Period. However, in the interactive media just mentioned the *illusionary effect* is created by very complex calculations, whose results, I believe, cannot be said to be identical – i.e., one and the same – with my action. Besides, any extreme extension of the concept of ‘interactivity’ (so that it would include books whose pages you can turn) would be conceptually self-defeating: to widen the concept of

There seems to be a relationship between the degree of interactivity that is offered by a FN on the one hand and its radicality on the other – if by radicality we mean the degree to which a FN does indeed *stage* openness, indeterminacy, potentiality, etc. The medium-specificity and medium-sensitivity of both FNs and interactivity will be covered in the following volumes of this series. But is it possible in a theoretical, abstract way to distinguish various kinds of FNs through the kind of interactivity they offer and presuppose?

In *Avatars of Story*, Marie-Laure Ryan suggested two binary pairs of forms of interactivity: internal/external and exploratory/ontological:

In the *internal* mode, users projects [sic!] themselves as members of the virtual world by identifying with an avatar, who can be shown from either a first-person or a third-person perspective. In the *external* mode, users are situated outside the virtual world. They either play the role of a god who controls the virtual world from above, or they conceptualize their own activity as navigating a database.

[...]

In the *exploratory* mode, users navigate the display, but this activity does not make fictional history nor does it alter the plot: users have no impact on the destiny of the virtual world. In the *ontological* mode, by contrast, the decisions of the user send the history of the virtual world on different forking paths. These decisions are ontological in the sense that they determine which possible world, and consequently which story, will develop from the situation where the choice presents itself. (108)

Crossing each binary pair with the other, we get four different modes of interactivity: external-exploratory, internal-exploratory, external-ontological, and internal-ontological.

The first binary seems unproblematic and to the second one could only object, at first sight, that ‘ontological’ is maybe an unfortunate term for an activity of the user that is somehow constitutive for the virtual world. ‘Constitutive’ or ‘creative’ interactivity would maybe be a more appropriate coinage.

The problems begin with Ryan’s examples for each of these four modes of interactivity. For external-exploratory she chooses text-based hypertext fictions:

‘interactivity’ to such a degree that normally printed and bound books would be included in the corpus of *interactive* media, would leave no media outside that corpus. In other words: then all media would be interactive, and the concept of ‘interactivity’ would no longer be of any analytic use, since it would not demarcate any difference any longer. Conversely, to limit the meaning of ‘interactivity’ in such a way that touch screens are excluded, if you scroll and swipe them with your fingertips, would seem obstinate as well: everybody *knows* that it’s one of the big selling points of these media that they are interactive, and it would be somewhat stubborn to deny this.

In the texts of this group, the user is external to both the time and space of the virtual world. There are no time limits to the user's actions; these actions do not simulate the behavior of a member of the virtual world; and interactivity is limited to the freedom to chose [sic!] routes through a textual space that has nothing to do with the physical space of a narrative setting. (108)

She then goes on to explain:

In classical hypertext, the network is usually too densely connected for the author to control the reader's progression over significant stretches. Randomness sets in after one or two transitions. Once it escapes the control of the author, the order of discovery of the lexia can no longer be regarded as constitutive of narrative sequence, because it is simply not possible to construct a coherent story out of every traversal of a reasonably complex network. The only way to preserve narrative coherence in this type of architecture is to regard it as a construction kit for assembling a world and a story. (109)

Oops. That sounds a bit like external-*ontological*, doesn't it? For sure, if you allow the idea – and Ryan's emphasis is strongly on the *user's* relation to the virtual world (cf. 107) – that the run of a user creates the story and the world as s/he goes along, beyond the control of the author, who just furnishes the construction kit (a position that is, I believe, perfectly tenable), then the distinction between exploratory and ontological collapses – because which run would then *not* be constitutive of the virtual world *as experienced* by the user?

For internal-exploratory, which Ryan calls “the least common” (112), she cites “early digital texts with limited technological resources, such as *The Manhole* (1988)” (112), which characteristically follow traditional print-based models:

Internal-exploratory participation is particularly well suited to a type of narrative that I will call the “go through a portal and discover another world” story: down the rabbit hole or through the looking glass of Lewis Carroll's Wonderland, inside the wardrobe that leads to C.S. Lewis's Narnia, or up the fairy-tale bean stalk with Jack. This exploration cannot present danger, otherwise the destiny of the avatar would be at stake. It proceeds therefore at a leisurely pace, within the time of the virtual world, but not in a race against the clock. (112)

External-ontological interactivity is mainly represented in simulation games, such as *Simcity*, *Simlife*, *Caesar*, and *The Sims*:

The range of possible developments at any given moment depends on the possibilities of action offered by the various objects and individuals within the virtual world. For instance, a computer in *The Sims* affords two types of action: play games or look for a job. The choice of one of these affordances affects the life and the options of several members of the virtual world. In one possible scenario, the user may decide that Betty in *The Sims* will use the

computer to get a job. When Betty earns money, she will be able to buy a wider variety of commodities, and this may affect Bob's feelings for Betty. The possibilities of action evolve during the run of the program, and since affordances are determined by the global state of the system, as well as by the nature of the objects, the user's choices will always produce a coherent narrative development. (114)

That is well as far as it goes, but Ryan's examples for internal-ontological bring the ontological/constitutive problem to the fore again, and with a vengeance. "[B]y far the most common form of internal-ontological interactivity is represented by computer games that project the player as an individuated character who must accomplish missions in a world full of danger", and her "best examples" are "first-person shooters (*Doom*, *Quake*, *Half-Life*), and medieval fantasy games inspired by J.R.R. Tolkien's *Lord of the Rings* (*Morrowind*, *EverQuest*, and *Ultima Online*)." (117) That is puzzling. I can see that a user's decision to look for a job rather than play games creates a different world in *The Sims*. Hence, ontological/constitutive seems justified here. But in which way could one say that a shooter's skills 'create' a different world as he shoots his way – for this was Ryan's characterization of 'ontological mode': "These decisions are ontological in the sense that they determine which possible world, and consequently which story, will develop from the situation where the choice presents itself." (108) Sure, this is seen exclusively *from the perspective of the user* (it is not a God's eye view of the scripted architecture). But what is then the difference between a world created by the run of a shooter and the world created by the run of a hypertext reader? If you say the first is ontological, then you cannot deny that accolade to hypertext interactivity either. And if that is so, then no interactivity is simply explorative. But if the explorative-ontological binary implodes, you are just left with internal-external, which is an obvious, but unexciting distinction.

Maybe it would be wise to reserve 'ontological/constitute interactivity' exclusively for a kind of interactivity that is really creative of a new kind of virtual reality (and not just the realization of a particular run); to reserve it for emergent gameplay and MMORPGs (massively multiplayer online role-playing games), for example, or types of emergent narratives.

1.14 Simulation

'Simulation' seems to be another hard one. It appears self-evident to say that FNs simulate the openness of the present moment, the potential of NOW, and the indeterminacy of the future. But when you look for definitions of 'simulation', the results are mostly depressing. Take Wikipedia's "Simulation is the imitation of

some real thing available, state of affairs, or process.”⁸ First, that’s not a definition at all, because it doesn’t say how a simulation differs from an imitation, and, second, I still wonder what a simulation of “a thing” might look like (is mimicry a ‘simulation?’) or, for that matter, the simulation of a “state of affairs” (like when a person is *dissimulating*?). Any convincing examples?

Gonzalo Frasca regards “simulations as dynamic systems that produce outcomes” (2), which raises the question, Since all dynamic systems produce outcomes, what’s the defining difference between a dynamic system and a *simulation*? For, to be sure, they are not the same? Not all dynamic systems can be called simulations, can they?

Likewise, Marie-Laure Ryan’s “a simulation is a productive engine that generates many different courses of events through a combination of fixed and variable parameters” (*Avatars* 13)⁹ is going in the right direction with regard to “different courses” and “fixed and variable parameters”, but surely “productive engine” is to be taken metaphorically, not literally? A simulation is not *really* a machine, is it? But if it isn’t, what is it?

How about this one then? *Simulation is the modelling of a process*. It is used either to arrive at a result (e.g., crash test) or to practice a skill (e.g., flight simulator) or to virtually observe (and afterwards be able to predict in reality) the course of a process (e.g., volcano eruptions, earthquakes, nuclear meltdowns). It is the *modelling* of a process because at least one element of the real thing is substituted by something else (e.g., the human body by a crash test dummy). Sometimes (pace Frasca and Ryan) simulations are used to get just one outcome (e.g., flight simulator → improved pilot skills), sometimes simulations are used to get different outcomes (that is why you keep the values for some parameters constant and for others variable, although it helps your understanding, if you have only one variable...).

If FNs *simulate* the openness of the present moment, the potential of NOW, and the indeterminacy of the future, then they also *display* these very qualities. As with other very specific sign constellations, they not only *signify* these qualities, these

⁸ This definition (accessed 17/11/2011) has meanwhile been significantly improved to “the imitation of the operation of a real-world process or system over time” (accessed 18/4/2012). Still, “over time”, it seems, is superfluous; and if a system is operating, then an imitation of its operation is an imitation of its internal processes – so “system” seems discardable, too, if we’re willing to apply Occam’s razor. Whether an imitation of the operation of a process that is *not* a “real-world” process would no longer be a simulation is indeed a philosophical question. According to the definition I will put forward four paragraphs on, it would indeed be a simulation, as long as it can be regarded as a *modelling* of that process (no matter whether the process is “real-world” or not).

⁹ In any case this seems more to the point than “A typical simulation consists of a number of agents that are given an environment to live in and some rules to follow.” (Ryan, *Virtual Reality* 63)

qualities appertain to them. For FNs not only thematize openness and potentiality, they *stage* it, for your use – they offer various continuations (always), choice (most of the time), and process (invariably so): *it is all there*. One could say: the reason why FNs *are* is that they also *are* what they are *about*. A situation that offers you choice does not just *signify* choice or *represent* choice – there really *is* choice.

1.15 As Node Leads on to Node: Nodal Structures and Their Representations

The simplest FN is one that has only one node. The next evolutionary step is a FN in which the continuations of one node lead to at least one other node. And the third step is a FN in which you reach a third degree, because at least one continuation of that second node leads to yet another node.

If you try to graphically represent or ‘map’ these different kinds of FNs, it is economical (following Occam’s razor) to only register nodal situations and the way they are interconnected. Thereby you do not deny that something happens ‘in-between’, on the way from one node to another (events, all *the changes* that happen between nodes). These are just not mapped into the representations (all good mapping is about leaving out irrelevant detail and highlighting detail that is of interest – that is why we have so many different kinds of thematic maps).¹⁰

So, a first-degree FN would look like this:

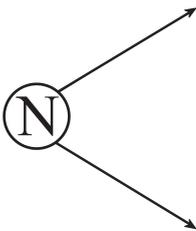


Fig. 1.3: A first-degree FN.

¹⁰ That leaving out is indeed the basic feature of any map that makes sense is made abundantly clear by the mind game about a map on the scale of 1 : 1, which, by definition, leaves nothing out at all and has to be an exact and complete – and therefore quite useless – reproduction of the whole of reality. The finest examples in fiction of this hypothetical and quite impossible map can be found in Lewis Carroll (*Sylvie and Bruno Concluded*), Jorge Luis Borges (“On Exactitude in Science”, to be found in his *Universal History of Infamy*), and Umberto Eco (“On the Impossibility of Drawing a Map of the Empire on the Scale of 1 to 1”, in *How to Travel with a Salmon and Other Essays*).

A mapping of a second-degree FN like this:

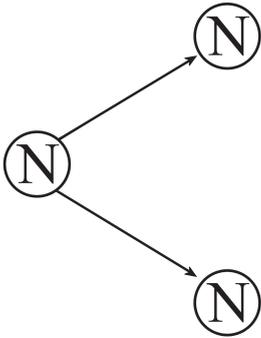


Fig. 1.4: A second-degree FN.

And a mapping of a third-degree FN like this:

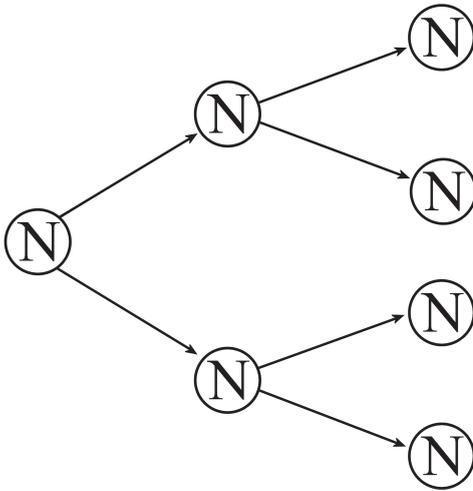


Fig. 1.5: A third-degree FN.

The most common representation of a FN therefore takes the form of an arborescent, or tree structure.

Note that (again to keep things simple) we give each node only *two* continuations (which is the minimal condition for a node), although it might have *any* number of continuations, as long as it is higher than one. Note also that in mappings 2 and 3 we have ended each continuation with another node (which need

not necessarily be the case). But this will later allow us to formally describe a nodal structure as a mathematical graph: a graph being a collection of *nodes* (or vertices) and *edges* (or links), the later connecting *pairs* of nodes. So, edges lead from one node to another, and that is what the above diagrams show.

Nodes and edges are our elementary building blocks. To work with only these two has two great advantages. The first is that you can hardly reduce the number of kinds of elementary particles any further (which is a matter of conceptual economy), but that, later on, we will be able to build up all sorts of compounds with only these two kinds of building blocks (although, before long, a third kind of building block will be introduced as an elegant shorthand for one particular node-edge-configuration – for the moment, we have just these two building blocks: nodes and edges). The second advantage is that nodes and edges are already clearly defined concepts in Mathematical Graph Theory, which we can later use to describe how FNs work in a highly abstract and formalized way (see part 2 of this volume).¹¹

11 It has been suggested that Mathematical Catastrophe Theory, as designed by René Thom, might also be a serious candidate for the formal description of what goes on in FNs. It is, of course, true that Catastrophe Theory, derived from theoretical biology, but fruitfully applicable to a variety of natural and social sciences, could potentially be used for any description of discontinuous behaviour: “As a part of mathematics, catastrophe theory is a theory about singularities. When applied to scientific problems, therefore, it deals with the properties of discontinuities directly, without reference to any specific underlying mechanism. This makes it especially appropriate for the study of systems whose inner workings are not known, and for situations in which the only reliable observations are of discontinuities. It is of course true that the techniques of mathematical physics have been successfully applied to the analysis of discontinuities, but they require a degree of knowledge of the system which workers of the ‘soft’ sciences are unlikely to possess [...]” (Saunders 1) So, every time “we observe in a system some or all of the features which we recognize as characteristic of catastrophes [i.e., of the seven types of catastrophes that René Thom has identified as possible in four-dimensional systems] – sudden jumps, hysteresis [according to Wikipedia, accessed 25/5/2012, “Hysteresis is the dependence of a system not only on its current environment but also on its past environment. This dependence arises because the system can be in more than one internal state. To predict its future development, either its internal state or its history must be known.”], bimodality, inaccessibility and divergence – we may suppose, at least as a working hypothesis, that the underlying dynamic is such that catastrophe theory applies.” (Ibid., 83) But while this makes Catastrophe Theory a strong candidate for the kind of discontinuous behaviours of such processes as are discussed in section 1.17 of this volume, there is no reason to suppose that it might also be a serious candidate for the formal description of the architecture of FNs, the difference of the two being exactly this: while discontinuous behaviour of systems demands a theory that can describe and, at best, model such processes, the openness of FNs is not of such a kind that it demands a Catastrophe Theory-specific description, because FNs only kick in when this modelling has already been achieved. In other words: while what in reality is beyond the conversion line of the present (cf. section 1.16, below), its preparation into a (designed) FN structure allows for a much simpler formal description of

Here's a little test. Keeping these rules in mind, what do you think is wrong with the following representation, if it is meant to be the complete representation of a FN?

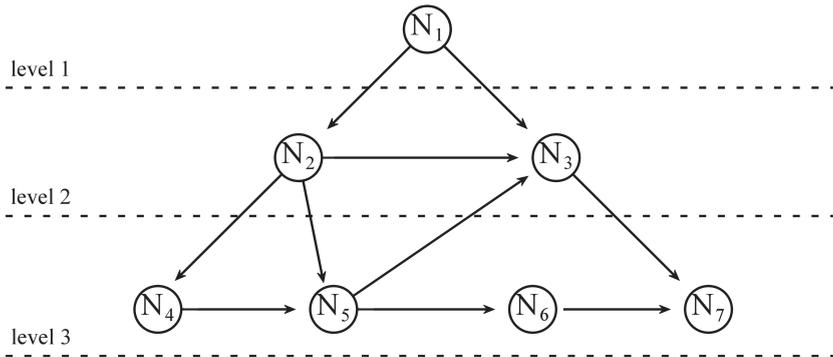


Fig. 1.6: A nodal pyramid?

Never mind the fact that one of the arrows (or edges) is pointing ‘upwards’ again, or ‘backwards’ (depending on how you hold the tablet), viz. the one from N5 to N3. We’ll address that point of ‘going back’ in a few moments. Right: four of these seven nodes aren’t nodes at all, because these situations have only one continuation. With the exception of N3, these impostors are all to be found in the bottom line: the one to the left (N4) and the two to the right (N6 and N7). But wait a minute: if we cross out N4 because it isn’t a node, can N2 still be called a node (after all, it only leads on to *one* other node)? And if N2 is disqualified, how can N1 still be a node? But then the whole nodal structure would unravel and collapse. An instance of the domino effect.

Obviously, we have to underline a restriction we mentioned before – a restriction that, however, did not make it into our representation. To be a node, a situation does not necessarily have to have at least two continuations that *both* lead to other nodes. It is not even necessary that one of them lead to another node. They may just go on and on, from event to event until they eventually reach the end of their roads. And if we stick to the rule that events are not mapped, because they are simply what happens on this road, then we still have to introduce a new sign that makes clear that N2 is a node after all (because it does have a bifurcation),

the architecture that a reader/viewer/user/agent/viewer is faced with. See also Ulbricht; Freber, Schmid.

and we have to mark the former N4 as “stop” (S) or: end of the game. Nothing follows from an S, but it does at least illustrate the fact that N2 is a node. The function of any S is just to demarcate the end of certain continuations and to graphically illustrate the fact that a node remains a node, even if not all of its continuations lead to other nodes.

The introduction of the stop-sign allows us to re-write the representation of a first-degree FN as follows:

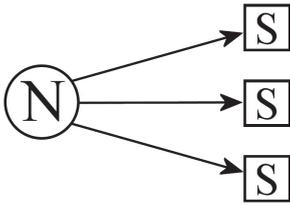


Fig.1. 7: First-degree FN with stops.

This is, evidently, a FN with just one nodal situation and three different continuations that lead – inevitably so – to three different endings. Mappings 2 and 3 could be re-written in the same way, and we could substitute any Ns with Ss (though nothing could, of course, follow from an S). (How Mathematical Graph Theory can deal with the new condition that edges do not only connect nodes, but can also connect nodes with end stops, is a matter to be dealt with in part 2.)

Still, a feeling of uneasiness remains. For, however ‘impossible’ the original mapping of level 3 in our ‘test’ diagram was, according to our cartographer’s rules (the impostors N3, N4, N6 and N7 not being nodes at all), it seemed to indicate that you could reach N5 by two different routes (indicated by two different edges) and this possibility seems to be lost in our revised mapping (because nothing can follow from an S). But is it not relevant that you can arrive at a nodal situation by two different ways? Does that not make a difference? And, to saddle that problem with another question: even in our ‘corrected’ mapping, you can reach N3 by three different routes and end up in a situation (N3, but no longer a nodal, rather another impostor) that had been formerly discarded, or side-stepped (once by choosing N2 over N3, then by choosing N5 over N3). So, sometimes our mapping does represent ‘different routes’ all right (if they involve nodes), sometimes it doesn’t. That is curious. Is that just some kind of trick that this kind of mapping plays on us, like one of those impossible etchings of E.M. Escher’s? But we all have an intuitive understanding of what ‘going by different routes’ or ‘going back’ means. Still, can we map it? If it characterizes the specific nodal structure of a given FN, I think we should.

Let us go back then and consider *directionality* and *temporality* (all the while remembering that our objective is to represent the nodal structure of the *architecture* of a FN, not to write a protocol of possible *runs* through this architecture).

The tree diagram of FNs implies uni-directionality: you read this diagram from left to right and from left to right *only*, and this uni-directionality mirrors a temporality, or precedence – you simply cannot visit N2 and N3 unless you’ve been to N1. Uni-directionality also implies irreversibility: like in a game of chess, you cannot take back a move (that is also the idea behind Choose-Your-Own-Adventure, although, different from chess, there are no sanctions if you do).

Are all edges uni-directional? Of course not. Some nodals *may* send you back to a previously visited situation. They may do so directly, then I would call the interconnecting edge ‘bi-directional’ (but never forget that many, many things can happen on such an edge – it is by no means necessarily empty of events – quite the contrary! –, so this is not a matter of merely sending you round in circles!). Or they do so through a series of uni-directional edges that form a loop and that constitute, in that particular section of the overall structure, a circular sub-structure. That is the third elementary building block I promised earlier on as an addition to nodes and edges: a *loop* – which may be either a bi-directional edge or a larger circular sub-structure within the overall nodal structure of a FN.¹² Nodes, edges (which can be either uni- or bi-directional), and loops – we are confident, as of now, that is all we need to sufficiently describe all nodal structures that are to be found in any FN, though ‘cycles’ will later appear in part 2.¹³

The advantages of such FNs as have these bi-directional or circular structural elements are palpable: by offering a re-visit or a first-time visit of a situation that had been formerly rejected (from N5 to N3), they take away some of the finality of decisions in strictly uni-directionally related nodes. Inversely, they emphasize the importance of re-consideration, learning effects, exploratively gained insights, acquired skills, etc. – and all in the course of one and the same run, because nobody could deny that all of these can also be had in repeated runs of strictly uni-directionally related nodes (some get better and better at playing chess, simply through practice). FNs that display an arborescent structure may be more life-like (just think of “The Road Not Taken”), but maybe that is exactly why FNs that do not have such an arborescent structure have a cutting edge over others – and over life: apart from the fact that they’re all sanction-free, their reversibility

12 For a discussion of the mathematical representation of loops, cycles, and elementary cycles, you are kindly referred to part 2 of this volume, in particular to section 2.6.

13 For an illuminating discussion of nodes, trees, loops, networks, and connectivity in general see the sixth chapter, “Web Worlds: Why We’re all in This Together”, in Ball, *Branches* 147–176, 149–159 in particular.

(you can take that move back, you can undo it) implies the possibility of a compressed learning effect *and* it lifts the weight of finality. You *can* go back again, and you *can* undo. That is a liberating idea. And not just an idea. Because in FNs you can *do* it. That is a liberating possibility. And that possibility is a *fact*.¹⁴

And since that fact is such an interesting feature of some FNs (though not of all), the key question is, Should the possibility of reversibility (re-visits possible in the same run, but also first-time visits to formerly rejected situations) not be mapped in representations of the nodal structure of a given FN, if it offers this possibility? And if it should, how could it be done?

It could be argued, of course, that since the mapping of a nodal structure is the mapping of the *architecture* of a FN, the mapping of ‘visits’ and ‘re-visits’ is none of its business. Unlike the magic map of Hogwarts, our map never pretended to be able to show who was in which room. A visit is something that happens during a particular run (or performance), and on principle we don’t map runs. The mapping of runs would have to be a temporal protocol, but we are interested in what the objective structure of the artefact allows, which remains unaffected by any runs.

But there’s the rub. All of this is true. And still, as I had occasion to remark *à propos* the arborescent structure, if a structure has directionality, it also has an inbuilt, if you will: objectified temporality (you cannot visit B and C before you’ve seen A – there is an unalterable, non-negotiable consecutiveness). And if some edges *are* bi-directional – like: you can go down this corridor to B and C and *then back again* to A –, then this is part of the objective structure of the artefact. It is an objective possibility that has *nothing to do* with the question of whether any user has realized it or not. To map this possibility is not to map a run. It is to map an objective feature of the structure that *allows* different runs (in which we are indeed not interested). Strictly uni-directionally interconnected nodes are like series of en-suite rooms that curiously enough have only valve-like or sluice-like one-way doors. It is a feature of *their* architecture. It would be a serious omission not to take note of the fact that not all nodal structures are like that. Because they aren’t. In mapping *the structural possibility of ‘re-visiting’* we are decidedly *not* mapping re-visits themselves (just like we’re never mapping visits either – both are phenomena that are strictly run-related). We’re only doing what we’re doing: surveying and mapping an objective feature of that situation, viz. that it can be

¹⁴ It may, however, be true that such a liberating effect is only felt in a virtual situation. Empirical evidence points to the contrary: in real life, people are much happier, if their decisions are non-reversible: it stops them from pondering whether their choice was actually the right one, whether they should go back and exchange the product for another one, etc. (cf. Schwartz 5, 144ff., 228–229).

re-visited (if it can...).¹⁵ Except for situations with which we'll deal later on, the nodal situation remains unaffected by any visitor or visits and revisits, because by definition all changes occur *outside* a nodal situation. The nodal situation is never an edge – where events happen –, and it is always *before* something potential is realized, in the sense of actualized. And then it is no longer a node.

Imagine a node that leads on to various other situations, from which, however, it would be possible to return to your starting node. Its representation could look something like this:

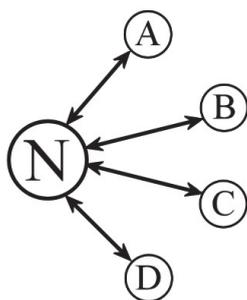


Fig. 1.8: A node with returns (1).

These four edges would be bi-directional. But since we've laid down that we map only nodes and edges and stop-situations, those different destinations A, B, C, and D would have to go and we'd only have base camp N, with loops representing the different sorties:



Fig. 1.9: A node with returns (2).

¹⁵ See Dagobert Frey, as quoted in Danielewski: “Every house is an architecturally structured ‘path’: the specific possibilities of movement and the drives toward movement as one proceeds from the entrance through the sequence of spatial entities have been pre-determined by the architectural structuring of that space and one experiences the space accordingly.” (153) Note however, that Frey’s “path” – meaning ‘structural possibility’ – is not to be confused with our ‘run’.

It is obvious that there would be no directionality in this, since it is part of your freedom in the nodal situation to choose one exit over the other. The only directionality we have here is that you have to re-visit N before you can go on another trip. You can, if you're bold enough, call this an *axial structure*, with N being the axis or axle and the loops the spokes (though they look more like ribbons to me).

Now, if one of these exits from N happens to lead to another node, then you have the conditions of a flow chart again, with possibly the minimal conditions of a tree structure with inbuilt uni-directionality. And if that second node has the same characteristics as the first, and so on and so forth, then you get a funny looking stem structure with axial nodes that allow for 'lingering' or some sideways action before you move on to the next base camp. In other words: the 'loopy' edges issuing from an axial node are bi-directional and, of course, non-hierarchical, whereas in the order of the nodes we find old-fashioned sequentiality:¹⁶

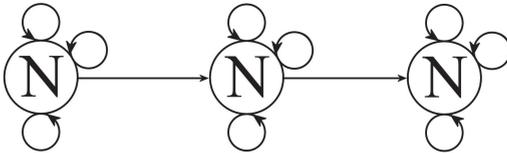


Fig. 1.10: An axial nodal structure.

But there lurks a potential objection here that one should address: is our base camp N really a node? It is a situation that has more than one continuation, so that makes it a node. But all the different continuations, one might argue, eventually lead back to N, so one might say they don't really make a difference in the long run. That may be true. But 'making a difference in the long run' was never a component of our definition of the 'more than one continuation' that characterizes a nodal situation. If the four exits from our situation are sufficiently different to be mapped as A, B, C, and D, then that marks that situation as a node. Objection overruled.

Still, that invalid objection raises a bigger issue, viz. What exactly does it mean to say that somebody returns to the 'same' situation? That issue should be discussed independently of the concrete structure we have just sketched, though it is, of course, a question that can only arise in FNs that generally have bi-directional edges or loops (later called 'cycles', see part 2) – for tree structures know no returns ("The Road Not Taken"). Evidently, the sameness or identity question

¹⁶ This is obviously a simplified rendition of what Marie-Laure Ryan calls "The Vector with Side Branches", cf. *Virtual Reality* 249–251.

is one that can only arise in structures that allow a return via bi-directionality or, *vulgo*, larger loops.

So, if somebody returns to a nodal situation – a wiser man? –, does that not change the situation as such? If s/he has more knowledge, wisdom, greater skills, etc., does that not change the nodal power of that situation? It shouldn't and it won't. The nodal power of a situation is the measure of its general openness. That quantity remains constant no matter how much of it a user is able to realize. S/he may realize it to a higher or lower degree, depending on her/his skills, experience, etc.. But the ceiling of what can be maximally realized in a given situation (because the situation is set up in such a way) remains unaffected by that. If you return to a situation with accumulated skills – points that you have collected in the course of your run –, you can still only realize what the situation allows objectively and has allowed objectively all along, even when you entered it as a greenhorn. The discrepancy between maximum score in that situation and your own performance may now have been narrowed, but that upper limit of maximum score hasn't changed at all (and it was the possibility of that upper limit of the maximum score that was factored into the quantity of nodal power, not your own performance!). There is therefore no contradiction to our earlier claim that the degree of potential for variance that a character or an avatar brings to a nodal situation has to be factored into the overall nodal power of that situation. What was meant was *the upper limit of a character's potential of variance or range of activity* – what he or she can do *generally*, in the most abstract sense –, not how much of that potential is actually realized in a particular run. The difference between 'demarcated range of possibilities' and 'degree to which a specific user is able to realize these possibilities' corresponds to the difference between the architecture of a FN on the one hand and any run through that architecture on the other. A situation's nodal power remains constant, because it is an objective measure of the openness it has. That openness remains constant, no matter how much of it is realized by a user (which may, and will, vary). That is the conceptual price we have to pay for the idea that we can indeed return to *the same situation*. For if that is not constant, then there is no 'same', and if there is no 'same', then we can never return and re-visit. The *situation* has to be *identical* – otherwise one cannot possibly speak of a *return*. And we *know* there is this possibility in non-uni-directional structures, and we did want to be able to map re-visits and first-time visits to previously rejected situations, we did want to be able to map reversibility, did we not? Well, that is the price.

It follows from this that whenever a nodal situation has changed substantially – meaning: whenever it now allows continuations that it did not allow before –, one cannot speak, like in everyday parlance, of a 'return' to 'that' situation: because it is no longer the *same* situation.

In this respect, it doesn't matter whether the changes in the situation are a result of your own previous visit (like in any kind of ecological game where, for example, your carbon footprints have worked 'behind your back' during your absence) or whether these changes occurred independently from a user's former actions (in such a game design environments could, for example, deteriorate or recover while they're left alone and then limit or enhance your previous opportunities). In both cases the situation would have to be mapped as a 'new' one, *if* it allows other, more, or fewer continuations than before. Consequently, you cannot *re-visit* a situation that is *new*.

It is true that this definition of 'same situation' is stricter than everyday usage. But terminology often is and has to be. In everyday experience a few visual signs will probably suffice to trigger off the response, 'Oh, I've been here before', when, strictly speaking, so much has changed in that situation that you'd be at a loss to explain what exactly 'here' refers to.

This is also the time to free ourselves from some (inevitable) spatial connotations of our 'architecture' terminology. If a room (equivalent to a nodal situation in a FN) now allows for different continuations than before, it would, of course, not be the 'same' room anymore, but a new one, and it would have to be mapped in a different place in that floor map.

Again, this has nothing to do with *runs*. It is a consequence of the fact that in some FNs nodal situations do not remain stable or identical, but morph into something else – and, morphed into something else, they cannot occupy the same place as their former self. They are *not the same*. This is not the mapping of the temporality of a *run* into our representation of a nodal structure; it is the mapping of a temporality that *this nodal structure itself displays*, if situations change.

'Change', of course, implies both continuity and discontinuity: there has to be enough continuity for a user to be able to identify a situation as one that s/he has been to before and, at the same time, there has to be sufficient discontinuity for us to speak of a *new* situation. In reality, that does not constitute a problem. Games offer enough hints to the former – and whenever the nodal power of a situation is different from before, then it is a new situation. It's as easy as that.

This kind of a visit to a *transformed* situation is, of course, dependent upon the medium in which the FN is set. You cannot do it in a book. Choose-Your-Own-Adventure books can really only send you back to the *same* situation. It's different in electronic media, and it becomes more and more state-of-the-art standard; the more sophisticated the media become, the more complexity they display. There is obviously some link between the degree of interactivity (though that in itself does not necessarily imply evolving situations) and the fact that a situation may be designed as dynamic (auto-dynamic or exo-dynamic) as well. If you will,

such FNs become more life-like, because in life you can never go back to the same situation, though cruder forms of FNs suggest you can.

Note again that none of this is about any acquired skills, experience gained, etc., that the user has accumulated in the meantime, or, for that matter, about different paths s/he may have taken to get there. If a situation allowed, say, the crossing of a river by swimming, only you couldn't do it at the time because swimming wasn't one of the capabilities you had chosen while assembling your avatar, but *now you can*, then that is still *the same* situation that has allowed the crossing of the river, all the time. Its nodal power is the same. It *is* the same situation. And you are re-visiting. But if the situation (as actually set up) simply didn't allow swimming across the river, but now it does (for whatever reason), then that constitutes a *new* situation.

Note also that all changes happen on edges. FNs are all about openness and process, about change and potentiality. But there is no change within a nodal situation itself, never ever – only when it dissolves. A nodal situation is the eye of the hurricane – all the action is outside. All that can happen in a node is that transformation from potentiality to actuality – and once that happens, the node is gone. It has dissolved into a particular event, a new situation (which doesn't have to be another nodal situation at all). The disappearance of a node is *not* a sad fact. That is what nodes are for. To allow the future to happen.

1.16 Why 'Narrative' Anyway?

In every present moment, everything that was possible solidifies into just one *realized* continuation. Along the line of the present, which separates everything that is and was from everything that is not yet, a continuous conversion of potentiality into actuality takes place, as mere possibility is transformed into actuality and the openness of a horizon of continuations solidifies into one single event – which is then a fact.

Every NOW is the needle's eye through which the future is fed to crystallize into actuality. A node is nothing but the deliberate setting up or the modelling of such a NOW, such a situation. Every node that we are presently in sits exactly on the fence that separates the future from everything that was and is. Nodal situations in FNs are artificially constructed conversion points that allow you to experience this flow in a magnified and 'prepared' way, as in a lab situation – 'as if', *and yet* not only 'as if', because it is also an instance of the real thing, since multiple continuations are *really* offered, and not just represented or thematized.

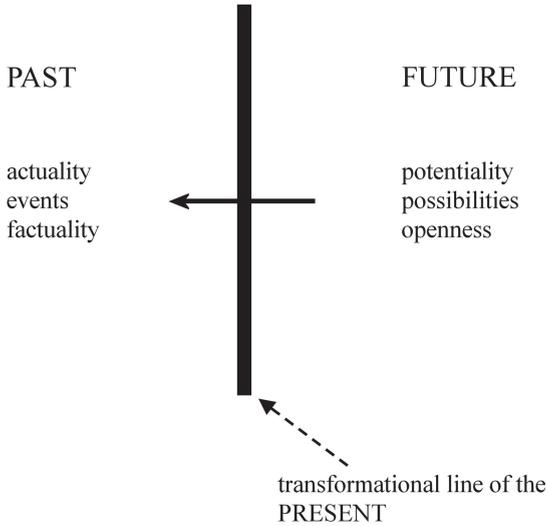


Fig. 1.11: The great conversion.

Note how the absolute direction of the flow does not matter: as time's arrow points to the right, the 'flow' of future time to present and past is in the opposite direction – it is all the same, since the illusion of *time passing* is preserved, irrespective of whether you imagine the line of the present as moving and the frame of absolute time as constant or time as flowing and the line of the present as constant and 'always here, now'.

Note, too, how this representation of the flow of time from right to left is similar to the Tantric idea that in every NOW the monster of time and fertility disgorges the world of experience and knowledge, so that the past is actually a product of every present moment; the decisive difference to other time philosophies – like Western Philosophy in general – that also see the past as something that is spatially removed from the NOW being that Tantric philosophy knows that the origin of everything is not 'out there', far away in the distance, but always here, NOW, so that nobody has to travel to arrive at the spring of things: we are always already there (cf. Rawson 11–14).

But to return to Future Narratives: every change is the dissolution of a node into an event. We said: nothing happens *inside* a node, nothing but the transformation that is identical with the disappearance of the node. That is what nodes do: they disappear, leaving a trail of actuality. Once possibility has solidified into fact, we are able to retrospectively identify cause-and-effect chains that seem to explain why 'this had to be'. In identifying what had to come together to create

the present situation, we imagine certain temporal lines (which we have marked out as relevant) *converge*. The result is that by connecting different events in a specific way, we have not only invested them with meaning, we have also given the whole process an air of inevitability.

This figure has its counterpart in the natural sciences when it comes to the retrospective understanding of random, unpredictable processes once they have solidified into fact. Mlodinow gives an example:

In any complex string of events in which each event unfolds with some element of uncertainty, there is a fundamental asymmetry between past and future. This asymmetry has been the subject of scientific study ever since Boltzmann made his statistical analysis of the molecular processes responsible for the properties of fluids. [...] Imagine, for example, a dye molecule floating in a glass of water. The molecule will, like one of Brown's granules, follow a drunkard's walk. But even that aimless movement makes progress in some direction. If you wait for three hours, for example, the molecule will typically have travelled about an inch from where it started. [...] In hindsight, [...] we can clearly explain why the past of the dye molecule developed as it did. [...] [But] the movement of the dye molecule was virtually impossible to predict before the fact even though it was relatively easy to understand afterward. (197)

In other words: our narrative processing of the past (selection of 'relevant' events and their relating) has created not only meaning (which cannot be had without a suggestion of causality, because the wholly contingent is not experienced as meaningful), but it has also created the semblance of necessity – narrative necessity, because it is exclusively produced by narrative, and therefore by virtue of narrative.¹⁷

¹⁷ The concept of narrative causality insists that the semblance, or illusion, of causation is indeed *produced by the narrative* and that cause-and-effect chains of events do not necessarily exist prior to their being perceived and related in such a way. This has far-reaching consequences: in her unpublished paper "Sequence, Linearity, Spatiality, or: Why Be Afraid of Fixed Narrative Order", Marie-Laure Ryan up to a point agrees with Roland Barthes's claim that narrativity [an unfortunate coinage to begin with, see below, CB], being a fundamentally temporal, uni-linear and sequential "structure" [sic, 3], is incompatible with triumphant pluralism, as endorsed by Barthes – only that Ryan makes a strong case for narrativity and against the more ludic and aleatoric attempts at creating more 'readerly' texts, which she finds unsatisfactory for a variety of reasons. In two of the three reasons that Ryan gives for "why Barthes' vision of triumphant pluralism cannot take narrative form" (4) 'causality' crops up: whereas in space, she argues, we can move about freely, "time is one-dimensional" (3) (I suppose what she means is uni-directional) and therefore any changing of the order of events "will result in the best cases in a different story" (which seems OK with me and Roland Barthes) "and in the worst case in no story at all. When a narrative sequence involves causality, it cannot be inverted, because an inversion would mean that the effect precedes the cause – an order that most philosophers regard as logically

The convergence of at least two cause-and-effect lines in the present moment can be represented in such a way:

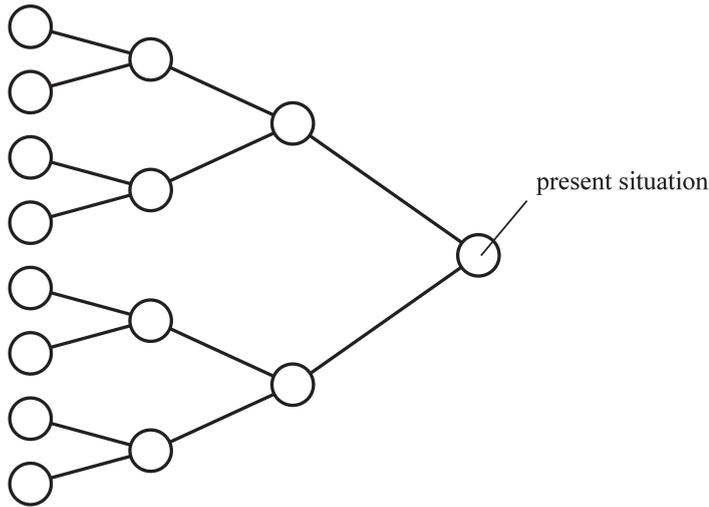


Fig. 1.12: Cause-and-effect lines.

impossible.” (3) And again, with a different emphasis under “third reason”: “The question, of course, is whether the total randomness of the system [her example is Marc Saporta’s *Composition No 1*] can really produce anything worth calling meaning. *It certainly cannot create narrative meaning* [emphasis added, CB], because narrativity is based on an a-symmetric relation [possibly meaning: irreversible relation] between cause and effect: if A causes B, A must precede B; but a random shuffling can generate the sequence AB as well as the sequence BA.” (4) Of course, it can. But that is beside the point. Since the human mind’s default position is to meaningfully link events by narrativizing them and since it can easily do so, even if – yes, especially if – the linkages are *not* given, the cause-and-effect assignation does not have to be pre-given, it can also be produced, by narrative, *ex post*. Therefore, even random orderings can pretty well trigger off the creation of narrative meaning. And the proof is in Marie-Laure Ryan’s own paper: in trying to map the different possible scenarios contained in Robert Coover’s “The Baby Sitter”, she soon gave up “because many paragraphs are compatible with different versions.” (7) Exactly. But “compatible with different versions” means ‘meaningful in more than one version’ or ‘meaningful in more than one order’. And that in turn means nothing but: they can easily be fitted into different cause-and-effect chains brought forth by their respective narratives. As spelt out in section 1.2, “What Narratives Do for You”, meaning doesn’t come ready-made, neither comes causality.

Note how every circle can be seen as both cause (of something that follows from it) and effect (of something that preceded it), except for the present situation which is always only effect.

Does that remind us of something? Here is the tree diagram of a FN, showing how a present nodal situation forks into diverging continuations:

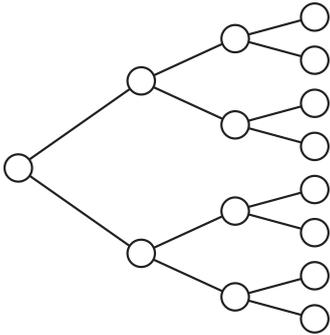


Fig. 1.13: Tree diagram of a FN.

It is easy to see that the present situation (as a result of everything that happened before) in a PN is identical with the present nodal situation (as a starting point for everything that will possibly occur after this) in a FN. Here is the whole picture:

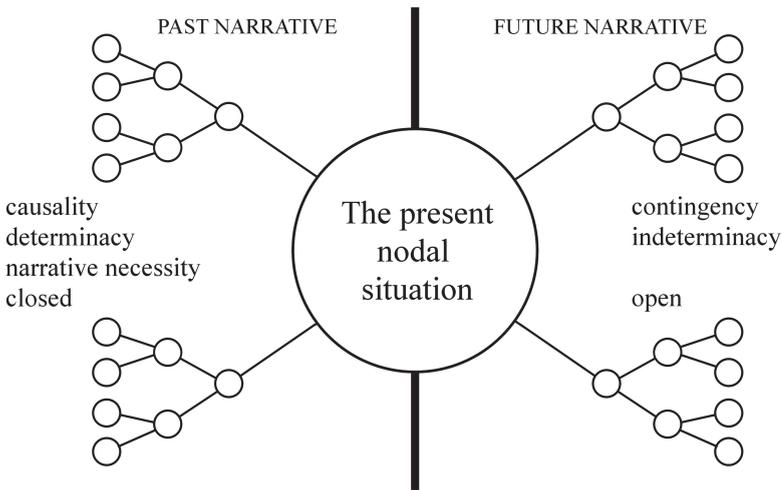


Fig. 1.14: PN and FN symmetrically mirrored in the present situation.

The line of the present – identified before as a transformational or conversion line – mirrors the tree structure of PNs in the tree structure of FNs, and vice versa (although we must not forget it is a mirroring of *representations* – but then again: what isn't? The transformation is as real as it gets.)

But why call structures that operate with nodal situations 'Future Narratives'? Because what they allow for, what they elicit and demand, what they make happen, is exactly the production of stories out of discursive events that occurs *instantly* as they materialize at the line of NOW, as a node evaporates. We said: it is always and invariably the reader who makes a story out of what is 'only' discourse (story and discourse being the two basic components of narrative). Whether as witness or agent, s/he does exactly the same when experiencing a nodal situation and its dissolution. Whether it was caused by you or not, what happens is the raw material of story-making, which is, after all, nothing but the conversion of discourse into what the recipient perceives as a meaningful summary of what s/he has just encountered. The raw material of narrative can be any two events than can be linked in a language.¹⁸

Given such a wide idea of 'narrative', it seems meaningless to say that something has (or lacks in) 'narrativity', or even 'narratability' – it is not right or wrong to say so, but just plain meaningless. Because *anything* can be told, as long as it is related, or at least relatable, and if this relation, actual or potential, is embedded in a kind of language. There is no quality *inside* an object or an event or a structure or a process, or, to be more specific, in a *sign sequence*, that makes it innately narratable. *Everything is narratable*, as long as it can be *represented* as partaking in a temporal sequence or as having at least two distinct time units, which, however, don't even have to be *present* in the object itself (think of the ekphrasis of a historical painting). Because to narrate is something we *do* to something. And consequently there are no degrees of it (though Marie-Laure Ryan, following Fotis Jannidis, speaks of "a scalar property" [*Avatars* 7]), simply because 'being able to be told', pace Ryan, is not a quantity.¹⁹ What is more: 'being able to be

18 Espen Aarseth's provocative question (oral communication) whether a telephone directory could then be regarded as material of narrative would have to be returned to the sender: if you can present or imagine two entries in that directory as two *events* (because that is what this definition asks for), then you could.

19 This is, of course, diametrically opposed to any position which holds that multi-linearity or interactivity are at odds with narrative (since they don't display enough 'narrativity', I suppose). Sturgess defines 'narrativity' "as the enabling force of narrative, a force that is present at every point in the narrative" (28). So, curiously enough, the condition for the existence of something is to be found in itself: there is narrative, because there is an enabling force within narrative that, I suppose, enables narrative to be narrative. What is the gist of Occam's razor? Do not multiply concepts beyond necessity. See also Ryan, *Virtual Reality* 257: "When hypertext

told' (leaving aside Wittgenstein's famous remark on "das Mystische") is just not a meaningful analytical category – simply because it lacks its opposite.

I do not say this because I have particularly strong feelings for narrative. I don't. (Apart from the fact that I happen to believe it is our primary mechanism for bringing meaning into this world.) Quite the contrary: along with Goethe I hold that the three basic genres of literature – lyric, drama, and epic – hardly ever occur in pure, unmixed form, so that there is no such thing as *the* lyric, *the* dramatic, *the* epic (which is also why Goethe presented these three basic genres *on a*

theorists describe the configuration typical of the genre [the network] as a storytelling machine, they trust the power of the reader's imagination to create narrative connections between any two nodes and to make every transition meaningful. This trust presupposes either a very loose conception of narrativity on the part of the theorist [or none at all, CB] or a very strong desire for narrative coherence on the part of the reader." Exactly so. Narrativization is the human default position. Since Ryan defines 'having narrativity' liberally as "being able to evoke [a narrative script]" (Ryan, *Narrative Across Media* 9), one wonders why she would like to deny such large areas of human experience that precious quality. Cf., by way of contrast, Landow (*Hypertext 2.0*), as quoted in Ryan's *Virtual Reality* 219: "In a hypertext environment a lack of linearity does not destroy narrative. In fact, since readers always, but particularly in this environment, fabricate their own structures, sequences, meanings, they have surprisingly little trouble reading a story or reading for a story [emphasis added]." Landow makes the same point in his updated *Hypertext 3.0*: "Since hypertext fiction and poetry often employ disorientation effects for aesthetic purposes, coherent and relevant linking might not seem to be necessary, but I suspect it's simply that coherence [does] not take as obvious forms as it does in information hypermedia. For example, our experience of reading pioneering hyperfiction, such as Michael Joyce's *afternoon*, proves definitively that much of what we have assumed about the relations of coherence to textuality, fixed sequence, and the act of reading as sense-making is simply false. Reading *afternoon* and other fictional narratives shows, in other words, that *we can make sense of – that is, perceive as meaningful – a group of lexias even when we encounter them in varying order*. This inherent human ability to construct meanings out of the kind of discrete blocks of text found in an assemblage of linked lexias does not imply either that text can (or should) be entirely random, or that coherence, relevance, and multiplicity do not contribute to the pleasures of hypertext reading [...]. [B]ut continued reading establishes the essential coherence of the link between [two given] lexias." (204, emphasis added; see also, in general, chapter 6 of Landow's *Hypertext 3.0*, "Reconfiguring Narrative", 215–271). Or, to quote Boyd once more: "[W]e will interpret something as story if we can" (137). – In spite of all that and in *Avatars* especially, Ryan stresses "the difficulty of reconciling narrativity with interactivity" (xxiii). Again, the root of the problem seems to be that even the property of "being able to evoke [a narrative script]" – nothing more than a *Bedingung der Möglichkeit*, which I, for one, would grant any day to any two events – is apodictically envisioned as *being handed down*: "[Interactivity] does not facilitate storytelling, because narrative meaning presupposes linearity and unidirectionality of time, logic, and causality, while a system of choices involves a nonlinear or multilinear branching structure, such as a tree, a rhizome, or a network. *Narrative meaning, moreover, is the product of the top-down planning of a storyteller or designer* [emphasis added], while interactivity requires a bottom-up input from the user." (99) Our differences could not possibly be spelt out any clearer.

circle – to allow all sorts of gradations and mixtures between the three of them). These basic modes are only the loftiest of abstractions (see Goethe 187–89).²⁰ So it is exactly because I do *not* subscribe to any essentialist view of what narrative is (and that some things *are* narratives and others *aren't*) that I can locate and identify it everywhere I see it happening. And for the very same reason I could never agree with somebody who said, as Frasca does, that “for an external observer, the outcome of a simulation is a narration” (emphasis added) (2). No, the process of simulation, like any other sequence of events, can be *turned into* narrative – which is decidedly not the same.

A while ago ‘narratologists’ and ‘ludologists’ clashed over the question whether it made sense to describe and explain gameplay with traditional narratological terminology, or whether that wouldn’t be missing the point about gameplay. Since major protagonists of the supposed clash are now denying there ever was a real controversy, I’ll be damned to stir things up again. And indeed, it takes nothing away from the experience of gameplay if one says that a game can be told (in the sense that not the rules, but a *run* can be told – I mean, even a game of chess can be *told!*) – just as it takes nothing away from the experience of *life* that we are able to tell it, and indeed do so all the time. Users, either witnessing or being instrumental in bringing about the dissolution of a node, instantly convert the resulting event into an element of story – and they can’t help it: otherwise they wouldn’t see or experience whatever they see and experience as *meaningful*. Like a bag of killed nodes,²¹ every run is the stuff of story, only that they have done this run themselves.²²

In claiming that there is a corpus of narratives called Future Narratives, we never claimed they are able to *directly or im-mediately narrate multiple futures* – in fact, we don’t see how that could ever be done. Rather we claimed that, by virtue of operating with nodes, they are able to preserve essential features of future time, viz. openness, indeterminacy, potentiality, the possibility of multiple continuations, and so on and so forth. They are able to do this because they not

20 For a critique of triadic structures like these see Genette.

21 This is, admittedly, a very oblique allusion to the *Wild* (or game), *das zur Strecke* (bag) *gebracht wurde*.

22 So it is only up to a point that I agree with Aarseth (Ryan, *Narrative Across the Media* 361–376): it is true that a game is a game and not a story, and that (some) games can be regarded as simulation. But it is not true that it’s only when the game is over that it falls into narrativity and that this fall into narrativity means its death as simulation. Rather, I would argue, *this conversion takes place all the time*, with every move that we make in a game. It is narrative that makes us experience the game as meaningful in the first place, *and while we’re playing it*. These narratives are not spun when the game is over. They are spun while we’re playing it, and in that sense simulation and narrative are inseparable.

merely represent or thematize, but actually *stage* these qualities of the future and thereby render them to experience. Narration kicks in at the line of conversion, and instantly so. Whatever is happening at that line of NOW can only be *communicated* through narrative (again: that is no denial of *experience*, quite the contrary: it is its preservation and mediation).

The mediation of futures can only be realized as a staging of virtual multiplicity and multi-linearity, as the encounter of a space of possibilities. This staging, in turn, can only be mediated through or take the form of narration. *Why? Because it is only then that whatever is communicated is communicated as a meaningful sequence.* That is so by definition. (You might say we loaded the dice by defining narrative in such a way. Yes. In that case we'd stand guilty as charged.)

1.17 Stranger than Fiction: The Failure of Prediction, the Virtue of Scenarios, and Why FNs Are the Key to Our Future

It was a dark and dismal December day in 2007. I was sitting in some café in Oxford, reading the *Guardian* newspaper. They were covering the World Climate Change Conference on Bali (forerunner to the later Copenhagen, Cancún, and Durban conferences), and they were critically discussing the attempts (some desperate, some half-hearted) to curb the emission of greenhouse gases, especially of CO₂, to keep the rise in global average temperature until 2100 below the critical threshold of 2C.

What caught my eye was that the *Guardian* journalists had spread out over two pages, if I remember correctly, four different scenarios of what would happen worldwide, if the global average temperature rose by 1C, 2C, 3C, and 4C respectively – much like the scenarios the *Guardian* published, in much briefer form, two years later, on December 19, 2009. I give you the median scenarios of +2C and +3C and leave out the extreme scenarios +1C (“virtually impossible to achieve”) and +4C (“Possible with an extremely weak deal” – like in Copenhagen and Durban...):

+ 2C The temperature limit the scientists want

The heatwaves seen in Europe during 2003, which killed thousands of people, will come back every year with a 2C global average temperature rise. The Amazon turns into desert and grasslands, while increasing CO₂ levels in the atmosphere make the world's oceans too acidic for remaining coral reefs and thousands of other marine life forms. The West Antarctic ice sheet collapses, the Greenland ice sheet melts and the world's sea level begins to rise by seven metres over the next few hundred years. A third of the world's species will become extinct.

+ 3C Looking increasingly likely

After a 3C global temperature rise, global warming may run out of control and efforts to mitigate it may be in vain. Millions of square kilometres of Amazon rainforest could burn down, releasing carbon from the wood, leaves and soil and thus making the warming even worse, perhaps by another 1.5C. In southern Africa, Australia and the western US, deserts take over. Billions of people are forced to move from their traditional agricultural lands, in search of scarcer food and water. Around 30–50% less water is available in Africa and around the Mediterranean.

These scenarios were illustrated with maps and figures, but mainly the message was conveyed through text – and as narrative, too. And that is why it caught my eye.

For, a year before that, I had hit upon the idea that there was a hitherto unidentified corpus of narratives that operated with nodes instead of events – nodes being situations that allowed for more than one continuation. I had called this corpus of narratives ‘Future Narratives’ – and, having other things to do, had put the idea on the back burner. Until now.

Because I saw, spread out before me, not only a FN (one node, four continuations) of a *non-fictional* kind and, obviously, a FN of the highest practical importance: about the possible futures for intelligent life upon this planet. I also saw the deeper implications for my concept of FNs. In the early seventies, I had been a student of English and American Literature at Marburg, Germany, with Geography as a minor. Initially, my interest had been in Social Geography, but before long I had become fascinated with Meteorology and Climatology, which I regarded as a kind of counterweight to my predominant interest in the Humanities. Sitting there in the café in Oxford more than 30 years later, I still remembered enough of Meteorology and Climatology to know that hundreds and hundreds of scientists had had to work collaboratively with incredible masses of data for long periods of time, running them through the most sophisticated computer programs to simulate the most complex physical processes that we have on this planet – and still, *to be communicated* to decision makers, to stakeholders (but aren't we all, in this matter?), and to the general public, *the outcomes of their calculations had to be transformed into a narrative*, and a very special kind of narrative, too: into a *Future Narrative*, a narrative that presented the present as a nodal situation with four distinctly different continuations. It struck me that future scenarios can be modelled and calculated, can be mathematically designed and computed with our most advanced technology – but in order to be communicated, they have to be *mediated through narration*, a kind of narration that both preserves the openness and multi-linear indeterminacy of the future and, at the same time, relies on our capacity to see sequences of events as *meaningfully related* – which is, after

all, just another expression for *seeing them as narrative*. Which was when I took my concept of FNs off the back burner – and ordered another Caffè Mocha.

The situation appealed to me. Up until that point in time, I had believed the job to do was solely one of *abstraction*, that one had to parse whatever FNs one could find and sketch out a narratological grammar, a narrative poetics for that new kind of narrative, in order to understand how they worked, how they ticked. And that was still the case, that was still a task both necessary and intellectually challenging, as well as stimulating. This here, however, added a new dimension, because evidently this process here was running in the opposite direction: masses of most abstract data (no doubt gained from systematic observation of concrete phenomena and processes on the surface and in the atmosphere of this planet, but translated into a totally abstract language) had to be re-converted into something *most concrete* to be of any use at all. They had to be *narratively processed* to have any impact whatsoever – to have *a meaning*. My task was still to abstract from the concrete, but it felt good to know – while drilling this tunnel – that on the other side of the mountain hundreds of scientists and communicators were engaged in going in exactly the opposite direction, engaged in the forging of FNs out of the abstract columns spit out by the most powerful computers simulating non-linear processes with data provided by mega-databases. Concrete to abstract, abstract to concrete – I loved the symmetry of these two complementary conversion processes; and yes, I loved the fact that we were not dealing with fictions here. This was hard-core science of the most advanced kind. This was about reality.

And yet I knew that this instant of insight also complicated the whole picture. For I knew, too, they were trying to communicate the unpredictable (which is why they understandably chose the form of a FN in the first place). But does the unpredictable become any more predictable if you present four different, but equally uncertain continuations? I had no doubt that if you wanted to communicate uncertainty, it had to be through something that took the form of a FN (with situations that allow for more than one continuation...). Even so, that was no proof that it could indeed be done, and be done both convincingly and in a scientifically honest way. When it comes to highly complex systems and non-linear processes, the odds are heavily against predictability,²³ and any scenario of

²³ Cf. Leonard A. Smith's fine exposition of the notion of non-linearity: "**Nonlinearity** is defined by what it is not (it is not linear). This kind of definition invites confusion: how would one go about defining a biology of non-elephants? The basic idea to hold in mind now is that a non-linear system will show a disproportionate response: the impact of adding a second straw to a camel's back could be much bigger (or much smaller) than the impact of the first straw. Linear systems always respond proportionately. Nonlinear systems need not, giving nonlinearity a criti-

how such processes will behave in the future will be, to the degree that it gives the illusion of being a credible, reliable *prediction*, a falsification of the nature of the situation (and, for that matter, a bad FN). For reality is stranger than fiction. Reality is, it seems, in its most existential aspects – that is, in those aspects that really *matter* and that define *life* – utterly and *irreducibly unpredictable*.

The weather, to begin with the most common kind of everyday prediction, is notoriously difficult to predict, even and especially in temperate latitudes. This is because what we call ‘the weather’ is a highly complex interplay of many different forces and factors such as inclination of the sun, temperatures in their daily and annual cycles, altitude, humidity, precipitation, areas of high and low pressure, winds, clouds, differences in terrain, the thermohaline circulation of the oceans, the global wind system – to give only the most prominent ones.

All of these are interrelated, some of them directly so, some indirectly. And that makes it difficult to make even short-term predictions and downright impossible to make medium- or long-range forecasts. Only at its most visible in weather forecasts, the problem is a general one. As early as in 1889, the French Mathematician Henri Poincaré had shown that it is impossible to calculate the motion of three celestial bodies that exert a gravitational pull on each other, because their three point masses interact through gravitational forces and thereby perpetually cancel out formerly established values (the gravitational force that one body exerts upon a second one is equal to the force by which it is, in turn, attracted by that second body – so a ball that falls to the earth does attract the earth with the same force, only that it cannot significantly force this planet from its orbit). The step from two to three bodies is a game changer: for a classical three-body system (like sun, earth, and moon) is an “intrinsically non-integrable dynamical system, i.e. its solution cannot be derived by mathematical means” (Dürr 493–504, here 500) – its dynamic is “chaotic” (Schellnhuber 3–195, here 152). You can observe it, but you cannot calculate or predict it. Ironically, “[Poincaré] had discovered chaos” (Orrell 99) at the very core of celestial harmony.

Evidently, things don’t get any better if you have a dynamic system with far more than just three mutually dependent bodies or factors. Quite the contrary. And that is why the irregularity of our weather is far greater than that of the (seemingly) regular and eternal motions of the planets around the sun, their moons in tow.

It is a characteristic of such dynamic systems as the global weather system that they display discontinuous trends and non-linear processes and produce dis-

cal role in the origin of sensitive dependence.” (10) Günter Küppers provides the link between non-linearity and chaos: „Die Komplexität des Chaos resultiert aus der Nicht-Linearität der Entwicklungsgesetze.“ (*Chaos und Ordnung* 173).

ruptive and extreme events, all of which constitutes remarkably chaotic behaviour. It is perfectly possible to estimate the general correlation of some factors: for example, high solar radiation combined with high humidity will lead to large-scale evaporation and eventually to the formation of clouds, which will, in turn, shield the surface of the earth from the sunbeams and therefore decrease direct solar radiation. So there seems to be a self-regulating feedback loop here. The same with clouds as carriers of water: sooner or later, the downpour will begin, namely when they have reached their saturation point, which is a tipping point. The same with differences in air pressure, which produce wind, which eventually results in a levelling out of any differences in pressure (the wind *is* the process of levelling out, and if there is much levelling out to do, it will blow hard). Sooner or later, there will be a calm. Only when? There are tipping points all over the place in such a system, but also feedbacks, thresholds, non-linear accelerations, in addition to lag effects, self-stabilizing and self-destructing phenomena, and points of no return (scientifically called hysteresis): in fact, the whole menagerie.

The point is: we know what's in the zoo, we know some patterns, we just don't know what will happen in the medium run, because everything interacts with everything else, and this fact of high interdependence of all parameters makes the behaviour of the overall system *systematically* uncomputable and unpredictable. You change just one tiny bit and since this affects all other elements, it triggers a process whose ultimate outcome is totally unforeseeable.²⁴

This effect of how in a dynamic system of highly sensitive interdependent factors the minutest change can have enormous consequences has generally become known as the 'Butterfly Effect'. Dan Gardner has the story of how it was originally discovered:

Poincare's [sic] observation [that prediction becomes impossible] remained little more than a theoretical insight until a meteorologist names Edward Lorenz made one of the accidental discoveries that are the stuff of scientific legend. In the winter of 1961, Lorenz, an MIT researcher, was testing weather forecasting models on what were then advanced computers. Among scientists, it was a giddy time. The new computing technology made it possible to run vast numbers of calculations, and complex modelling exercises became practical for the first time. Scientists were confident their ability to peer into the future would explode as a result: Soon they would predict earthquakes, the weather, and much else just as precisely as they did eclipses and tides.

²⁴ Günter Küppers concludes that any planning that tries to interfere with chaotic processes finds its limit not in a lack of knowledge – you may have all the knowledge you need and all the knowledge there is, still “chaotische Systeme zeigen ihre berechenbare Unberechenbarkeit schon im deterministischen Fall, und nicht erst in der Gesetzlosigkeit der Anarchie.” (*Chaos und Ordnung* 172).

One day, as Lorenz's computer ground out calculations, he stopped it midway through a modelling exercise. Later, he wanted the computer to resume, so he entered data the computer had produced on the first run and left it to its work. But Lorenz was startled to find the computer spitting out results that were dramatically different than the first time around. Something was wrong. It wasn't a programming error. And the computer was working fine. So what was the problem? Lorenz was stumped until he realized that he had programmed the computer to use data that extended to six decimal places. But when the computer delivered its results, it rounded numbers to three decimal places. It was the rounded numbers that Lorenz had re-entered into the computer, not the actual results. The difference between the two was almost invisible but even this slight deviation was enough to produce dramatically different forecasts. "This was exciting," Lorenz recalled. "If the real atmosphere behaved in the same manner as the model, long-range weather prediction would be impossible." [...] Lorenz himself came up with a [...] down-to-earth image to capture the idea of minuscule changes making a big difference to outcomes: The flutter of a butterfly's wings in Brazil, he said, could ultimately cause a tornado in Texas. The label "Butterfly Effect" has stuck ever since. (37, 38; cf. also Mlodinow 193–195)

A more scientific explanation of why the Butterfly Effect is called the Butterfly Effect is that when two variables are plotted against each other, the trajectory takes a form that resembles the shape of the wings of a butterfly (cf. Orrell 119). Lorenz introduced the term in 1972, a full eleven years after his discovery of the phenomenon (cf. Orrell 165).

Lorenz's discovery itself had enormous consequences for the study of non-linear dynamic systems in general and for Chaos Theory in particular, since a system's sensitivity to its initial conditions, or its *sensitivity dependence*, invariably leads to highly different continuations and outcomes – to say this is practically a tautology (cf. Küppers, esp. 107–111, Smith 1ff.). But let us remain within Lorenz's own field, weather forecasts: in spite of the ubiquity of the Butterfly Effect, weather forecasts for a day are comparatively accurate in our climes, that is, they have an accuracy of some 90%, depending, of course, on their scale or the size of the area they appertain to. It is in the two-day weather forecast that the Butterfly Effect begins to kick in in the form of increasing imprecision (or a failure of the computation to predict accurately), and for three days and beyond it is impossible to make reliable predictions. Since this is so for *systematic* reasons, there is a *systematic* limit to our prognoses, not so much affecting the accuracy as such, but the accuracy *in its dependence upon the temporal extension* of the forecast – with regard to weather forecasts it's somewhere between 48 and 72 hours. And since these limits are set by the very nature of the processes we are observing, they cannot be pushed – no satellites or advanced computer technology allows us to calculate the medium-range behaviour of a non-linear dynamic system over a longer period of time. Any improvement will be in the region of one or two percentage points of accuracy, but the fundamental problem of unpredictability over

a longer period of time remains – *since the process itself doesn't 'know' where it's going and has not yet actualized the conditions from which it will proceed further* (cf. Gardner 246, Orrell 151). The evolution of a highly complex non-linear process is path-dependent. If X, Y, and Z are three different stages in such a process, then we cannot deduce Z from Y, if we do not have X. If Y is not part of our present knowledge, because it is not yet realized, then we cannot build upon it, but only upon its possible range. There is, to change the metaphor, no way to steal that solid information about Y and no agent that could leak that document, because *that document doesn't exist (yet)*. It will come into existence, it will emerge. The scientifically honest way would be to say, 'We'll have next week's forecast ready by next week.' And it wouldn't even be a cheeky thing to say.

In temperate zones like Central Europe, the simplest of all rules of thumb, viz. 'the weather tomorrow will be roughly the same as today' will yield a 67% rate of accuracy over three days – the odd change in the weather accounting for the remaining 33%. It is a sobering idea that with all our technology, we cannot significantly improve the magnitude of the depth of our vision into the future in this respect. If two-week weather forecasts are nonsense and useless, why do we want them? Apparently because we are suckers for certainty, even when none can be had. Here's an anecdote: Kenneth Arrow, the Nobel laureate economist, recalls that when he was working as an air force weather forecaster in World War II, he and his team found their long-term predictions were useless, because no better than random guesses. They informed their superiors, but were told in reply, "The commanding general is well aware that the forecasts are no good. However, he needs them for planning purposes." (Orrell 301)

It would seem that the problem of medium- and long-range forecasting evaporates once you look at very long periods of time and choose a time scale and a spatial scale that edits out the details in favour of the larger picture: it is easier to predict that a summer's day in central Europe will be warmer than a winter's day than to predict whether it will rain or not the day after tomorrow. The *climate* of a region is a generalization of long-term observations of weather phenomena that show a stable, periodic recurrence. The various climate classifications we have are not only based on average values for the different parameters I filed above under 'weather', they are also based on averages of (annual or daily) changes and amplitudes. A place on the Sahara desert may have the same mean temperature as an island in the temperate zones, favoured by the generally attenuating effects of the sea and say, the Gulf Stream in particular. But in the Sahara this mean temperature of, say, 20C results from really mean extremes of 40C during the day and -10C at night, whereas on that mild island the same 25C result from a flat temperate curve that is much less steep and more or less plays around this average of 25C. And since these differences matter, they are mapped into our climate clas-

sifications. It does make a difference, too, whether the amount of average precipitation results from 310 days on which there is some kind of precipitation (like dew or heavy fog, for example) or whether the same amount of precipitation falls torrent-like in a few days. It is the difference between Seattle and a half-desert. The irregular can be taken into account if it happens regularly enough to form the signature of a region.

But what happens – and our eyes are still on what sort of change can be predicted and how we are to deal with those cases in which the prediction of exactly one and only one continuation is systematically impossible – if our current world climate system, which in the history of this planet is only one among many, begins to change, and dramatically so? By definition, we have no rules for singularities, whether they are events or trends. We have no precedents that would allow us to draw any parallels. We know that today's world climate system is precariously based on the functioning of the thermohaline circulation of the oceans and on the planetary wind system (which are, in turn, a consequence of our world climate – their relationship being like that of a river and its river bed: the river digs its own bed and can only flow in its bed, but where its course runs is the result of the same kind of precarious give-and-take). We know there is a correlation between the amount of greenhouse gases, most notably CO₂, in the atmosphere and the temperature of that same atmosphere. We know that the concentration of CO₂ in our atmosphere today is the highest in 600,000 years – and still counting. We know of Ice Ages and warm periods and of fluctuations even in historical time, like the so-called Little Ice Age of ca. 1385–1850. Are we only bouncing back to normal? We know that a large amount of CO₂ is stored in the vegetation of the large rainforests of this earth – once these are destroyed, their CO₂ will be freed and it will further increase the temperature of the atmosphere. We know that another large amount of the CO₂ of this planet is stored in Siberia's permafrost.²⁵ If that unfreezes, we might easily hit a point of no return – when even the methane in the ocean floors (another potent greenhouse gas) is released because of the rising temperatures of the oceans. And there are indications it may already be too late to stop this, because of systematic lag effects. It's taken us too long to step on the brakes. David Orrell paints this gloomy picture:

Without greenhouse gases in the atmosphere, the average temperature would be -18°C instead of +14°C. We have all been raised in a hothouse.

The greenhouse gases, which include water vapour, carbon dioxide (CO₂), and methane, are therefore vital to our survival. However, you can have too much of a good thing. Increasing CO₂ from its pre-industrial levels of about 280 ppm to 380 ppm is a substantial relative

25 For an illuminating discussion of some tipping elements see Huber, Schellnhuber 29–42.

change. And even if we were to freeze CO₂ emissions at current levels, its slow rate of decay means that the total amount will still continue to grow well into the future. Furthermore, because of the slow response of the ocean/atmosphere system, the effects of high CO₂ levels will be with us for centuries, and may even be irreversible. A common property of non-linear systems is hysteresis: once a change has been made, it is difficult or impossible to undo. (285)

More concretely, this is what the + 4C scenario means in real terms:

+ 4C Possible with an extremely weak deal

At this stage, the Arctic permafrost enters the danger zone. Methane and carbon dioxide in the soils will be released into the atmosphere. At the Arctic itself, the ice cover would disappear permanently, meaning extinction for polar bears and other native species that rely on the presence of ice. Further melting of Antarctic ice sheets would mean a further 5m rise in the sea level, submerging many island nations. Italy, Spain, Greece and Turkey become deserts. Southern England's summer climate could resemble that of modern Morocco. (*Guardian* 19/12/2007)

Some argue that there may be some correlation between the activity of our sun's spots and our global mean temperature. Whatever the magnitude of that influence may be (most likely comparatively low), what we are witnessing right now in terms of (seen in geological, or deep time) *extremely abrupt change* has, for all we know, absolutely no precedent in humanity's historical time – and it is, the experts are agreed, *man-made*.

This would seem to close the lid on predictions on world climate change. Because we not only have to deal with uncertainties *within* models,²⁶ and with uncertainties *between* models as well as with uncertainties that stem from dubious *data quality* (Costanza, Graumlich and Steffen 39ff., 142–143) – we also have to deal with natural processes for which we have no precedent and which themselves result from processes that are systematically incalculable, which are now being heated up (bad pun, I know) by the most unpredictable player ever seen on this earth: *mankind*.

If it is true that the changes in world climate we are observing now are to a significant degree attributable to man, then any sort of *prediction* is hopeless. We do not have the formula for that kind of calculation, simply because *there is no such formula*, no formula for how human societies will develop and therefore no formula for how the societal system will interact in the future with that other systematically uncomputable system on this planet – everything that is *not* society: *nature*.

²⁶ See Orrell on how model error can be of greater significance than the so-called Butterfly Effect, 9, 163–165.

From the point of view of theory design, it is mandatory to conceptualize such a thing as the *socio-ecological system* of this planet (cf. Costanza, Graumlich and Steffen 12), because we do evidently observe how human societies fundamentally affect this planet and how these changes in turn affect societies (e.g., wars for resources like oil and water, migration, refugee movements, large-scale flooding of densely populated coastal areas, increasing number of extreme weather events, desertification of formerly arable land, etc.). But if you multiply the extremes and uncertainties of one system (cf. Kropp and Schellnhuber) by the extremes and uncertainties of the other, what you get is more uncertainty, not less – more unpredictability, not less. Small wonder then that, if you only examine the last hundred years of the human-environmental relationship, what you find is “discontinuities, nonlinearities, thresholds, feedbacks, and lag effects” (Costanza, Graumlich and Steffen 341) – in short, the whole familiar menagerie of non-linearity. And chances are that if you choose the larger perspective, the picture would still be the same: no straightforward linearity – of course not. And even if the picture were different and showed some correlation between whatever parameters in the past, it wouldn’t matter, because that was *then* – it would only be more evident that *we find ourselves in a singularity now*,²⁷ in a situation that is totally new and that, because of its undetermined precariousness, certainly allows for more than one continuation.

It is an interesting philosophical question whether there are any laws of human history, whether historical events, by definition singular, form any abstract pattern that would allow us to extrapolate, to project trends and tendencies into the future. Empirically, the question seems to be settled, because all attempts at formulating such historical laws have proved woefully inadequate, and since 1989 the number of people who publicly profess to believe in such iron laws of history has declined significantly. Serious socio-historical research only duplicates the fundamental problem of any science that observes non-linearity: when is an event an instance of some general rule and when is it only itself, a singularity from which nothing else follows (not in the sense that it has no consequences – it does! –, but in the sense that nothing can be learnt from it, no lesson can be drawn from it).

Historians solve this problem the way they’ve always done: by narrating stories. Because, once emplotted in a narrative, historical events gain a meaning that seems to lift them from the solipsism of their singularity. By being narrated, they are endowed with the semblance of a *meaningful* relationship *to us* –

27 Cf. what scientists call the ‘Great Acceleration’ (since 1950), Costanza, Graumlich and Steffen 13, 346, 351.

although they happened only *once* and long ago. However, this will not do for the *present* situation. We don't need Past Narratives. We need Future Narratives.

At the moment, the biggest obstacle to reality-related Future Narratives is our obstinate craving to have certainty where none can be had. As Leonard Mlodinow points out: “[I]n all except the simplest real-life endeavors unforeseeable and unpredictable forces cannot be avoided, and moreover those random forces and our reactions to them account for much of what constitutes our particular path in life.” (195) There is therefore “a fundamental clash between our need to feel we are in control and our ability to recognize randomness”: “[I]f events are random, we are *not* in control, and if we are in control of events, they are *not* random.” (186) Living in a world that is, to put it very mildly, “to some degree unpredictable, unknowable, and uncontrollable” (Gardner 176), it is our “hard-wired aversion to uncertainty” (Gardner 15) and our equally deep-seated love of the feeling of being in control – even if, yes, especially if this is only an illusion²⁸ – that makes us live in denial and embrace the predictions of whatever experts we can find. Refusing to accept that “[u]ncertainty is an ineradicable fact of existence” (Gardner, 41), we prefer to follow experts whom we *know* to get it wrong every time their expertise is asked.

In a large experiment carried out in the 1980s by the psychologist Philip Tetlock, almost 300 experts from various fields (Political Scientists, Economists, journalists) were asked, over a period of many years, what their predictions were for the immediate future. The outcome was depressing. As Tetlock himself remarked, the experts would have been beaten by a dart-throwing chimpanzee (cf. Gardner 25): their expert predictions were little more than random guesses. Within this group of under-performers those that were particularly bad were the ones who were more self-assured and confident than the rest of their peer group and who in general were not very comfortable with complexity and uncertainty (cf. Gardner 26). Ironically, they're exactly the type that is more likely to be invited by the media to air their expertise. So a public averse to uncertainty get what they ask for: self-assured experts who deny uncertainty – and who get it wrong practically every time. Who wants an expert who says she doesn't know and is only guessing? Well, they get it right more often, though still in the performance range of a chimpanzee.

As corroborated in a number of surveys and by reality both before and after 2008, the science of Economy is no exception. In fact, predictions by Economists are particularly awful. As Burton G. Malkiel, himself an Economist, remarked:

²⁸ Cf. Gardner 134: “Plenty of [...] research points to the same conclusion: If we do not perceive ourselves to have at least a little control of our surroundings, we suffer from stress, disease, and early death.” See also 75, 76.

“Financial forecasting appears to be a science that makes astrology look respectable.” (quoted in Orrell 238) The main reason for their failure to predict the market and GDP growth rates correctly is easy to identify: time and again, that is, *systematically, they fail to predict turning points* – or exactly *that* which is surprising, what is *new* about the future. But if you miss that, you miss what is essential about the future: namely that it is *not* always ‘more of the same’. Since the different forecasting models equally fail to predict turning points and have a tendency to merely continue and prolong current trends, it does not come as a surprise that “[they] agree with one another far more often than they do with the real economy.” (Orrell 243) That was only to be expected.²⁹

But if that is so, it doesn’t seem to be a particularly promising strategy to single out the economy as a quasi-autonomous sub-system of society and ask these experts to feed into Integrated Global Models (IGMs) – of which we already have a great many (cf. Costanza, Graumlich and Steffen 425–426) – whatever they can offer by way of theories, tools, and knowledge:

The environment, society, and the economy each represent complex systems characterized by nonlinearities, autocatalysis, time-delayed feedback loops, emergent phenomena, and chaotic behavior [...]. Furthermore, these fundamental systems are intimately linked in ways that we are only just beginning to appreciate [...]. These complexities pose multiple challenges. Chief among these challenges is the recognition that to achieve the outcomes we desire, it will be necessary to incorporate simultaneously several different perspectives. Clearly it will be necessary to incorporate the essential theories, tools, and knowledge of multiple disciplines across the spectrum from social to biological to chemical to physical sciences [...]. (Costanza, Graumlich and Steffen 419, 421)

As Charles Babbage once reported in a non-plussed way: “On two occasions I have been asked [by members of Parliament], ‘Pray, Mr. Babbage, if you put into the machine wrong figures, will the right answers come out?’ I am not able rightly to apprehend the kind of confusion of ideas that could provoke such a question.” (Smith 123)

In *The Poverty of Historicism* (1944/45), Karl Popper voiced strong, fundamental objections against the predictability of history:

“The course of human history is strongly influenced by the growth of human knowledge”, Popper wrote. But it’s impossible to “predict, by rational or scientific methods, the future

²⁹ In their current bestseller on debt and default crises, Carmen M. Reinhart and Kenneth S. Rogoff add a new twist to economic prediction in claiming that, contrary to what experts say, viz. ‘This time is different’, “It almost never is.” (xxxv). Still, the basic problem remains: to be able to see the pattern of past crises does not seem to enable you to predict the next one, though once it has occurred, you will, of course, (great comfort) be able to explain it retrospectively.

growth of our scientific knowledge” because doing so would require us to know that future knowledge and, if we did, it would be present knowledge, not future knowledge. “We cannot, therefore, predict the future course of human history.” (Gardner 43)

“Prediction is very difficult, especially if it’s about the future.” (quoted in Orrell 1) This quip, sometimes attributed to Niels Bohr, sometimes to baseball coach Yogi Berra (cf. Taleb 136), bespeaks great wisdom, not always heeded; but, to my mind, it is surpassed by something Paul Gascoigne, the famous and infamous British football player once said – because it contains in a nutshell the whole human ambivalence about uncertainty, even if, yes, *especially* if we have identified its relevance for human existence. “I never make predictions”, Gascoigne said, “and I never will.” (quoted in Gardner 244)

Some things are predictable, others are not. And it is surely a sign of wisdom to be able to tell the one kind from the other. “Kick a stone, and a sense of physics will explain what happens; kiss a person, and it’s more complicated” (Orrell 318) – more complicated and therefore less easy to predict (and consequently, more exciting). Because of their complexity, real-world systems appear to be uncomputable (cf. Orrell 115, 310, 311). They display ‘emergent’ properties that elude calculation (cf. Orrell 118). Some systems are “[s]ituated on the border between order and chaos, with no enduring pattern that repeats in a predictable way” (Orrell 111). Such systems have “a property known as computational irreducibility”, and, curiously enough, “there is a direct correspondence between a system being interesting – that is, appearing to have a life of its own – and our inability to predict its evolution.”³⁰ ‘A life of its own’ – the expression is very apt, because of all phenomena that escape prediction *life* is the most commonly known – as well as the closest to the bone. And it seems to be one of the greatest attractions of life (not only when you’re kissing a stranger) that it is basically unpredictable. Otherwise it would be pretty boring. In David Orrell’s words again (but he is only echoing the wisdom of ages): “We are unpredictable, and that’s no bad thing.” (348)

So, if “[l]iving things have properties that elude prediction” (Orrell 14), and if the unpredictability of life, not only of individual lives, but also of the ‘lives’ of economies and societies and – as the uncertainties of one system (the socio-economic system) are multiplied by those of another (the physical-ecological system) – of the amalgamated socio-ecological system of this planet is *in principle*

³⁰ Orrell 111. Cf. Taleb 149: “[The problem with prediction] comes mainly from the fact that we are living in Extremistan, not Mediocristan. Our predictors may be good at predicting the ordinary, but not the irregular, and this is where they ultimately fail.” In other words: prediction necessarily fails whenever the path is non-linear.

insurmountable, then we are faced with a formidable dilemma: on the one hand, the future at large is *always* uncertain (cf. Gardner 241), and it would be wise to not live in denial, but rather accept this fact. Yet, on the other hand, it would be good (and not only for reasons of psychological well-being) to at least have an idea of where we are going, for example in such existential matters as concern the future possibility of intelligent life on this planet (which would certainly be endangered if the system we live in – as is not just likely – has critical thresholds and points of no return, coupled with processes that show considerable lag effects).

Ingenuously enough, the solution to this dilemma lies exactly in *copying, or duplicating, the very processes of 'life'* (here really meaning the general ability of highly complex systems to evolve in unpredictable ways) in order to arrive at something one might tentatively call *test-runs of futures*, or test-runs of known unknowns, revealing unknown unknowns, producing *multiple evolutionary paths, multiple continuations*. As the biologist Antoine Danchin once observed (whose deterministic premise we do not have to share so as to accept his conclusion), “even if we do not deny its deterministic character, what we know about [life] *does not enable us to predict its future. Life is simply the one material process that has discovered that the only way to deal with an unpredictable future is to be able to produce the unexpected itself* [underlining added, CB].” (quoted in Orrell 213–214)

If we, in turn, copy or duplicate these processes once more – in a gesture that repeats the evolutionary duplication of the world in the human mind commonly known as consciousness –, we (re-)produce the unexpected in ‘quasi’ situations, in sanction-free arenas. We said we could tentatively call that which then becomes possible ‘test-runs’. But there is already another word for it. And not only a word, but a concept: we are then producing *Future Narratives*. Because the ‘quasi’ situations that allow for a multiplicity of continuations are nothing but – *nodes*.

Contrary to a widespread misconception, scenarios do not predict. Rather, they treat the present as a nodal situation that allows for different continuations and then they simulate possible evolutions from this point in time – sometimes changing parameters, sometimes just watching where the non-linear development of a highly complex system (with a life of its own) might take us; sometimes ranking outcomes according to their supposed probabilities, sometimes according to their supposed feasibility, sometimes (in a kind of back-casting that first articulates the objective and then, retrospectively, identifies possible paths to get there) according to their desirability.

But scenarios always operate on parallel tracks, since their *raison d'être* is exactly to test out *different* corridors and paths of future development. One sce-

nario alone doesn't make much sense, it takes (at least) two to fathom the depth of the space of possibility. And no matter how sophisticated their Global Climate Models (GCMs) become (to be sure, we have made incredible progress here), no matter what their conceptualization of the socio-ecological system of this planet is (IHOPE, e.g., which stands for Integrated History and future Of People on Earth, has gone far – as far as one can – in the direction of at least acknowledging the enormity of the task) (see Costanza, Graumlich and Steffen), there is always something they *don't* do: *they're not predicting the future*. Instead, what they do is to simulate possible paths of evolution in a space that basically *defies prediction*, but is, of course, open to future processes – what am I saying? *It is* the space of future processes.

The difference between prediction and the production of possible scenarios is thus essential and absolutely fundamental, but world climate change experts have become wary of explaining it to the uninitiated. The reason why is that practically every time they point out they are not making predictions but simulating possible paths ('Only?'), an army of (professional and not so professional) climate sceptics (meaning both people who do not believe we are currently experiencing world climate change on a dramatic and unprecedented scale and those who believe that if we do, it is not man-made) who say, 'So, you're not sure yourselves, are you? You're just guessing? You just admitted it: this isn't science. You have no *proof*.' When in reality it's as scientific as it can be in these matters. To say one was predicting would be unscientific, and it would cater to a popular confusion of science with precision. But there is, with regard to this distinction, an undeniable "epistemic lag" between the scientific community on the one hand and the media and the public on the other (see Gramelsberger 28–50), sometimes even discernibly reflected in the works of scientists who are up in arms to fight 'climate hysteria' (see, for example, Reichholf).

When the director of the Potsdam Institute for Climate Impact Research (PIK) Hans Joachim Schellnhuber suggested, in *Earth System Analysis*, that "E & D [Environment & Development] policy is not primarily a forecasting problem, but a *control task on the scientific basis of Earth System Analysis*" (Schellnhuber and Wenzel 45), he also drew attention to the fact that, especially when our forecasting is limited, decision making and human agency take front stage. That is, especially when reliable medium-range prognosis is impossible for systematic reasons, cautious and surgically administered step-by-step interventions, or "*iterated approximative control*", may be the optimal "*strategy for steering complex systems*." (Schellnhuber and Wenzel 156)

But when Schellnhuber ended his impressive contribution to the volume with a repeated plea for “Fuzzy control”³¹ intervention –

The future of the Earth System cannot be predicted – due to irreducible cognitive and voluntative uncertainties. Yet the global E & D process may be shaped – to a certain degree and in an iterative way. Allons corriger le future! –, (181)

he received a well-calculated rejoinder from fellow Physicist Hans-Peter Dürr:

In closing let me stress that I definitely agree with H.J. Schellnhuber’s final statement: “It is easier to shape the development of the earth than to predict its future!”, but I have to add: “It is easier to wreck the earth in an attempt to shape it than to predict this outcome.” (504)

Dürr’s is, of course, a valid point: if outcomes are uncertain because of the complexity of the system, then the medium- and long-range consequences of your own actions are also uncertain – or you claim special dispensation, an unjustified privilege, for the consequences of your own actions, and only for them.

But possibly Dürr’s clever warning underestimates the importance of three points (two of them, admittedly, points on an interventionist agenda): the first is that in these matters, as in much of life, we have to learn to act upon probabilities – to wait for certainty where none can be had is obviously no reasonable strategy;³² the second, building upon the first, is that not acting is no valid option, because not acting is also a kind of acting; and finally: the scale of the time-dimension makes for all the decisive difference between catastrophic actionism and cautious preventionism. If in simulation exercises we operate with a mix of real variables (*observables*) and simulated activities (*simulables*) (cf. Schellnhuber and Wenzel 148) and on a radically compressed time-scale at that (always in *different* runs, realizing *different* scenarios), then short-term moves may produce short-term outcomes that ask for, but also make possible close and swift responses to an unfolding process, so that it seems to become feasible to get an idea of both the spread of possible paths and of the appropriateness of our

31 “Based on uncertain and/or fragmentary information, adopt a rough long-term and/or large-scale strategy, which has to be continuously readjusted in an appropriate fashion according to all sorts of generally imprecise additional data.” (Schellnhuber and Wenzel 168)

32 Cf. Smith 146: “[...] coming to understand chaos and nonlinear dynamics has improved both the experimental design in and the practice of climate studies, allowing more insightful decision support for policy makers. Perhaps most importantly, it has clarified that difficult decisions will have to be made under uncertainty. Neither the fact that this uncertainty is not tightly constrained nor the fact that it can only be quantified with imperfect models, [sic] provides an excuse for inaction.

models, as the refinement, exactitude, and reliability of these become themselves objectives of the overall exercise:

[I]nstead of just playing the game with fixed rules, we may modify these rules; we may watch ourselves playing, modifying, and responding to our own actions; and *we may model all this including the modelling itself and the implications thereof* [...]. (Schellnhuber and Wenzel 144)

The objective of the simulation game resulting in different scenarios can never be to ultimately achieve the predictability of the systematically unpredictable. That was never what it's all about. However, it seems possible to create a (science-based and media-generated) sense of the possibility space that opens up after this node and of the major paths and thresholds that pre-structure this space, as certain forkings demarcate special phase transitions and plateaus of likely stabilization.³³

Although the IHOPE project mentioned above was split up in groups dealing with the socio-ecological system of this planet on different timescales (“The Millennial Timescale: Up to 10,000 Years Ago”, “The Centennial Timescale: Up to 1000 Years Ago”, “The Decadal Timescale: Up to 100 Years Ago”, and finally “The Future”), they found they had several themes in common, from which I should like to extract the ones that are FN-relevant:

There is a general movement away from simple cause-and-effect paradigms as a credible explanatory framework. There is a strong consensus that we are dealing with complex, adaptive, integrated socioecological systems that often defy simple cause-effect logic in their behavior. Complex systems may exhibit multiple interactions between apparent drivers and responses where the direction and strength of interaction are not necessarily explicable in terms of simple, direct, and linear causative links; there may be internal dynamics that drive system changes. IHOPE studies, therefore, will need to encourage the use of concepts from complexity science, including linear and nonlinear dynamics, feedback, thresholds, emergence, historical contingency, and path dependence as well as the application of nonlinear simulation tools, spatially explicit and agent-based models to simulate relevant phenomena [...].

The ability to influence the future comes with a loss of ability to predict it. A better way to look at it is that IHOPE can use a deeper understanding of the past to help us create a better future, rather than to predict the future. [...]

As human societies become more complex, they are less able to withstand shocks from the natural world and, ironically, in the process of making themselves more complex, societies

³³ See, for example, the Global mean temperature forkings given in Costanza, Graumlich and Steffen xix; the patterns in Philip Ball, *Branches* 186–187, 197; or Küppers, 145.

inadvertently and (often) unknowingly change natural systems in ways that make these systems more prone to abrupt changes or extreme events!

The role of feedback processes is crucial in complex socioecological systems (and a big reason why simple cause-and-effect paradigms often have little explanatory power). A potentially dangerous positive feedback loop was mentioned above. Are there, however, counteracting negative feedback loops that can generate increased resilience in socioecological systems? For example, is there a general self-regulating feature in human civilizations that acts to lessen environmental stresses when they become apparent? Are the “decelerating trends” we see now in some aspects of the contemporary human enterprise part of a self-regulating feature that will slow the Great Acceleration?

Finally, the group reports point to a number of phenomena that are difficult to model or project but are nevertheless extremely important:

- Temporal dynamics, especially rates of change in critical phenomena. This includes thresholds, nonlinearities, and abrupt or extreme events (in both human and natural parts of the system). Are we approaching global-scale thresholds in contemporary socioecological systems, especially in either the natural or the human part of the system? Is the Earth system shifting to another state? Can increasing resource scarcity and environmental impacts trigger a collapse of the global economic system?
- Contingencies or contingent events – chance events can strongly affect the trajectory of a socioecological system – and legacies from the past (or path dependencies) are very important. An example of the latter is the contemporary energy system, which cannot be changed immediately in response to climate change. [...] (Costanza, Graumlich and Steffen 13–15)

Especially the inverse relation between predictability on the one hand and the need for agency and creativity on the other – to create a better future, rather than to predict the future – needs further explanation because of its relevance for planning futures. As Schellnhuber illustrates in a deliberately daring parable in his foreword to *Sustainability or Collapse*,

[t]he same actors that can destroy a prophecy can also help to realize it. In fact, the best way of anticipating the future is *by construction*. Nobody is able to predict the precise position of a given dozen of individuals a week in advance under normal circumstances; however, the same task becomes fairly simple if one organizes a get-together with them at a certain location at the time in question. This observation is much less trivial than it appears at first glance. (Costanza, Graumlich and Steffen xxi)

For, notwithstanding Dürr’s cautionary remarks, even on *fuzzy* control, the interventionist stance exerts a shaping power that can hardly be overestimated. Because, how can one seriously hold both that world climate change is man-made and that we can do nothing about it? If human agency is factored in, it has to be factored in in all scenarios, not only in the catastrophic ones, but also in the catastrophe averting ones. But then Dürr’s objection was never against the

magnitude of the human factor, but about the possibility to foresee its consequences. But again could one seriously argue that the consequences of what we effect consciously and deliberately are any more unknowable than what we cause unconsciously?

It is no contradiction if especially a prediction sceptic like Dan Gardner holds that it is a good thing to survey “a wide array of futures” (266) and that “[a] good decision is one that delivers positive results in a wider range of futures” (248) – a phrase that ties in with a phrase by Henry James to the effect that your decisions should always increase the number of possible continuations for yourself, or, in other words, you should not choose to narrow down your operative space (‘Don’t paint yourself into a corner.’).

So, to combine these two aspects once more, to construct or create the future (particularly when it cannot be predicted) makes it easier to handle, and to construct it in such a way that a multitude of scenarios, of different continuations can be realized, helps me to choose my options. Understanding the past will in no way make it possible for us to predict the future (that is Hegel’s model, or Marx’s, or Comte’s), “but it does mean that we might be able to *identify, justify and rank alternative futures* for humanity to work toward [emphasis added].” (Costanza, Graumlich and Steffen 23) Acknowledging that specifically “the human part” of the Earth system is “highly unpredictable” and that “[t]he least predictable processes can feedback strongly in a non-linear fashion to ‘more’ predictable processes in an unpredictable manner”, the IHOPE “Decadal Timescale Group” reiterated once more that “[t]he suggestion for providing projections of the future is *not to predict but rather to produce scenarios* [emphasis added].” (Costanza, Graumlich and Steffen 373) But it also proposed “a hierarchy of predictability”:

Biophysical processes (incoming solar radiation, ocean circulation, Arrhenius functions) are probably the easiest component of the human-environment system to predict, followed by population/demographics, technological and scientific change, and geopolitical change. Values and social movements are the least predictable variables in the human-environmental equation.

The remarkable technological advances of the Great Acceleration exacerbated the momentum and inertia in the human-environment system. Tension between deceleration and inertial or momentum processes make [sic] it difficult to offset the large machine of global change. At the same time, observations underlying nonlinearities, discontinuities, and thresholds in the biophysical world make system predictability almost impossible. We begin the 21st century in a very volatile situation. (Costanza, Graumlich and Steffen 373)

While this, in my assessment, radically overestimates the predictability of long-term physical processes (like world climate changes on a scale of deep time) – for it is not simply humanity that mars an otherwise relatively clear picture of

largely linear developments –, it does, once more, underline the need for and the necessity of *Future Narratives*, because it is only in *narratively mediated simulations of multi-linear continuations* – a.k.a. scenarios – that humanity can form a *meaningful* idea of different paths and different options, of their feasibility and desirability.

In his fundamental article “Scenarios: Guidance for an Uncertain and Complex World?”, Bert J.M. de Vries has sketched out the role of scenarios and simulation models as tools for policy exercises and decision making (in Costanza, Graumlich and Steffen 379–397). Starting from what by now may appear to be a commonplace, viz. that “the scenario method emphasizes the construction of alternative futures in order to prepare for divergent plausible futures”, de Vries argues that “[t]o this purpose, existing mental models should be challenged, and qualitative (‘storytelling’, ‘narrative’) as well as quantitative (‘modeling’) approaches are to be used” (Costanza, Graumlich and Steffen 380) – a point that he repeats with greater emphasis shortly afterwards: “I tend to have most affinity with and expectations about scenarios that combine storytelling and modeling. The storytelling part consists of carefully constructed narratives, built around interpretations of past and current observations and trends.” (Costanza, Graumlich and Steffen 383) Surveying two future scenario projects, TARGETS and SRES, de Vries remarks, among other things, how “perspective based scenarios” (in TARGETS) invite people to take part in discussions and reveal their values, or how in SRES the pre-assumption of four basic storylines or narratives (grouped in *scenario families*) led to a confusion of the transferability of relationships from one level, or scale, to another –

In my experience, confusion about how to interpret the storylines occurred because key assumptions from high-level aggregate empirical relationships (“stylized facts” or meta-models) were not well understood. To mention a few of the ones used: net population growth declines with income and, directly and indirectly, with globalization; economic growth and energy intensity are bell-shaped functions of income; and globalization in the form of less trade barriers – operationalized by lower transport costs – increases economic growth via higher rates of capital and technology transfer [...]. Many more such assumptions are hidden and/or implicit and lifted from country to region level; [...]. (Costanza, Graumlich and Steffen 389) –

or, curiously enough, to a predominance of the models operating with such transfers:

A fourth and serious shortcoming in SRES was, in my view, the fact that the computer models became leading in what had been envisaged. Translating storylines into model assumptions is expectedly a procrustean process. All of the models used had (and still have) a bias in terms of process relationships and data reliability which may make them some-

what realistic to project the future economy-energy-emission path for the U.S. or Europe; this causes, however, serious distortions and pseudo-insights if applied, for instance, to 800 million Chinese or Indian farmers in 2030 in a setting of traditional culture and economic protectionism. This has been shown to be especially devastating for the B2 scenario: the models cannot realistically cope with, for instance, energy demand-price of renewable energy penetration rate dynamics in a diverse, equity- and environment-oriented world. To some extent the models became a legitimization not for how world regions are but how they should be, thus representing (inadvertently?) the ideology of the Washington consensus (World Bank, IMF) that dominated the 1990s. (Costanza, Graumlich and Steffen 390–391)

Laconically, de Vries sums up that “it makes no sense to assign probabilities to the scenarios. SRES rightly states that *there is no single most likely, ‘central’ or ‘best-guess’ scenario*. In a way, all four scenarios are highly implausible.” (Costanza, Graumlich and Steffen 391)

To be sure, his own blueprint for better scenarios reads appealing enough:

In essence, my critique and suggestions of improvement boil down to four keywords: *uncertainty, complexity, values, and participation*. We must address explicitly and scientifically uncertainty and complexity. A new epistemology is needed. We should incorporate people and their values in the process of scenario construction and use. Participatory methods, such as simulation games and policy exercises, are necessary complements. (Costanza, Graumlich and Steffen 391)

But it seems to me that – while I am deeply sympathetic with any project that aims at using gaming simulation as a means to involve people as stakeholders in policy exercises – the fundamental flaw here lies in how the relationship of narrative and modelling is conceptualized, namely as a conceptualization of narrative *versus* modelling.

Surely, any *imposition* of a pre-fabricated narrative is bound to limit and ultimately eliminate the openness of any future scenario and, as evidenced by SRES, a multiplicity of pre-fabricated narratives will only cause noise and confusion. *Any such narratives can only be projections of Past Narratives upon the future* – and invariably they eliminate what is essential about the future. That was only to be expected. Narratives that preserve the openness, uncertainty, and contingency of the future should not come pre-fabricated at all – and, what is more, there is absolutely *no need* for that. *Narrative kicks in the very the moment a node is exploded*. Narrative is not something that has to be added, complementary, to a model, like an additional ingredient of the recipe before the cooking or baking starts. Narrative is something that *follows* from the concrete running of a series of nodes.

To be sure, every simulation operates with an array of assumptions, or else it could not model real-life processes. But these assumptions need not take the

form of storylines, or narratives. On the contrary: as de Vries has shown, their assumption may well prove utterly detrimental to what the model is supposed to produce: a shot at emerging reality. Narrative can take care of itself. Because we cannot help but experience anything in a (somewhat) meaningfully related way – and that means, *as narrative*.

Gaming and interactive simulation models (cf. Costanza, Graumlich and Steffen 463ff.) are an exciting tool for imagining and shaping the future.³⁴ They devise the future as a series of nodal situations, each allowing for a multiplicity of continuations. But whatever else they do, they do definitely *not* “make abstract narratives concrete” (cf. Costanza, Graumlich and Steffen 466). I wouldn’t even know what sort of animal an ‘abstract narrative’ should be. Narratives are the traces left behind by exploded possibilities, otherwise known as events, linked meaningfully together; in that sense only are they abstractions, abstractions from concrete events, but in a way just as concrete as they, because they are nothing but a series of events meaningfully related, even meaningfully experienced before they are related, in the sense of being told. It is only when we realize that narratives and storylines are not pre-existent (and therefore ‘discoverable’ in the future) that the possibility of our own agency even in this becomes obvious: it is only when we convert possibility into actuality that *this narrative comes into existence*, not any earlier. Facing the future, we produce a possible future (one of many) as we traverse the field or space of possibilities issuing from this situation HERE, NOW. Each story may be an abstraction from a discourse. But the operational transformation of nodes into events, upon which – the moment they emerge – our minds exert their correlative power, their unceasing plotting, is never one of abstraction into concretion, it is always and invariably a transformation of potentiality into actuality. To say otherwise means to have one’s axes seriously twisted.

As the title of this subsection suggests, FNs may well be the key to our future(s), because their structure allows an engagement with the not-yet that is at one and the same time playful and serious, both virtual and with irrepressible reference to reality. To make such enormous claims for narrative in general and for *Future Narratives* in particular, it may be wise to start a new chapter on the human brain as an anticipation machine – its grandeur and its flaws, and the central role of the imagination for any attempt to live life meaningfully, or to live human life at all.

³⁴ On the general capacity of games to serve as a “platform for enabling the future” (9) cf. McGonigal, esp. part 3, “How Very Big Games Can Change the World”.

1.18 The Human Brain as an 'Anticipation Machine'

Early on in Daniel Gilbert's award-winning *Stumbling on Happiness* (Royal Society Prize for Science Books 2007), the Harvard Psychologist makes a reference to Daniel Dennett, the cognitive scientist and expert in the philosophy of mind, that seems to support Gilbert's claim that "[t]he human being is the only animal that thinks about the future" (4) – this is the passage:

To see is to experience the world as it is, to remember is to experience the world as it was, but to imagine – ah, to *imagine* is to experience the world as it isn't and has never been, but as it might be. The greatest achievement of the human brain is its ability to imagine objects and episodes that do not exist in the realm of the real, and it is this ability that allows us to think about the future. As one philosopher noted, the human brain is an 'anticipation machine', and 'making future' is the most important thing it does. (5)³⁵

In spite of its sensationalist title, Gilbert's monograph gives a serious and brilliantly written state-of-the-art account of "what science has to tell us about how and how well the human brain can imagine its own future, and about how and how well it can predict which of these futures it will most enjoy." (xvi) Gilbert knows full well that propositions of the type, 'The human being is the only animal that...', have a notoriously early sell-by date, and that is why strong claims like, "We think about the future in a way that no other animal can, does or ever has, and this simple, ubiquitous, ordinary act is a defining feature of our humanity" (4), come with cautionary riders that warn against a confusion of *thinking about the future* (which is what only humans can) with mere "nexting" – 'nexting' is what brains (both human and animal) are quite good at,

[b]ut while these automatic, continuous, nonconscious predictions of the immediate, local, personal future are both amazing and ubiquitous, they are not the sorts of predictions that got our species out of the trees and into dress slacks. In fact, these are the kinds of predictions that frogs make without ever leaving their lily pads, and hence not the sort that The Sentence [the human being is the only animal that thinks about the future] was meant to describe. No, the variety of future that we human beings manufacture – and that only we manufacture – is of another sort entirely. (8–9)

Ironically enough, science tells us that, although the human brain as an anticipation machine may be the latest model in the motor show of evolution, it is still

³⁵ Gilbert's reference is to Dennett's *Kinds of Minds* (1996), but the insight "that the fundamental purpose of brains is to produce future" can already be found in Dennett's foundational *Consciousness Explained* of 1991 (177; cf. also 144) and indeed in some of his early 1980ies publications, as, e.g., in *Elbow Room* (1984).

a deeply flawed and faulty vehicle. For, as Gilbert shows in depressing detail, it makes us remember the past as it wasn't, experience the present as it isn't, and imagine the future as it is very likely *not* to be.

One of the problems about the past (and this is where our problems with the future begin) – the past as we remember it (a highly selective process in the first place) – is that we do not retrieve any original memory ready-made and deep-fried, but seem to fabricate it to the moment, filling in information and evaluation of the *now* that not only colours our past experience, but actually helps *produce* it, every moment anew:

[T]heir brains were *reweaving* their experiences – [...] precisely what one would *not* expect if their brains were *retrieving* their experiences.

This general finding – that information acquired *after* an event alters the memory of the event – has been replicated so many times in so many different laboratory and field settings that it has left most scientists convinced of two things. First the act of remembering involves 'filling in' details that were not actually stored; and second, we generally cannot tell when we are doing this because filling in happens quickly and unconsciously. (79–80)

Among other things, this “hindsight bias” (Gardner 210) serves our powerful need to make our own behaviour more coherent, more consistent, and more ‘rational’ than it actually is. Time and again, we smooth over our memories and ‘rationalize’ what we did – or think we did. Time and again, when confronted with “cognitive dissonance” (cf. Gardner 200–207), humans opt for denial and against the facts; they deny the obvious and come up with the most creative explanations of why they chose this over that – even if, in fact, they never chose this over that. (This is what experiments about ‘choice blindness’ tell us: test persons are asked to pick their most attractive photograph; after a while they are shown a photograph they didn't chose and are asked why they chose it. Instead of protesting that this isn't the photograph they chose, most test persons will give you all sorts of ‘rational’ reasons why they preferred the photograph that, in fact, they did not prefer – they will produce reasons in defence of a choice they never made.)

Why do we do that? Because it makes us feel good. Because it feels good to be consistent, to have a coherent philosophy, to display predictable, ‘rational’ behaviour, to be able to come up with ‘reasons’ for what we did – or, more precisely, because it feels good to at least *believe* that one is consistent, has a coherent philosophy, etc., especially when one isn't, or hasn't. Our capacity for self-delusion seems almost limitless: we are able to produce, at the snap of a finger, seemingly coherent explanations and justifications of things we never did.

It may be true that our “irrepressible explanatory urge” (Gilbert 191) often spoils the intensity of the unexpected and the unexplained (cf. 185–191, “Explain-

ing Away”), but the payoff is obvious: as long as we *think* we can make sense of what happened and of what is happening right now, we can imagine to be somehow in control of this – and we *are*, undeniably, *to the degree* that we are the producers of these *stories* (even though the first victim in this process invariably is the truth, or whatever fashionable placeholder it is that now acts and functions as TCFKAT, ‘The Concept Formerly Known As Truth’).

People are gullible. You make them do the most senseless things, but tell them it is for a scientific purpose – and they buy it. In fact, they hate to be told that what they’ve done and what they’re doing is totally senseless. And they love to fool themselves – they love to think that they exercise control, they love to think that they *matter*: “Being effective – changing things, influencing things, making things happen – is one of the fundamental needs with which human brains seem to be naturally endowed, and much of our behavior from infancy onward is simply an expression of this penchant for control. [...] Mattering makes us happy.” (20–21, 23). Or, to give the obverse of the picture, “[i]f we do not perceive ourselves to have at least a little control of our surroundings, we suffer stress, disease, and early death.” (Gardner 134)

This passion for control (mostly delusionary) seems ubiquitous, a universal and irrepressible trait of *homo sapiens*: “Researchers have even demonstrated that people who feel they lack control are more likely to see patterns that don’t exist.” (Gardner 136) There is only one group of people that have a realistic idea of the degree of control they can actually exercise in a given situation: in our society this group of people is routinely diagnosed as ‘clinically depressed’ (cf. Gilbert 122). The great majority, however, have not only a Willy-Loman-like memory of the past and an inflated sense of their own importance in the present, they also tend to be “unrealistically optimistic about [their] futures.” (Gilbert 18)

But, although Malcolm Gladwell is certainly right in saying that “[w]e have, as human beings, a storytelling problem. We’re a bit too quick to come up with explanations for things we don’t really have an explanation for” (Gladwell 69) (and, as I indicated, even for things we never did and things that never happened), this charmingly disconcerting trait of ours – to ascribe sense and meaning to *everything* by emplotting it in a *narrative* and to attribute *agency and importance* to *ourselves* as first-person narrators (and heroes) of the stories we weave – has a very fundamental evolutionary function (apart from the obvious feel-good factor mentioned above): “We see things that aren’t really there and we remember things that didn’t really happen, and while these may sound like symptoms of mercury poisoning, they are actually critical ingredients in the recipe for a seamlessly smooth and blessed normal reality” (Gilbert 94–95). It is not just coincidental that we are story-telling animals: “People love stories, both the listening and the telling. It’s a central part of human existence, found in every

culture, in every place, in every time. That universality suggests its origins are biological, and therefore evolutionary.”³⁶

In his impressive monograph *On the Origin of Stories: Evolution, Cognition, and Fiction*, Brian Boyd has argued that

[f]or the great bulk of the 600-million year evolution of mind on this Earth, this ability to think in sustained fashion beyond the here and now has not been available to *any* species. But humans not only have this ability; we also have a compulsion to tell and listen to stories with no relation to the here and now or even to any real past. [...] our compulsion for story improves our capacity to think in [an] evolutionarily novel, complex and strategically invaluable way [...]. By developing our ability to think beyond the here and now, storytelling helps us not to *override* the given, but to be less restricted by it, to cope with it more flexibly and something more like our own terms. (50–51)

All these fictions make us the one species not restricted to the here and now, even if that must be where we act and feel – and imagine. (208)³⁷

For us, *this is the only way to exist meaningfully – as creators of the stories we have woven ourselves, of the stories that bring meaning into this world. That is the prime function of narrative, not necessarily to adequately represent or reflect something or other.*

But if, “[f]or human beings, inventing stories that make the world sensible and orderly is as natural as breathing” (Gardner 81), we have a problem once the mechanisms of these *Past Narratives* are projected onto the future, because our narrativized rationalization of the past (largely fictional anyway) do not make us very good at imagining the future (and I do not mean that we generally tend to be overly optimistic about it). The same mechanism that successfully hinders us from even registering errors of retrospection (let alone acknowledge and admit them) also keeps us “from discovering our errors of prospection.” (Gilbert 209) The wonderful and unique gift of being able to think about the future – about something that is *not yet* – is perpetually spoilt by our present incapacity to be sufficiently imaginative, to think the unexpected, to factor in surprise, discon-

³⁶ Gardner 157. See also the chapter “The Narrative Fallacy” in Taleb’s *The Black Swan* (62–84). One of our main differences, though, is that Taleb is “against overinterpretation and against the overestimation of cause”, whereas I hold that every narrative is necessarily ‘always already’ an interpretation of reality and that the comforting, complexity-reducing semblance of causality is exactly why narratives are produced in the first place. The creation of the illusion of a cause-and-effect chain is what narrative is all about (narrative necessity); and that is why an “overestimation of cause” is not an undesirable side effect that somehow has to be hedged in. An overestimation of cause is exactly what stories are designed for to bring into this world.

³⁷ See generally part 3, “Evolution and Fiction”, of Boyd’s *Origin*, 129–208.

tinuities, reversals, tipping points, etc. – the whole zoo of the future, the whole menagerie of *life*. In the same sense that when P.B. Shelley wrote, “we want the poetry of life” (509–535, here 530), we can say today, ‘We still lack the poetry of the future’ – because what we have up until now is still too much tied to the present, to what *is*. But any continuation of the present that is only a prolongation of it is bound to miss what is essential about the future – namely that it will be *different* from the present, that it will not simply be ‘more of the same’.

In a part aptly entitled “Presentism” (109–147), Daniel Gilbert explains the psychological basis of this shortcoming. “Imagination’s products are . . . well, not particularly imaginative, which is why the imagined future often looks so much like the actual present.” (24) This may partly be so because we are hardwired to imagine time in terms of space,³⁸ which makes us constitutionally miss the *temporality* of the future – a defining trait of any time dimension, one should think. Imagining future possibilities as only spatially separated possibilities in the present, we habitually fall into the mistake of comparing “the present with the past even when [we] *ought* to be comparing it with the possible” (140): “Because time is such a slippery concept, we tend to imagine the future as the present with a twist, thus our imagined tomorrows inevitably look like slightly twisted versions of today. The reality of the moment is so palpable and powerful that it holds imagination in a tight orbit from which it never fully escapes.” (147)

But the worst is yet to come: we fail to *imagine ourselves as any different from what we are now*. By that failure, we miss the key player of any future scenario – *ourselves, as we are not yet, but as we might be*. We treat one of the decisive variables in the game – the one that will eventually have to answer the question, ‘Well, how do you like this?’ – as if it were a constant, when it never is: “Presentism occurs because we fail to recognize that our future selves won’t see the world the way we see it now. As we are about to learn, this fundamental inability to take the perspective of the person to whom the rest of our lives will happen is the most insidious problem a futurian can face.” (147)

In other words: even if we *could* imagine a future as future, i.e. as not just another prolongation of the present, but something potentially *very different*, we can hardly imagine how this would feel to us *then*, as different from the way we are *now*. We have a hard time imagining ourselves as different from now. But chances are we *will* be different. Because the only certainty is change, is discontinuity.

It would be good to have a device that helped us to experience what it would mean to have to systematically face the unexpected, the new. The good news is

38 Cf. my essay “Theoriethorie als Praxis”, esp. 84–88; see also the fascinating chapter “Time Bomb” in Gilbert 127–147.

that we already have such a device. It's called life. But it would be good to experience it in a sanction-free environment and in varying degrees of vicariousness, in order to have some more exercise, especially without existential restraints, in a series of 'as if' situations. Well, that is exactly the arena of *Future Narratives*, in all their different forms and guises.

Still tied to the present moment – which, in a way, is all we ever have, as it is productive of both our pasts and our futures –, we began our escape from the confinement of permanent present and immediate actuality some two or three million years ago, as Gilbert narrates:

For the first few hundred million years after their initial appearance on our planet, all brains were stuck in the permanent present, and most brains still are today. But not yours and not mine, because two or three million years ago our ancestors began a great escape from the here and now, and their getaway vehicle was a highly specialized mass of grey tissue, fragile, wrinkled and appended. This frontal lobe – the last part of the human brain to evolve, the slowest to mature and the first to deteriorate in old age – is a time machine that allows each of us to vacate the present and experience the future before it happens. (15)³⁹

Why the frontal lobe? Because we know from patients with damages to their frontal lobes, especially from those on whom a frontal lobotomy (cutting the connection to and from the prefrontal cortex) was carried out in order to rid them of their deep anxieties and cure them of various types of schizophrenia, that, after the operation or the accident that caused the damage, no other symptom is recorded more often than *an absolute inability to plan*. These patients have lost their anxiety all right, they feel calm – but they seem to be incapable of thinking about the future (even to the point of being unable to say what they will do in the afternoon), *which is exactly why* they are not worried any more:

The fact that damage to the frontal lobe impairs planning and anxiety so uniquely and precisely suggests that the frontal lobe is the critical piece of cerebral machinery that allows normal, modern human adults to project themselves into the future. Without it we are trapped in the moment, unable to imagine tomorrow and hence unworried about what it may bring. As scientists now recognize, the frontal lobe 'empowers healthy human adults with the capacity to consider the self's extended existence throughout time'. As such, people whose frontal lobe is damaged are described by those who study them as being 'bound to present stimuli', or 'locked into immediate space and time'. In other words, like candy guys and tree climbers, they live in a world without *later*. (14)

But they lost something else as well. And that loss, not recorded by Gilbert, may well be the key to release the blockage which still prevents us from making full

³⁹ See also part 9, "The Architecture of the Human Mind", of Dennett, *Consciousness*.

use of the greatest gift – or so says Gilbert – that nature ever bequeathed on us: “Our ability to project ourselves forward in time and experience events before they happen enables us to learn from mistakes without making them and to evaluate actions without taking them. If nature has given us a greater gift, no one has ever named it.” (238) For, as he never tires of pointing out, human beings are still fumbling with this gift, we are actually not very good at imagining *different continuations*.⁴⁰ We have a one-track mind, and we are still very much tied to the present.

Now, the loss that coincides, in patients with damaged frontal lobes, with the loss of planning, the loss of an idea of the future and, consequently, the loss of their anxieties about the future, is this: they can no longer understand jokes. Aamodt and Wang believe that this is because patients with frontal lobe damages have problems with the reinterpretation phase at the end of most jokes (cf. 105). I don't think so. In fact, I should like to strongly disagree. These patients have no problem with the unexpected continuation of a joke – its twist –, *because they never expected any particular continuation in the first place*. They don't get the joke, because to them the continuation presented is just senseless. Exactly because of their lack of projection, no *re-assessment* is necessary. They don't get the point precisely because they expected nothing specific, nothing in particular: no expectations, no surprise – no joke.

It seems to me a consoling and a philosophical idea that the very brain structure which gave us the future (and thereby, along with our hopes and aspirations, our deepest anxieties and fears) also gave us jokes – the capability to laugh about unexpected continuations and to smile about how mistaken we've been, yet again. It is a capability we sorely need, because we are still poorly equipped for getting it right. And to laugh about our misconceptions and illusions and projects and plans and to self-ironically admit to our failings and frailties may not be the worst strategy for dealing with the great unknown – life.

In 1760, Immanuel Kant wrote a letter of condolence to the mother of one Johann Friedrich von Funk, a student of his who had died of sheer exhaustion. This is what Kant wrote:

Ein jeder Mensch macht sich einen eigenen Plan seiner Bestimmung auf dieser Welt. Geschicklichkeiten, die er erwerben will, Ehre und Gemächlichkeit, die er sich davon aufs künftige verspricht, dauerhafte Glückseligkeiten im ehelichen Leben und eine lange Reihe von Vergnügungen oder von Unternehmungen machen die Bilder der Zauberlaterne aus,

40 Gilbert 238: “When we imagine future circumstances, we fill in details that won't really come to pass and leave out details that will. When we imagine future feelings, we find it impossible to ignore what we are feeling now and impossible to recognize how we will think about the things that happen later.”

die er sich sinnreich zeichnet und lebhaft nacheinander in seinen Einbildungen spielen lässt. Der Tod, der dieses Schattenspiel schließt, zeigt sich nur in dunkeler Ferne und wird durch das Licht, das über die angenehmere [sic] Stellen verbreitet ist, verdunkelt und unkenntlich gemacht. Während dieser Träumereien führt uns unser wahres Schicksal ganz andere Wege. Das Loos, das uns wirklich zu theil wird, sieht demjenigen selten ähnlich, was wir uns versprochen; wir finden uns bei jedem Schritte, den wir tun, in unseren Erwartungen getäuscht; indessen verfolgt gleichwohl die Einbildung ihr Geschäfte und ermüdet nicht neue Entwürfe zu zeichnen, bis der Tod, der noch immer fern zu sein scheint, plötzlich dem ganzen Spiele ein Ende macht. (Kant, "Gedanken" 41)

Our plans, hopes, and aspirations are like ever so many pictures shown by a magic lantern – pictures we have drawn ourselves and then allowed to play in our imagination, eclipsing by their light the presence of death in the far-away distance. While we thus dream, our true destiny leads us far other ways. What we get is seldom what we expected. In our every step we find ourselves deceived by our expectations. But meanwhile our imagination never tires in designing ever new projections – till death, which still seems to be a long way off, puts an end to this whole spectacle.

To be able to register, especially in great adversity, the difference between our aspirations and our accomplishments seems to promise the serene strength that is the philosophic mind (cf. William Wordsworth's "Ode: Intimations of Immortality"). And against the backdrop of the evolution of humanity, it seems to be *the* supreme human capability: to see oneself as the one animal that is capable of thinking about the future – and that, at the same time, gets it wrong, most of the time.

It would be such self-reflexive irony that could catapult us over the stage of Bob Dylan's "There are many here among us / Who feel that life is but a joke" (from *All Along the Watchtower*) and bring us to the insight that, if we can only live meaningfully *by imagining a future for us*, but life is also very likely to run a different course and surprise us with an unexpected continuation, then life indeed has the structure of a joke – a joke that is on us. And although this is dead serious, the wisest attitude might indeed be to treat it only 'as if', to look at it as some kind of existential joke.

If Kant is right, what makes us go on is our *imagination* – irrespective of what actually happens, yes, *in necessary opposition* to what actually happens and is (Why should the imagination be a reproduction of anything that is in the first place? That would not make any sense); which is also why the imagination cannot be *taught* by experience, it can only be tamed, and numbed, and killed.

Just as what we remember – the stories we tell ourselves and to each other – are necessary for the illusion of a *meaningful* life, so what we imagine for ourselves in the future serves only the function to allow us to go on. It is our imagina-

tion that makes us tick, makes us persevere. That our memories and dreams be realistic was never a requirement.

Yet to realize this self-delusion and accept it as a necessary condition of human life means to adopt a *self-ironic* and ultimately *aesthetic* attitude towards life, because that seems to be the only way to bridge the incommensurability between the sphere of the object and that of the subject, as Friedrich Nietzsche put it in “Über Wahrheit und Lüge im außermoralischen Sinne” (4: 541–554, here 549). To see life as a Future Narrative, as the feeding of a possibility space through the needle’s eye of the present so that we can make meaning out of it as we experience it and process it into a narrative is to regard life as a meaningful (since narrated) artifice whose seeming necessity is only the effect of a narrative processing, while its utter contingency is the acknowledged background against which we operate. Such activity must be imagined happy.

1.19 The Way Ahead

As Antoine Danchin (see above) has suggested, “[l]ife is simply the one material process that has discovered that the only way to deal with an unpredictable future is to be able to produce the unexpected itself.” (quoted in Orrell 213–214) It seems that of all life forms humans are the only ones that narrativize their past so as to give it coherence, a sense, and a meaning. They are also the only life form that can imagine a future. If the future is imagined not as a uni-linear continuation of the present, but as a space of possibilities that allows a spectrum of multiple continuations, then we are looking at a nodal structure. And if a narrative does not operate with past events as its basic unit, but with nodes (which are *before* events take place), then we are looking at a Future Narrative, in contrast to a Past Narrative.

The emergence of FNs – a rapidly increasing and rapidly evolving corpus if there ever was one – marks the possibility to systematically produce the unexpected. It is, if you will, the raising of life to the power of three (imagination being life raised to the power of two).⁴¹ FNs allow the user to experience the openness,

⁴¹ Cognitive scientists and chaos theoreticians have established a correspondence between phases of increased chaotic instability of a neuro-system on the one hand and its ability to creatively reconfigure sign complexes (cognitive flexibility) on the other, as the threat of chaotic instability provokes new configurations – facing the unexpected, the mind re-organizes itself: “Reorganisation und konzeptuelles Neulernen sind zumeist an eine [...] kurzfristige Steigerung der Chaotizität gebunden. [...] Wahrnehmung, Denken, Gedächtnis und Kreativität sind gebunden an das Wechselspiel von Chaos und Ordnung in der Dynamik des Nervensystems. Kognition ist Ordnungsbildung in der Balance von Stabilität und Instabilität. [...] Die zur Stabilisierung

uncertainty, multi-linearity, potentiality and contingency of the future in a sanction-free space that (very often) also allows retrieving and repetition – a going back with the chance to choose differently; but most of all: to experience a virtual version of what can only be imagined – what the future will feel like.

FNs do not bring something entirely new into this world. But by duplicating processes that already exist – life as a duplication of the unexpected, and the imagination as a complement (not: reproduction) of what is –, FNs bring to the fore a potential of the human mind that has, up until now, been overshadowed by our preoccupation with the past and our never-ceasing attempts at making our existence here meaningful.

The imagination has always been concerned with things that are not (yet), with things unknown; see, for example, these lines from Shakespeare's *A Midsummer Night's Dream*:

And as imagination bodies forth
The forms of things unknown, the poet's pen
Turns them to shapes, and gives to airy nothing
A local habitation and a name.

If now the imagination moves on to sketch spaces of multi-linear possibilities that we are allowed to roam and explore, we can give the realm of that airy nothing of potentiality the name of *Future Narratives*. Because they build upon that airy not yet, upon any NOW whose continuation is not certain, any NOW that displays openness.

And if we are not mistaken, we are currently experiencing a major sea-change in the cultural history of mankind, which can itself be represented in the form of a FN.

der Ordnungsbildungen im Gehirn notwendigen Bewertungen sind Spiegel der gesamten entwicklungsgeschichtlichen und kulturellen Gewordenheiten des Menschen. Die Bewertungen sind selbst Bestandteil eines eigendynamischen evolutionären und kulturellen Prozesses. Die Komplexität und Dynamik kognitiver Ordnungsbildung ist das Ergebnis einer Interaktion vieler nicht-linearer Dynamiken und damit grundsätzlich nicht vorhersagbar.“ Michael Stadler, Peter Kruse, Hans Otto Carmesin, „Erleben und Verhalten in der Polarität von Chaos und Ordnung“, *Chaos und Ordnung*, ed. Küppers, 346, 351, 352. If the emergence of FNs does indeed mark the possibility to systematically produce the unexpected, we are entering a most exciting evolutionary feedback loop, though this is evidently not the time and place to fully elaborate the mental, social, and cultural implications of this. – On discontinuities and the productive role of paradox see Geyer and Hagenbüchle, as well as Gumbrecht and Pfeiffer.

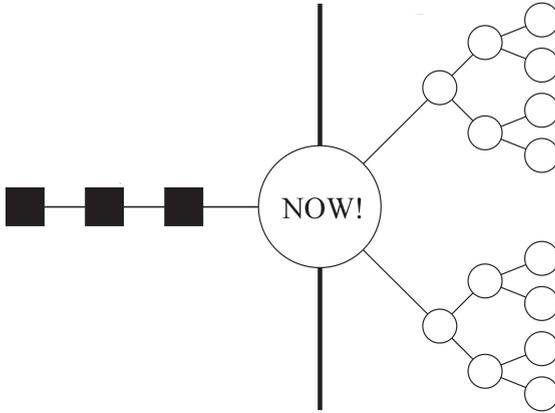


Fig. 1.15: NOW!

As FNs increasingly complement PNs, we pass from a dominant preoccupation with the past to an exciting interest in futures, in what is not yet determined.

Turning our backs upon the past and facing the future, we can downgrade (though never deny) the importance of events and become fascinated by nodes instead, as focal points of future developments, charged with possibility.

We turn from mere actuality to the potentiality of the present moment, to all that it contains in the way of possible continuations.

We turn from the illusion of necessity and causal determination (largely an effect created by PNs anyway) to the dizzying reality of contingency.

We turn from past-tied uni-linearity to future-bound multi-linearity.

From closure to openness.

We turn from an unhealthy preoccupation with objects to the category of agency.

Most importantly, we increasingly re-orientate ourselves from an exclusive pre-occupation with retrospectively making meaning(s) to the creative activity of making future(s), prospectively.

And as in any proper FN, all this is happening NOW!

The nodal power of a situation, it was said, is the degree of openness it has. It seems there is an incredible amount of nodal power in this present moment of the evolution of mankind.

It could, of course, be objected that from the moment on that a node is exploded and has become an event, it is just like any other event and therefore subject to the narrative logic and narratology of PNs. This stance focuses, puzzlingly so, on what FNs and PNs have in common. They are both narratives, right. That is why they are called Past and Future *Narratives*. But the crucial element of the above objection is *from the moment on that*. From then on, admittedly – but *only* from then on – traditional narratology knows what to do with them, knows how to treat them. Not before. By way of contrast, *Narrating Futures* is all about that *before*. Because nobody took care of that. Because there was no narratological grammar, no logic or poetics for this new kind of phenomenon (which had not even been identified as a unified corpus). Now, this is beginning to emerge.

The next part will present a formal representation of the logic of FNs by way of Mathematical Graph Theory; the final part will offer a sketch of the media-historical moment of FNs that will also give a historical explanation of how and why FNs are refracted the way they are in and by the different media (thereby preparing the way for volumes 2 through 5 of this series) and why it is only in the last third of the twentieth century that we are experiencing this take-off of a corpus whose mere possibility has been with us for the last 400 years or so.

2 Formal Models for Future Narratives

2.1 Introduction

In this second part of this volume, mathematical models for Future Narratives (FNs) are constructed in order to provide an abstract, general description to FNs. In addition to the concept of nodal power that has been introduced in the first part and can now be discussed in more detail, a topological classification scheme will be considered. The first chapters will refer to a preliminary model according to which there are only few possibilities for reaching the same situation in different ways (a subcase of FNs, true, but an interesting one). However, this model is a bit more simple than the final one, and some concepts, including most ideas that are necessary for the understanding of nodal power, can be understood more easily in this context. The final model will be large and sophisticated enough to accommodate all concepts that have been introduced previously.

Throughout this part, basic mathematical concepts from the fields of set theory, graph theory, and calculus are used without further explanation; they are discussed briefly in the appendix to this part.

2.2 Representations of FNs

2.2.1 Nodal Graphs

Representing Future (and also Past) Narratives in terms of a nodal graph seems to be an obvious choice. This concept has already been applied in the preceding part of this volume. Here, the underlying mathematical structure will be studied in more detail, revealing both advantages and inevitable shortcomings of this representation.

For our preliminary models, we will construct a time-ordered graph that can be abstracted from the FN in the following way. Let us posit that a FN has only one beginning.¹ Then there is a unique first situation that has more than one continuation. This is denoted by a *node* or *vertex* (dot), followed by a number of *edges* (arrows) leading away from it for each continuation. The endpoints of these edges will, in turn, be other nodes or, as introduced in part one, a stopping point, if we

¹ Note that this does not exclude any interesting aspect from the discussion, since in the case of multiple entries, we simply have multiple instances of what is constructed in the sequel.

only note nodes and edges and not events. This process is iterated until there are no more continuations – either, because all edges are terminated by a stopping point, or, because some nodes can be identified with previous ones. The latter situation will be dealt with in depth in section 2.4. The result of this process will be a tree diagram which is called the *nodal graph*. It consists of nodes and edges, and we map such edges as lead to no further node as ending in a *stopping point*. Figure 2.1 shows a typical situation. It is not finished yet since there are still nodes to be continued.

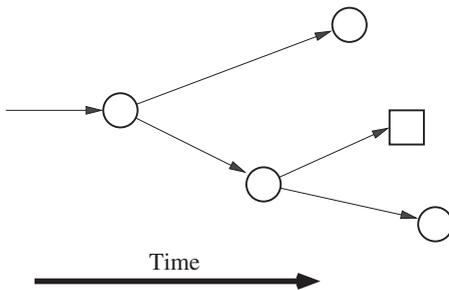


Fig. 2.1: Part of a nodal graph.

It is worth noting that the dimensions of the nodal graph have no importance whatsoever. The two-dimensional representation is just a matter of convenience, but three or even more dimensions would do as well.² There is one dimension, however, which has a special meaning. As has been stated above, our graphs are *time-ordered*, i.e. all nodes are positioned along the time axis. In figure 2.1 this is indicated by the horizontal arrow. In contrast to this, the perpendicular positions of the nodes are random, just chosen at one's liking.

Formal definition of a nodal graph

In a more mathematical way, objects can be defined by their constituents. In this regard, a *nodal graph* is a directed graph $NG = (V, E, o, t)$, where V is a set of vertices and E is a set of edges. o and t are functions specifying the origin and the terminus of each edge, respectively. As stated above vertices will also

² In some cases even better, because eventual crossings of the edges may be avoided.

be called nodes and we can now add that edges will also be called *continuations*.

A *nodal point* in a nodal graph is a vertex that is the origin of at least two continuations, that is, which has a branching power of at least two. This is obvious from our point of view, but in general *mathematical* usage, nodes with only two adjoined edges (one incoming and one outgoing) are also possible. Even the case of an isolated node with no edges at all might be useful, although in NAFU theory, as introduced in part 1, such a situation would not be a node at all. But since we are not dealing with such cases here, the set of all nodal points in the nodal graph NG will be denoted specifically by

$$\underline{NP}(NG).$$

Given a nodal point N , we call the set of all continuations which have N as their origin the *continuation set* of N , and we denote this set by the symbol

$$\underline{CON}(N).$$

As an illustration, figure 2.2 (adapted from [Madsen]) shows a graphical representation of a nodal graph (in this example, the continuations have names).

Usefulness of nodal graphs

Mathematical graph theory is commonly applied to situations where different states are connected by transformations. E.g. the nodes might represent storage places and the edges show in which way goods may be transported from place to place. Or imagine the traffic lights at a street crossing. The nodes represent configurations of all the lights – red, red-yellow, green, ... – whereas the edges just show which configuration comes next. In a certain way, the focus is clearly on the nodes. As has been stressed in part one, the nodes *are* the crucial parts of FNs, because their existence constitutes the whole genre.

However, when it comes to nodal power, the sheer number of continuations turns out to be a poor measure. This is evident from the fact that it is the edges that make the difference. Any considerations of ‘closeness’ or even ‘sameness’ can only be formalized if we are able to introduce some kind of ‘coordinate system’, where the nodes have to be placed at definite values and distances can be measured. This can no longer be achieved in the presented framework of nodal graphs, necessitating a more powerful representation.

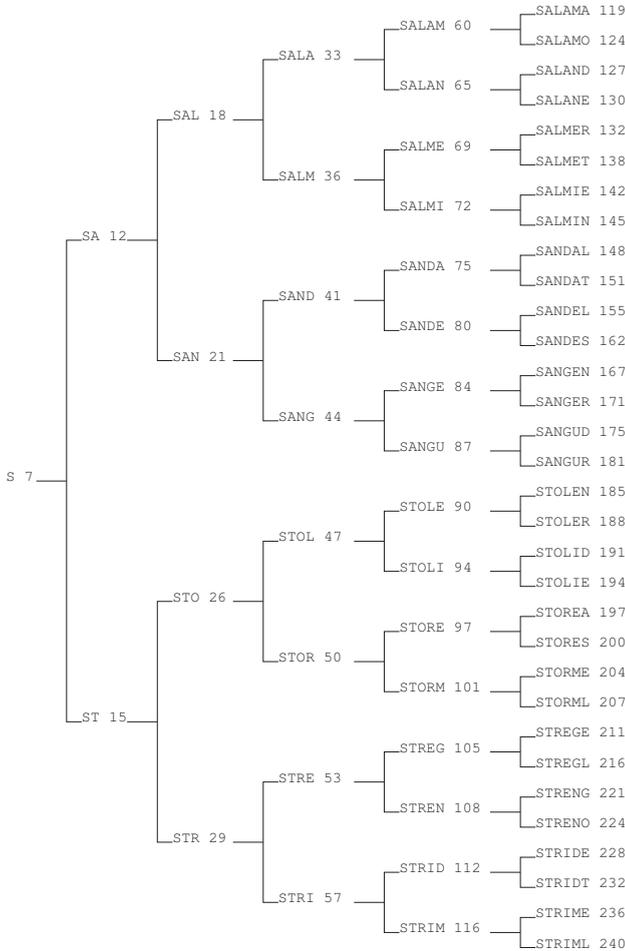


Fig. 2.2: Nodal graph.

2.2.2 Aspects

One basic objective of this approach will be the grading of nodal points according to their degree of openness. This degree will result from a careful analysis of the spectrum of different options entailed in a nodal situation. To this end, our model will have to contain some representation of what makes different situations and continuations different: this is clearly what we usually call their content. In this section, we will consider an approach towards a formalization and quantification of content.

For a first idea, imagine a simplified ‘Alice in Wonderland’ scenario: a character moves around a certain path and changes in size – either due to decisions made or just randomly. If, for any given moment, the current values for position and size are plotted in a coordinate system, the results may look like those in figure 2.3. Both position and size are *aspects* of the narrative, as their changes are essential to the story. That is, by the way, the reason why in aspect graphs, as opposed to nodal graphs, edges are not represented as *straight* arrows.

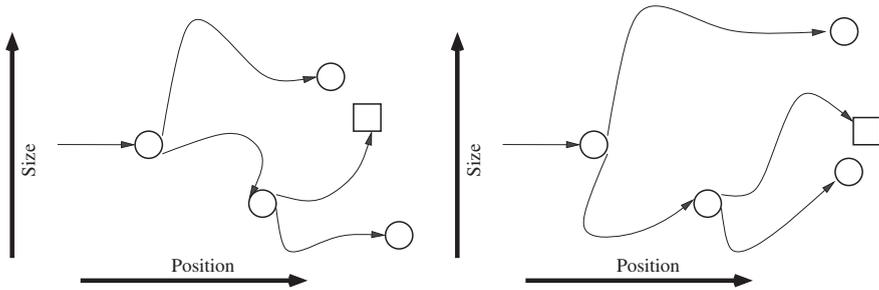


Fig. 2.3: Examples of aspect spaces.

Aspect spaces

This very simple example can be extended towards a general scenario: for every property of interest a new dimension has to be added to our coordinate system. This may seem immensely complicated at first glance, as the number of these dimensions easily grows beyond imagination. However, the mathematical treatment of vectors is essentially the same, regardless of the dimension. This is, in fact, the reason for the formalizations encountered in this part: the mathematical treatment permits a unified framework fitting for any kind of FNs, regardless their complexity.

The first ingredient of a formal model of aspects will be a representation of the possible realizations and changes of these aspects in the underlying narrative. More precisely, we will need the following two items: first, an *aspect space* \mathcal{A} , which is the set of formal representatives of the different realizations. For the above simple example, this is, firstly, the set containing all the different sizes Alice may have. Secondly, all the possible positions of Alice form another aspect space. The other item needed is a *space of aspect differences* $\Delta\mathcal{A}$, which is the set of formal representatives of possible changes of the aspect.

Since a change is a transformation of one realization into another, aspect changes will be functions

$$\delta A : \mathcal{A} \rightarrow \mathcal{A}.$$

If $a \in \mathcal{A}$ is a realization of an aspect, and $\delta A \in \Delta\mathcal{A}$ is a difference, then $\delta A(a)$ is the realization that results from applying the change δA to a . We will write this as an addition

$$+ : \mathcal{A} \times \Delta\mathcal{A} \rightarrow \mathcal{A}.$$

The meaning of this formal statement is as follows: via the $+$ sign, an element of \mathcal{A} and an element of $\Delta\mathcal{A}$ are merged together, resulting in an element of \mathcal{A} . Regarding these elements, we define

$$a + \delta A := \delta A(a).$$

Moreover, given two changes δA_1 and δA_2 , we will denote the change that results from subsequent application of these two by

$$\delta A_1 + \delta A_2$$

so that we have a formal addition for changes

$$+ : \Delta\mathcal{A} \times \Delta\mathcal{A} \rightarrow \Delta\mathcal{A}.$$

Aspect assignments

Nodal graphs and aspect spaces are two abstract representations of the same underlying structure. This leads in a natural way to the question of how these representations can be related.

First, it should be noted that different representations in aspect space can correspond to the same nodal graph. Figure 2.3 shows an example of this where both narratives lead to the nodal graph of figure 2.1.

The complete formal representation of an aspect will be given by an aspect space \mathcal{A} , the corresponding space of differences $\Delta\mathcal{A}$, and a rule which determines how the aspect is related to the situations and continuations that are represented in the nodal graph. At this point, we have to distinguish different manners in which the aspect can be related to different parts of the narrative: on the one hand, the aspect can be related to the different nodal situations, and on the other hand it can be related to the continuations, i.e. to the edges. In both cases, one can define formal functions f_A and F_A acting on vertices (nodes) and edges, respectively.

In a more abstract way, the relation of formal situations to aspect realizations is done by a function

$$f_A : V \rightarrow \mathcal{A}$$

on vertices V with values in \mathcal{A} . We will call such a function an *assignment of realizations of \mathcal{A} to situations (ARS)*. Formal aspects such as have a (static) situation as underlying structure will be called *static aspects*.

The relation of formal continuations to aspect realizations is done by a function

$$F_A : E \rightarrow \mathcal{A}$$

on edges E with values in \mathcal{A} . It will be called an *assignment of realizations of the aspect to continuations (ARC)*, and formal aspects of this kind will be called *dynamic aspects*.

2.2.3 Consequences

So far, global models for FNs have been presented. But for measurements of the openness of a given situation, i.e. for definitions of a ‘nodal power’, a local perspective has to be adapted. This brings about the question: what consequences has the realization of a certain continuation in the situation corresponding to a nodal point? And how can these consequences be measured, i.e. how can we assign numbers to them?

Consequences will be identified by either accumulating the realizations of the dynamic aspects that are assigned to this continuation or by registering the changes of the static aspects along that continuation. These data will be collected in a so-called vector of consequences. Such a vector can be thought of as an array of k numbers, each of them specifying some of the aspects defined above. However, the simple example from figure 2.3 may be misleading. In that case, both relevant aspects were already lengths easily to be measured or quantized. But imagine that the changes affect Alice’s skin color or the color of her dress. Then we do not only have to know what number corresponds to, say, red. We also have to make sure that the ‘difference’ of, for example, red and blue is meaningful. Or, in other words, do the changes make a difference? To this end, another mathematical definition has to be added.

Changes

Suppose that we are given a continuation that connects nodal situations v_1 and v_2 , given as vertices of the nodal graph. Then a given static aspect \mathcal{A} has the realizations $f_A(v_1)$ and $f_A(v_2)$, respectively. What is the change of this aspect along the continuation under scrutiny? A seemingly natural answer to this question would be the difference

$$f_A(v_2) - f_A(v_1)$$

between the realizations. The problem with that answer is that we have not yet discussed the possibility of subtracting realizations. In order to do so, we will first have to impose a further condition on the structure of the formal aspects.

Recall that an aspect change is a rule that determines how each possible realization of an aspect is transformed into another one. We are now interested in the case where such a change is uniquely determined by the change that it imposes on one particular realization and where, to every pair a_1 and a_2 of realizations, there is one (and, by the preceding condition, only one) change that transforms a_1 into a_2 . In this case, this change is called the *difference* between a_2 and a_1 and it is denoted by

$$a_2 - a_1.$$

If the formal aspect satisfies this condition, we call it *subtractive*. Subtractive aspects are therefore equipped with a natural subtraction rule

$$- : \mathcal{A} \times \mathcal{A} \rightarrow \Delta\mathcal{A}.$$

These considerations slightly change our definition of static aspects: static aspects must be subtractive. A static aspect is thus characterized by three ingredients:

$$\mathcal{A}, \Delta\mathcal{A}, f_A$$

where \mathcal{A} is a space of realizations, $\Delta\mathcal{A}$ is a corresponding space of changes such that \mathcal{A} is subtractive, and f_A is a ARS (assignment of realizations to situations).

Note that this new condition for a static aspect does not confine our framework to special situations only. It just forces us to choose the ‘right’ set of aspects. This might result in replacing one non-subtractive aspect (‘What does Alice’s dress look like?’) by two or more subtractive aspects (‘What is the color of Alice’s dress?’, ‘What is the color of the stripes on the dress?’, ‘What is the width of these stripes?’ etc.). But, as mentioned before, the dimension of the vector is of no importance to the underlying mathematics.

We are now in a position to assign systematically to every continuation the change of a given static aspect along that continuation. The resulting rule will be

called the *differential* of the assignment f_A and will be denoted df_A . If the change is the difference between the realizations at the origin and at the terminus, that is, if the edge e joins the vertices $o(e)$ and $t(e)$, we have to define

$$df_A : e \mapsto f_A(t(e)) - f_A(o(e)).$$

Consequences in a basic model

Although it is our final objective to arrive at a *general* model of FNs, it is nevertheless instructive to first look at a very basic model, which in the following is called *model of type I*. For this special model, we only will consider three aspects: ‘time’, ‘space’ and ‘character’. The former is a dynamic aspect; the latter two are static aspects.³ The model then consists of the following data:

1. a nodal graph $NG = (V, E, o, t)$
2. a static aspect ‘character’ $(\mathcal{C}, \Delta\mathcal{C}, f_C)$
3. a static aspect ‘space’ $(\mathcal{S}, \Delta\mathcal{S}, f_S)$
4. a dynamic aspect ‘time’ (\mathcal{T}, F_T)

In this case, we can assign a *vector of consequences* K to each continuation e following a specific node. It is a 3-dimensional vector and can be defined by its components referring to character, space and time, respectively:

$$K(e) := (df_C(e), df_S(e), F_T(e)).$$

The corresponding product set

$$\mathcal{K} = \Delta\mathcal{C} \times \Delta\mathcal{S} \times \mathcal{T}$$

is called the *space of consequences*.

2.2.4 Reaching the same Situation in two different Ways

So far, we have not taken into account the possibility that in some FNs the same situation can be reached by two different ways. It is possible to identify two points in the nodal graph, if it is clear that they refer to the same situation. In other words and in the sense of abstraction of this section: they have continuation sets

³ Static aspects here meaning of course not that space and character can not change but rather that changes are only registered from node to node.

which can be identified and all aspects are the same for these sets (which in the model means that the functions which assign realizations assign the same values to them).

Then we can easily modify the graph in such a way that instead of containing two (or more) nodes representing the same situation, it contains only one. We identify the nodes in the graph so that we obtain a new graph, which then contains a loop. What is lost, however, is the property of being time-ordered. Since all aspects agree for the nodes that have been identified, it is obvious how to define a new formal aspect for the new model.

The above condition for the identification of nodes will be modified when we come to the more refined models in section 2.4.

2.3 Quantification of Openness

This chapter is concerned with the possibility of quantifying nodal situations according to their degree of openness. The result is a formal conceptualization that quantifies at once the answers to the questions,

- how extensive is the spectrum of alternatives?
- what is the relation between the spectrum of offered alternatives and the spectrum of imaginable alternatives?

The theoretical construct that quantifies these ideas is developed for types of narrative as have such a rich structure that it is possible and meaningful to represent aspect parameters and in particular consequences (as defined in the preceding chapter) by k -dimensional real spaces,

$$\mathcal{K} = \mathbb{R}^k.$$

That is, we can think of the space of consequences as something similar to our intuitive idea of a space in which we can add up arrows, compute areas and volumes, connect points by lines, and perform similar operations. To do this, the following arguments will rely strongly on the concept of integration, which is reviewed briefly in the appendix.

2.3.1 The Spectrum of Consequences

The structure of the consequences of a nodal situation can be quantified by some parameters; their conceptualization is motivated by the following questions:

- What is the size of the region spanned by the alternative continuations (vaguely speaking, ‘the space between the extreme points of the spectrum’)?
- To what extent is this space covered by the alternative continuations?

Size

In order to answer the first question, we have to make the idea of a space spanned by the alternative continuations more precise. Suppose that a given nodal situation has as its set of continuations the set

$$\{v_1, \dots, v_n\}.$$

To this set corresponds a set of vectors of consequences

$$A = \{K_1, \dots, K_n\} \subset \mathcal{K}$$

which will be referred to as the *set of alternative continuations*. Based on our above assumption, these vectors can be thought of as arrows from some origin to points in a k -dimensional space \mathbb{R}^k . Then what is the region spanned by these endpoints? The obvious answer is the k -dimensional space between these points, which can be quantified by the k -dimensional volume.

One problem arises from this approach, because there may be cases in which there is no such space. Suppose, for instance, that $k = 3$, that is, consequences can be modeled in a 3-dimensional space. Then in a situation with, say, three alternative continuations, which span only a plane surface, there is no 3-dimensional volume between these alternatives. The same problem arises in higher dimensions when all alternative continuations lie on the respective equivalent of a surface.

Intuitively, a solution to this problem is obtained by replacing a flat surface by a thin table. This is supported by the following idea. If two vectors of consequences are reasonably close, then one might say that practically there is no detectable difference between them. More precisely, we will suppose that there is a minimum value

$$\delta \in \mathbb{R}$$

that a difference between two vectors of consequences has to have in order for these consequences to be considered different at all. If that is so, then, together with every consequence given by a point $K \in \mathcal{K}$ being offered, all the space around K up to the distance δ can be thought of as covered by this particular continuation. Thus by ‘the space spanned by the alternatives’, we mean the set of all points that lie between the alternatives enclosed by a δ -layer.

More precisely, we call a set $L \subset \mathbb{R}^k$ *convex*, if, for every two points in L , all the points on the line connecting these points are also contained in L . The *convex hull* of the consequences K_1, \dots, K_n is the smallest convex set that contains all the K_i . The δ -*hull* is the set of all points in \mathbb{R}^k that lie in the convex hull or at a distance of at least δ from the convex hull. It will be denoted by the symbol

$$\mathfrak{R}(\{K_1, \dots, K_n\})$$

and called the *space spanned by the consequences*. This space is illustrated in figure 2.4.

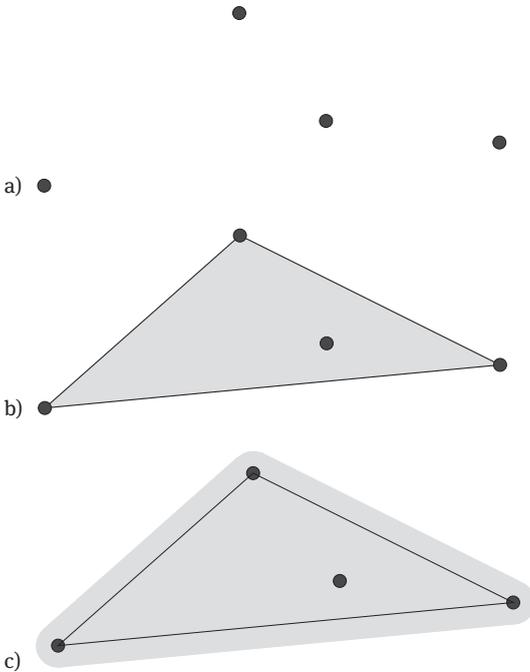


Fig. 2.4: Above: points in the space of consequences. Center: their convex hull. Below: their delta-hull.

The size of the space spanned by the consequences (which is what we are interested in) can now be quantified by the k -dimensional volume of this space:

$$V(K_1, \dots, K_n) := \text{VOL}(\mathfrak{R}(\{K_1, \dots, K_n\})) = \int_{\mathfrak{R}(\{K_1, \dots, K_n\})} dp$$

where the integration is understood to be over all points p of the δ -hull.

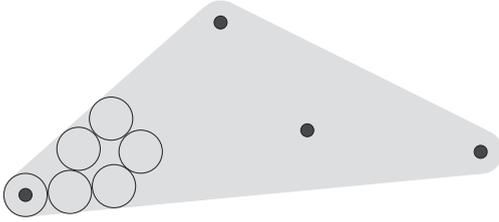


Fig. 2.5: Scope of consequences: how many delta-spheres can be put into the delta-hull?

However, once we think of consequences as spheres rather than points, it is more intuitive to ask: how many consequences can be put into the delta-hull? The concept which answers this question is called the *scope of consequences*, which is again a measure of the size of the space of consequences. This means that the above volume is measured in units of ‘ δ -spheres’ (figure 2.5); formally this is defined as

$$V_{\text{rel}} = V / \text{VOL}(B(\delta))$$

where $B(\delta)$ is a k -dimensional sphere of radius δ .

Covering parameter

Our next goal is a quantification of the covering of the space spanned by the consequences. This is not just a function of the number of consequences in that space. To see this, look at figure 2.6: in both scenarios there are five consequences inside the δ -hull but clearly the covering in the right situation is much better.

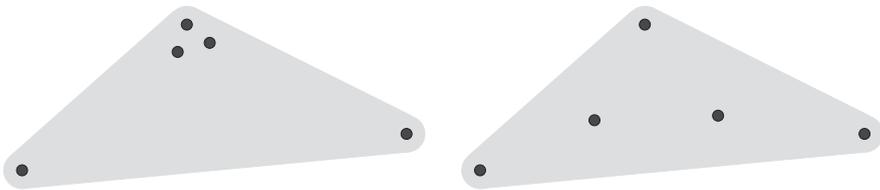


Fig. 2.6: Different qualities of covering by consequences.

Obviously, the lower the average distance of a point in that space \mathfrak{X} from the nearest consequence K_i is, the higher the quality of the covering will be.

More precisely, if $p \in \mathfrak{R}(\{K_1, \dots, K_n\})$ is some point in our space,⁴ then we define its distance from the nearest consequence as

$$r(p) := \min(|p - q| : q \in \{K_1, \dots, K_n\}).$$

Since we only distinguish such consequences as are separated by a distance of at least δ , we have to apply a slight modification and consider the distance of the delta-spheres at p from its nearest consequence:

$$r'(p) := \min(r(p) - \delta, 0)$$

The mean distance can be obtained by integration of r' over $\mathfrak{R}(\{K_1, \dots, K_n\})$ and subsequent division by the volume of \mathfrak{R} :

$$\langle r' \rangle = \frac{\int_{\mathfrak{R}(\{K_1, \dots, K_n\})} r'(p) dp}{\int_{\mathfrak{R}(\{K_1, \dots, K_n\})} dp}$$

Since, for the time being, we are looking for a parameter that contains as its only information the *relative quality* of the covering, some further adjustments to this definition are appropriate. As in the case of the size parameter, it seems natural to consider a *relative mean distance* instead of the above mean distance. In order to define it, we proceed as follows. First we define the largest possible distance of two points in the space \mathfrak{R} , its diameter, as

$$d(\mathfrak{R}) := \max(|p - q| : p, q \in \mathfrak{R}).$$

Note that this number is finite, for the delta hull of a finite number of consequences is always of finite size.

Now the relative mean distance can be defined as

$$\langle r' \rangle_{\text{rel}} := \frac{\langle r' \rangle}{d(\mathfrak{R})}.$$

This parameter is a number between 0 and 1. The larger it is, the poorer the quality of the covering will be. Therefore, in the last step, we define a final *covering parameter* as

$$C := 1 - \langle r' \rangle_{\text{rel}}.$$

⁴ This point is not necessarily a consequence itself!

The covering parameter is a number between 0 and 1. The higher it is, the better the quality of the covering will be. If it is 1, then every point has in its neighborhood some consequence which is at a distance of at most δ .

Spectral parameter

The two parameters we have defined so far are now combined in a so-called *spectral parameter* which quantifies at once both the size of the space of consequences and the quality of the covering of that space:

$$S(K_1, \dots, K_n) := V_{\text{rel}} \cdot C$$

As a first example, we consider the special (and for practical purposes irrelevant) case where a situation has only one continuation. Note: such a situation is not a node and can therefore not be a constitutive element of a FN. In this case, the set of alternatives contains only one element and can therefore be written as

$$\{K_1\}.$$

Its convex hull is $\{K_1\}$ and so the δ -hull is simply the sphere of radius δ around K_1 . The volume of this hull is identical to the volume of the δ -sphere, which implies that

$$V_{\text{rel}} = 1.$$

Moreover, every point in this hull is at a distance of at most δ from the center, where the nearest consequence is located. Therefore, the function r' vanishes identically on this space, and so its integral also vanishes. Therefore, the mean distance vanishes and the covering parameter is given by

$$C = 1.$$

So in this case, the spectral parameter satisfies

$$S(\{K_1\}) = 1.$$

In order to be meaningful, the spectral parameter should allow for a distinction between the case where we have more than one consequence and the trivial case just discussed. That is, if there is more than one consequence, we should have that $S > 1$. This is indeed the case and one can state the following:

The spectral parameter is a number greater than or equal to 1. It is always greater than 1, given that there is more than one continuation. It has the monotony property.

The latter statement is mathematically proven in the next section; it may be skipped for a first reading.

For practical reasons, we define a *renormalized spectral parameter* as

$$P_s := 1 - \frac{1}{S}.$$

On the basis of the above, we have that **the renormalized spectral parameter is a number between 0 and 1. It is 0 if and only if there is only one continuation and it has the monotony property.**

Proof of monotony

A property which it seems meaningful for our spectral parameter to hold is the following. Suppose that we start with some set of alternatives A_1 . We construct another one (A_2) by adding some more consequences. Then the spectral parameter of the second set should be at least as high as the spectral parameter of the set we started with. Formally,

$$A_1 \subset A_2$$

should imply that

$$S(A_1) \leq S(A_2).$$

This property is called the *monotony property*. If, in addition, we have that

$$A_1 \subsetneq A_2$$

implies that

$$S(A_1) < S(A_2)$$

we say that the *strict monotony property* holds. We have the following result.

Theorem 1. *The spectral parameter has the monotony property.*

Proof. Let A_1 and A_2 be sets of alternatives satisfying

$$A_1 \subset A_2$$

We have corresponding δ -hulls \mathfrak{R}_1 and \mathfrak{R}_2 , respectively. In addition, we have diameters $d(\mathfrak{R}_1)$ and $d(\mathfrak{R}_2)$ and distance functions r'_1 and r'_2 . We have to show

that:

$$S(A_1) \leq S(A_2)$$

which is expanded as

$$V_{\text{rel},1} \cdot C_1 \leq V_{\text{rel},2} \cdot C_2$$

and in turn means that

$$\frac{\text{VOL}(\mathfrak{R}_1)}{\text{VOL}(B(\delta))} \cdot \left(1 - \frac{\int_{\mathfrak{R}_1} r'_1}{\text{VOL}(\mathfrak{R}_1) \cdot d(\mathfrak{R}_1)}\right) \leq \frac{\text{VOL}(\mathfrak{R}_2)}{\text{VOL}(B(\delta))} \cdot \left(1 - \frac{\int_{\mathfrak{R}_2} r'_2}{\text{VOL}(\mathfrak{R}_2) \cdot d(\mathfrak{R}_2)}\right).$$

This inequality can be rearranged to yield

$$\text{VOL}(\mathfrak{R}_1) - \int_{\mathfrak{R}_1} \frac{r'_1}{d(\mathfrak{R}_1)} \leq \text{VOL}(\mathfrak{R}_2) - \int_{\mathfrak{R}_2} \frac{r'_2}{d(\mathfrak{R}_2)}$$

and finally

$$\text{VOL}(\mathfrak{R}_2) - \text{VOL}(\mathfrak{R}_1) > \int_{\mathfrak{R}_2} \frac{r'_2}{d(\mathfrak{R}_2)} - \int_{\mathfrak{R}_1} \frac{r'_1}{d(\mathfrak{R}_1)}.$$

Now let us look more closely at this condition. Obviously, we have that

$$\mathfrak{R}_1 \subset \mathfrak{R}_2.$$

As a consequence we also have that

$$d(\mathfrak{R}_1) \leq d(\mathfrak{R}_2).$$

Moreover, adding consequences improves the covering of *the first set*, which means that we have

$$r'_1 \geq r'_2.$$

In sum, the above gives us

$$\frac{r'_1}{d(\mathfrak{R}_1)} \geq \frac{r'_2}{d(\mathfrak{R}_2)}$$

implying that

$$\int_{\mathfrak{R}_2} \frac{r'_2}{d(\mathfrak{R}_2)} - \int_{\mathfrak{R}_1} \frac{r'_2}{d(\mathfrak{R}_2)} \geq \int_{\mathfrak{R}_2} \frac{r'_2}{d(\mathfrak{R}_2)} - \int_{\mathfrak{R}_1} \frac{r'_1}{d(\mathfrak{R}_1)}.$$

The right-hand-side of this inequality is the same as encountered above. Therefore, the theorem is shown once we have seen that

$$\text{VOL}(\mathfrak{R}_2) - \text{VOL}(\mathfrak{R}_1) \geq \int_{\mathfrak{R}_2} \frac{r'_2}{d(\mathfrak{R}_2)} - \int_{\mathfrak{R}_1} \frac{r'_2}{d(\mathfrak{R}_2)}$$

which is obvious since it holds that

$$\frac{r'_2}{d(\mathfrak{R}_2)} \leq 1$$

and (by definition)

$$\text{VOL}(\mathfrak{R}_1) = \int_{\mathfrak{R}_1} 1 \quad , \quad \text{VOL}(\mathfrak{R}_2) = \int_{\mathfrak{R}_2} 1. \quad \square$$

From the proof of the above theorem we can deduce two other results.

Corollary 1. *If we have that*

$$\text{VOL}(\mathfrak{R}_1) < \text{VOL}(\mathfrak{R}_2)$$

then the spectral parameter is strictly monotone.

Proof. In this case,

$$\text{VOL}(\mathfrak{R}_2) - \text{VOL}(\mathfrak{R}_1) > 0.$$

Moreover, the function

$$\frac{r'_2}{d(\mathfrak{R}_2)}$$

vanishes identically on some subset of the difference set $\mathfrak{R}_2 \setminus \mathfrak{R}_1$. This can be made plausible as follows. Since the volume has increased between \mathfrak{R}_1 and \mathfrak{R}_2 , the δ -hull has increased. This is only possible if some points in A_2 do not lie in the convex hull of A_1 . The δ -sphere around this point is therefore not (completely) contained in \mathfrak{R}_1 and the part of it which is not contained in \mathfrak{R}_1 has a volume different from 0. On this subvolume, the above function vanishes identically. This gives us

$$\text{VOL}(\mathfrak{R}_2) - \text{VOL}(\mathfrak{R}_1) > \int_{\mathfrak{R}_2} \frac{r'_2}{d(\mathfrak{R}_2)} - \int_{\mathfrak{R}_1} \frac{r'_2}{d(\mathfrak{R}_2)}$$

which by the arguments of the above theorem is equivalent to the strict monotony property. □

Corollary 2. *If there is more than one continuation, then*

$$S > 1.$$

Proof. Since two alternatives correspond to two different points in the space of consequences which are separated by a non-vanishing distance, their δ -hull must be different from the δ -hull of a single point. Therefore, the volume of this hull is strictly larger than the volume of the δ -hull of a single point. □

2.3.2 The Spectrum of the Agent

If, as we will suppose in this section, different alternative continuations can be associated with different actions of some character in the narrative – we will call this character the *agent* – then we can characterize the relation of this character to the given situation by another parameter. For its conceptualization it will be of interest to what degree the alternative continuations that are offered accord with the capabilities of the agent. This point is important because even if a character may travel round the world – and, consequently, its spectral parameter will yield a large value – this will be meaningless if not some substantial change in the character himself takes place.

Our formalization will be based on the assumption that both offered alternatives (or, more precisely, the corresponding actions) and capabilities can be modeled as points in a common space of actions. The degree to which the latter are covered by the former can then be given, similar to what we saw in the section on the covering parameter, by the relative mean distance of one set of points from the other.

In other words: given a concrete nodal situation, we have realizations of the aspects character and space. In sight of these realizations, our options K_1, \dots, K_n correspond to certain actions. These actions will be collected in a set \mathfrak{S} called *set of actions* or *horizon of options*.

On the other hand, there is the set of all actions which in principle can be thought of as feasible for the agent and situation in question. This set will be denoted \mathfrak{S}' . We will suppose that both \mathfrak{S} and \mathfrak{S}' are contained in a common *space of actions* which has some basic geometrical structure that allows us to determine the distance of points from each other.

The degree to which the alternatives that are offered accord with the capabilities of the agent is quantified by the relative mean distance of the set \mathfrak{S}' from the set \mathfrak{S} , i.e., by the mean distance of an element $h' \in \mathfrak{S}'$ from the closest element $h \in \mathfrak{S}$.

To make this definition more precise, we define the distance of a point $h' \in \mathfrak{S}'$ from the set \mathfrak{S} as

$$\tilde{r}(h') := \min (|h' - h| : h \in \mathfrak{S}).$$

The total difference is then defined as

$$\tilde{R} := \begin{cases} \sum_{h' \in \mathfrak{S}'} \tilde{r}(h') & \text{if } \mathfrak{S}' \text{ is finite} \\ \int_{\mathfrak{S}'} \tilde{r}(h') dh & \text{otherwise.} \end{cases}$$

Moreover, in order to consider a mean distance, we have to introduce a normalization factor

$$\frac{1}{\text{VOL}(\mathfrak{H}')}$$

where $\text{VOL}(\mathfrak{H}')$ is the total volume of the set \mathfrak{H}' , defined as

$$\text{VOL}(\mathfrak{H}') := \begin{cases} \sum_{h' \in \mathfrak{H}'} 1 & \text{if } \mathfrak{H}' \text{ is finite} \\ \int_{\mathfrak{H}'} dh & \text{otherwise.} \end{cases}$$

The mean distance can now be defined as

$$\langle \tilde{R} \rangle := \frac{\tilde{R}}{\text{VOL}(\mathfrak{H}')}.$$

Finally, our goal is to define a relative mean distance. We have to divide the above number by the maximum possible distance of two points in \mathfrak{H}' ⁵. The maximum distance is given by

$$d(\mathfrak{H}') := \max(|p - q| : p, q \in \mathfrak{H}')$$

and so the relative mean distance is defined as

$$\langle \tilde{R} \rangle_{\text{rel}} := \frac{\langle \tilde{R} \rangle}{d(\mathfrak{H}')}.$$

This value specifies the degree to which the alternatives that are offered cover the possibilities of the agent. In order to have a number between 0 and 1 we define a parameter, called *conformity parameter*, as

$$P_c := 1 - \langle \tilde{R} \rangle_{\text{rel}}.$$

The conformity parameter is a number between 0 and 1. The more the offered alternatives accord with the capabilities of the agent, the larger this value is.

⁵ We will suppose that this is a finite number, which can be justified by the fact that the possibilities of a character are limited by the individual capabilities, which are finite.

2.3.3 The Degree of Openness of a Situation: Nodal Power

We are now in a position to introduce a number that quantifies the degree to which a certain situation is open. This number is called the *nodal power* of the given situation, and it combines the parameters that have been introduced so far:

$$P_n := P_s \cdot P_c.$$

This parameter takes into account the size of the space of consequences, its covering and the degree to which a given character ‘acts out’ its capabilities in a given nodal situation.

The above construction of the nodal power was aimed at giving a first glimpse of the concept. Although it was carried out for a somewhat idealized type of FN – e.g. we have not been concerned with loops yet – it can be expanded to cover the whole spectrum of FNs. This will be done in the next section.

Another point, however, should be addressed here. When it comes to assigning numbers to consequences, i.e. mapping from \mathcal{A} to \mathcal{K} , this gives rise to ambiguities. Resting with our toy model of figure 2.3: should the size of Alice be weighted in the same manner as her position? This surely depends strongly on the recipient of the narrative. But in the framework of mathematical analysis presented here, this will not affect the concept of nodal power. It will just alter the numbers an effective calculation of P_n will yield. As this affects all FNs in just the same way, the difference can be compared to switching from the metric system to inches, yards, etc.

For a conclusion of this section, let us review some of the properties of our measure P_n .

Range

The renormalized spectral parameter P_s and the conformity parameter P_c are numbers ranging between 0 and 1. Thus also the nodal power P_n is a number between 0 and 1.

Normalization

The nodal power of a situation with only one continuation is 0, as such is the spectral parameter.

Monotony

The spectral parameter has the monotony property, and so does the conformity parameter. The latter has not been proven so far but can be easily seen. If we have that

$$A_1 \subset A_2$$

then, since the sets of feasible actions coincide,

$$\mathfrak{A}'_1 = \mathfrak{A}'_2$$

and for the sets of possible actions we have that

$$\mathfrak{A}_1 \subset \mathfrak{A}_2.$$

It follows that the covering of the feasible actions by the possible actions improves,

$$P_{c,1} \leq P_{c,2}.$$

Thus, nodal power has the monotony property since it is the product of two monotone parameters.

24 Advanced Models for Similarities

At the end of section 2.2 we identified as same nodes in the graph whenever we were convinced that they referred to the same situation. As a condition for this assumption to be valid, we required that the formal aspects that we had abstracted for these nodes agree in all cases.

However, the scope of the model we have been looking at so far is too limited in the following sense. It is not possible to reach the same situation twice while some aspects have changed, the reason simply being that aspects are properties of the situation. Different aspects constitute different situations. But since there are cases in which it is reasonable to assume that this is possible, we have to change something.⁶

In this section we will therefore broaden our view and discuss a new type of model in which aspects can change when a situation is reached again. The idea behind this is to represent two situations which are reasonably similar by the same

⁶ In the first part of this book, we have seen that the ‘character’ is typically an aspect that may change when the same situation is reached in two different ways.

node, meaning that *within our model* they are equal. Of course, the aspects in which they differ can then no longer be considered essential for the situation. On the formal side, we can no longer attach the realizations of these aspects to the situations. We have to leave them out of the model and keep only the changes that occur to these aspects. The new model can be used to discuss FNs that possess what Marie-Laure Ryan calls ‘narrative memory’.⁷

2.4.1 Similarity

Bases of situations and basal graphs

As mentioned above, it is the basic idea of this section to say that two reasonably similar situations are *equal in the model*. Here, by ‘reasonably similar’, we mean that they differ only in some non-essential aspects. So in this sense it is possible to reach the same situation twice even if some aspect has changed – we simply have reached a situation that is reasonably similar to some other that we have been in before.

This concept gives rise to a new model. We will suppose that we have already constructed a model of type I, as presented in 2.2. In this model, two situations in the narrative correspond to two formal situations in the graph. The first step towards the new model is to identify the points in the graph that correspond to ‘reasonably similar’ situations and represent them by one common point in the new model. Here, of course, it is supposed that ‘reasonably similar’ implies in particular that the number and nature of continuations that are related to the situations in question do not differ, so these continuations can be also identified. The latter condition is necessary for a new graph.

Since in the new kind of graph, a point no longer represents a particular nodal situation but rather a bulk of nodal situations or, more precisely, the common denominator of a bulk of nodal situations, it seems reasonable to say that it represents a common basis. We will therefore call it a formal *basis of nodal situations*. Similarly, the edges in the new model are called *bases of continuations*, and the graph is called a *basal graph*.

As already explained in detail in the first part of this volume, a new building block is needed to adequately describe the situation for the basis graph: the loop. The existence of loops may seem to collide with the idea of temporal order, or uni-

⁷ See [Ryan, *Virtual Reality*], p. 253.

directional sequence. But as can be seen in figure 1.10, the temporal order may still be effective at least on a large scale.

Loops allow a ‘going back’ though that going back is not necessarily a going back *in time*. For example, time travel can be an important element in FNs that belong to the sub-genre of alternate histories, but very often loops allow only a revisiting of a situation without any reversal of temporal order.

Basis aspects

Of course, we also want our new model to contain some representation of the content, which traditionally was the role of the formal aspects. Thus we have to find a way of adapting the concept of formal aspects to the new situation presented here.

Remember that for assigning aspects we made a distinction between assignments related to situations (vertices) and to continuations (edges).

Looking at the continuations, we will assume that the dynamic aspects have the same realizations for all continuations that have been identified. Therefore, we have a natural way of assigning realizations of aspects to bases of continuations: the common realization that in the preliminary model was assigned to all continuations (which are now summarized) is assigned to the basis of continuations. This assignment, which will be part of the new model, will be called a *basis dynamic aspect*.

In the case of static aspects related to situations, there are some that are equal for all situations that have been summarized by a common basis and some that are not. In order to keep our model simple, we will assume that this distinction is valid globally for the entire FN. In other words, we are able to define a set of non-essential aspects which, in cases where situations are identified, do not have to coincide in their realizations. At the same time the remaining aspects do coincide, and this set of remaining aspects is the same for all cases in which situations are identified, i.e. throughout the narrative. Additionally, we will suppose that even in those cases where the realizations of the (non-essential) aspects do not coincide, at least the changes of these aspects along the continuations which are identified as the same *do* in fact coincide.

All these definitions are summarized in figure 2.7. We have essential aspects in directions 1 and 2 plus one non-essential aspect in direction 3. The basis static or dynamic aspects can be seen as projections from the (full) aspect space onto the sub-space spanned by directions 1 and 2.

With these assumptions, it is obvious how to include aspects in the new model. For the non-essential aspects, we are not able to include the realizations

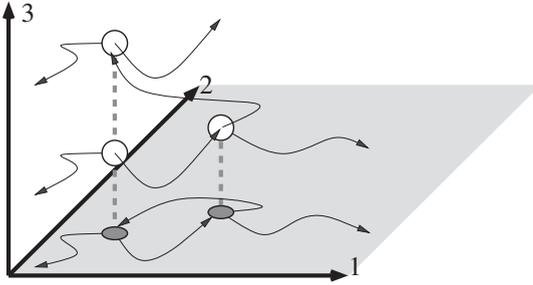


Fig. 2.7: Essential and non-essential aspects.

in the model: our model contains only bases of situations, and there is no meaningful, i.e. unambiguous, assignment of realizations of these aspects to bases of situations. We will therefore call these aspects *external basis static aspects*. It is, however, possible to keep the changes in the model, as the changes can be meaningfully assigned to the bases of continuations. It is at this point that we benefit from our careful distinction of aspects and aspect differences in section 2.2.

The remaining, essential aspects exactly match the definition of the original model and can therefore be carried over to the new one. The result is an assignment of realizations to bases of situations which will be called *internal basis static aspects*.

The process just described amounts to extracting a model of type I from a more extensive model by identifying situations which are reasonably similar. The new model will be called model of type II in the sequel. The next section will briefly give a formal description.

2.4.2 Formal Definition for Models of Type II

Aspect assignments

We have to distinguish between three ways in which an aspect can be related to the graph:

1. By specifying for each basis of situations what the realization of the aspect in this situation is,
2. by specifying for each basis of continuations which value the aspect takes if this continuation is chosen,
3. by specifying for each basis of continuations what change occurs to the aspect if this continuation is chosen.

First, the realization of the aspects in the different bases of situations has to be specified. This is achieved by a *realization assignment rule for bases of situations* (RAbS), which is a function mapping vertices from the set V to values in \mathcal{A}

$$f_A : V \rightarrow \mathcal{A}.$$

We suppose \mathcal{A} to be subtractive. Since these aspects which are related to situations have values that are contained in the model (via the given function), we call them *internal static aspects*. Their formal representation is by the combination

$$(\mathcal{A}, \Delta\mathcal{A}, f_A).$$

External static aspects are, again, related to situations. However, we do not specify the realization of the aspect in the different cores of situations, but rather only the change that the aspect incurs when a certain basis of continuations is chosen. This is done by a differential form (also called 1-form) ω_A which is essentially a mapping from some set of edges E to the space of changes $\Delta\mathcal{A}$:

$$\omega_A : E \rightarrow \Delta\mathcal{A}$$

We call this a *change assignment of the aspect \mathcal{A} for bases of continuations* (CAbC). The realizations of the underlying aspects of this kind do not belong to the model, that is why they are called *external static aspects*. Their formal representation is given by

$$(\mathcal{A}, \Delta\mathcal{A}, \omega_A).$$

We observe that by constructing the differential of a RAbS, we can always obtain a formal external aspect from an internal one, but not every external aspect can be obtained in this way.

Summing up, the above three ways of graph-aspect-relations are specified by:

1. an *internal static aspect* given by a triple⁸ $(\mathcal{A}, \Delta\mathcal{A}, f_A)$, where f_A is a realization assignment rule for bases of situations (RAbS) and \mathcal{A} is a subtractive aspect,
2. a *dynamic aspect* given by a pair (\mathcal{A}, F_A) , where F_A is an assignment of realizations of the aspect to bases of continuation (ARbC),
3. an *external static aspect* given by a triple $(\mathcal{A}, \Delta\mathcal{A}, \omega_A)$, where ω_A is a change assignment of the aspect for bases of continuations (CAbC).

8 A triple is an ordered set of three.

Models of type II

We end this section by giving a possible definition of a model of type II in which ‘character’ and ‘space’ are external aspects. Of course, other aspects may be incorporated as external ones by a similar definition.

A *model of type II* is the collection of the following data:

1. a basal nodal graph $BNG = (V, E, o, t)$
2. an external static aspect ‘character’ $(\mathcal{C}, \Delta\mathcal{C}, \omega_{\mathcal{C}})$
3. an external static aspect ‘space’ $(\mathcal{S}, \Delta\mathcal{S}, \omega_{\mathcal{S}})$
4. a dynamic aspect ‘time’ $(\mathcal{T}, F_{\mathcal{T}})$

2.4.3 Models of Type II without underlying Subtractive Aspects

So far we have only been able to construct a model of type II on the basis of a complete model of type I. We obtained a basal graph by identifying nodes in a type-I graph, and we obtained basis external aspects from differentials of subtractive static aspects of a model of type I.

This construction helped us to understand the new models, but since we are now familiar with them, we can shorten their construction process. We will keep the assumption that, at least in principle, the graph of the model, which is a graph of bases of situations, can be constructed by identifying nodes in a graph of situations.

What seems less reasonable is the requirement that we first have to construct a model of the aspects of the old style which is then transformed into a new model of aspects (in the case of the external ones). Rather, a model is obtained by directly assigning, in the case of external aspects, changes of aspects to the diagram without the assumption that these changes come from an old-style model.

2.4.4 Path Dependency of External Aspects

Generally, the models we consider describe the *architecture* of FNs. From these models, it cannot be directly concluded which realizations occur in the course of concrete runs through a FN structure. This just lies outside the framework presented here. Models of FN architecture only show what the FN in question allows.

As has been stressed in the preceding sections, the values of the external aspects are not included in the architecture. However, these values can be reconstructed for a certain point in a run if we know the values at the start and the path that has been taken so far. We denote by a *partial performance* the model for a run

up to a certain point. It is characterized by a path in the nodal graph together with initial values for the external aspects. The value of an external aspect at the end of a partial performance is obtained by applying all the changes to the initial values that occur along the path.

Although we stick to the concept that our description of FNs is a description of the architecture, not of particular runs, the concept of partial performance will be useful for extending the definition of nodal power from section 2.3.3 to models of type II.

The above can be made explicit by the following definition: A *partial performance* is a specific path out of all instances leading from node e_0 to node e through a given nodal graph NG

$$\gamma \in \underline{P}(e_0, e; NG)$$

together with initial values

$$(c_0, s_0) \in \mathcal{C} \times \mathcal{S}$$

where $\mathcal{C} \times \mathcal{S}$ is the combined space of aspects regarding character and space (as an example; see the definition of models of type II above).

We write this in the form of a tuple, i.e., a ‘list of ingredients’:

$$p = (\gamma, c_0, s_0).$$

In order to discuss the calculation of the external aspects, some additional vocabulary is helpful.

Integration of a differential form along a path

Let ω be a differential form on a NG with values in $\Delta\mathcal{A}$ and let

$$\gamma = (e_1, \dots, e_k)$$

be a path in the NG joining continuations e_1, \dots, e_k . We then define the *line integral* of ω along γ as

$$\int_{\gamma} \omega := \sum_{j=1}^k \omega(e_j) = \omega(e_1) + \dots + \omega(e_k).$$

The line integral is again an element of the space $\Delta\mathcal{A}$. It represents the total change of the aspect \mathcal{A} along the path γ .

Path dependency of character and space

We can now state the computation rule for the values of the external aspects. We denote these values by the symbols C (for character) and S (for space) respectively. If $p = (\gamma, c_0, s_0)$ is a partial performance, we set

$$\begin{aligned} C(p) &:= c_0 + \int_{\gamma} \omega_{\mathcal{C}} \\ S(p) &:= s_0 + \int_{\gamma} \omega_{\mathcal{S}}. \end{aligned}$$

We then aggregate the values of the different external aspects (that is, their possible combinations) into a so-called *state space*

$$\mathcal{Z} := \mathcal{C} \times \mathcal{S}.$$

The *state* of a FN after a partial performance p is the tuple of values of the external aspects, which is a specific point in the above space:

$$Z(p) := (C(p), S(p)) \in \mathcal{Z}$$

With this new vocabulary, we can say that any kind of ‘narrative memory’ corresponds to the state space in our model and that the content of this memory is just given by the state.

2.4.5 Computing Nodal Power in the Presence of External Aspects

The spectral parameter

Let $e \in E$ be a basis of continuations. The *vector of consequences* of e can then be written as the tuple

$$\underline{K}(e) := (\omega_{\mathcal{C}}(e), \omega_{\mathcal{S}}(e), F_{\mathcal{T}}(e))$$

Note that this definition is similar to the one made for models of type I in section 2.2.3, the difference being that we have replaced the differential of some assignment of realizations to situations (ARS) by a change assignment for bases of continuations (CABC). In particular, the vector of consequences is once again an element of the respective space of consequences

$$\mathcal{K} = \Delta\mathcal{C} \times \Delta\mathcal{S} \times \mathcal{T}$$

which allows us to carry the construction of the spectral parameter over to our new models.

The above construction can easily be generalized in such a way that it also extends to cases of models with arbitrary aspects of any kind. The space of consequences is the product of the spaces of changes of all static aspects with the spaces of realizations of all dynamic aspects. The vector of consequences of some basis of continuations is thus given by all the three items from section 2.4.2:

1. the values of the differentials of the RAbS (realization assignment rule for bases of situations) of the internal static aspects at this continuation,
2. the values of the ARbC (assignment of realizations of the aspect to bases of continuation) of the dynamic aspects at this continuation and
3. the values of the CAbC (change assignment of the aspect for bases of continuations) of the external static aspects at this continuation.

The conformity parameter

Unlike the spectral parameter, the definition of the conformity parameter involves action spaces of a character which may depend on the content of the variable $C(p)$. Thus, its construction has to be modified if we do not want it – and in consequence the nodal power parameter – to depend on the path that is taken.

A solution to this problem is the following: First, we will construct the set of all realizations of the character aspect that are possible in the situation in question. In order to do so, we have to look at all valid partial performances that end up at the given situation. If we call this situation ν , then this set is denoted by

$$\underline{P}(*, \nu).$$

The set of possible character realizations of ν is then the set of all values $C(p)$ where p is an element in the above set. We will denote this set by $\mathfrak{C}(\nu)$,

$$\mathfrak{C}(\nu) := \{C(p) : p \in \underline{P}(*, \nu)\}.$$

Now, for each possible character value $\tilde{c} \in \mathfrak{C}(\nu)$, we can compute a conformity parameter $P(\tilde{c})$. To make this independent of the actual value of \tilde{c} , the overall conformity parameter is then defined as the maximum value among these parameters:

$$P_c := \max (P(\tilde{c}) : \tilde{c} \in \mathfrak{C}(\nu)).$$

The nodal power is then defined as usual: it is the product of P_s and P_c . As already for the models of type I, the nodal power is independent of any path taken to reach the node and is just a measure of the (local) architecture of the FN.

2.5 Reversibility

2.5.1 Undoing Choices

Within the framework of our new models, we can also discuss the concept of reversibility. By this we mean the possibility of undoing a choice. More precisely, we say that the choice of some alternative e_i in a situation v is *reversible* if there is a path starting and ending at v which begins with e_i . In other words, reversibility means that it is possible, once e_i is chosen, to make some other choices in order to ultimately arriving again at the situation v .

Note that when speaking of v , we are referring to a basis of situations as defined in section 2.4. This includes the possibility – and actually, this possibility will be used by FNs – of external aspects which are not the same when one returns to v .

2.5.2 Degree of Reversibility

If this is the case, we can also introduce a degree to which the consequences of a former choice are reversible. Reversibility means that there is a closed loop that brings us back to the situation v after the choice e_i has been made. Since there are external aspects in our FN, the narrative is in some state (as defined in section 2.4.4) before the loop and in some other state after the loop. The degree to which these two states differ is an appropriate measure for the degree of reversibility: the closer they are, the less needs to be changed in order to get back to the initial situation. Thus the higher is the degree of reversibility.

Of course, there can be more than one possibility of entering a loop after e_i , so, correctly speaking, the degree of reversibility is determined by the least difference of states among all such loops.

As in the case of nodal power, this idea will be made more precise with the help of the assumption that we are considering a FN with a space of consequences which it is reasonable to model as a k -dimensional space \mathbb{R}^k .

In this case, suppose that γ is some closed loop starting and ending at v and beginning with e_i . The total difference of the external aspects is the tuple of inte-

grated differential forms along the path γ ,

$$\left(\int_{\gamma} \omega_C, \int_{\gamma} \omega_S \right)$$

which is an element of the space

$$\Delta\mathcal{C} \times \Delta\mathcal{S}.$$

Here, as before, we have chosen ‘character’ and ‘space’ as external aspects. The generalization to other situations is obvious.

This space is a subspace of the space of consequences, i.e., it can be modeled as a m -dimensional space \mathbb{R}^m with $m < k$. All the properties of the original space of consequences still apply. Therefore, the element $(\int_{\gamma} \omega_C, \int_{\gamma} \omega_S)$ has a size which is the numerical measure of the total difference of external aspects along γ . It will be denoted by the symbol

$$\Delta(\gamma) := \left\| \int_{\gamma} (\omega_C, \omega_S) \right\|.$$

As has been pointed out above, there may be more than one path starting and ending at v and beginning with e_i , and the degree of reversibility will be determined by the minimal total difference among all such paths. We will therefore introduce the *length of reversibility* as

$$L(v, e_i) := \min (\Delta(\gamma) : \gamma \text{ is closed and } \gamma_1 = e_i)$$

and, if there is no such closed curve, we set

$$L(v, e_i) = \infty.$$

In order to have a value that can be used to compare different situations in different FNs, we will normalize this value. To this end, we suppose, as in the case of nodal power, that there is a minimal distance δ , below which consequences are indistinguishable. Then the value

$$\frac{\max(\delta, L(v, e_i))}{\delta}$$

ranges between 1 and infinity and the *degree of reversibility* can be given by its inverse

$$D_r := \frac{\delta}{\max(\delta, L(v, e_i))}.$$

D_r is a number between 0 and 1. If there is no closed curve starting and ending at v and beginning with e_i , then the choice of e_i is not reversible. The length of reversibility is ∞ , and, with the convention $\frac{1}{\infty} = 0$, we have that the degree of reversibility is zero.

If, on the other hand, there is a curve for which the length of the total difference of the external aspects is less than δ , then within the given precision, the choice of e_i is fully reversibly. In this case, we can compute that

$$\frac{\max(\delta, L(v, e_i))}{\delta} = 1,$$

leading to a degree of reversibility

$$D_r = 1.$$

Conclusion: the degree of reversibility that has been introduced in this section is a number between 0 and 1. The higher it is, the more reversible a given choice is. In particular, a degree of reversibility 0 means that the choice is ‘non-reversible’. In contrast, a degree of reversibility 1 indicates that it is ‘fully reversible’.

2.6 Topological Classification of Future Narratives

2.6.1 The Topology of the Nodal Graph

So far, our attempt to formally describe the mathematical structure of FNs has been focused on *local* properties such as the nodal power or the degree of reversibility. If, however, we attempt a general classification of FNs, then a *global* view can no longer be avoided. The mathematical tools are provided by the field of topology, which is concerned with relations of geometrical objects irrespective of their distances. E.g., from a topological point of view, there is no distinction between a sphere and an ellipsoid or even a cube, since all of these objects may be transformed easily into each other. On the other hand, a torus (‘donut’) or a cup-like object with a handle is different, because of the – simply speaking – ‘hole’ they have.

Similarly, the geometrical structure of a nodal graph can be studied from a topological perspective. In particular, the complexity of the graph can be characterized by the possible loops in the graph and thus by the ‘holes’ that are in the graph.

Loops and cycles

First we have to make the notion of a loop more precise. Of course, if there is a path in the graph that goes along certain edges and finally arrives at the node where it started, then we speak of a loop. But if there are two different ways of going from one node to another, we may also say that we get some sort of loop as long as we disregard their direction. This sort of loop is called a *cycle* in mathematical parlance. We can even go further and call a cycle any sequence of edges that, when walked through regardless of direction, connects some node with itself. This definition, which may at first seem superfluous, will prove relevant in a few moments.

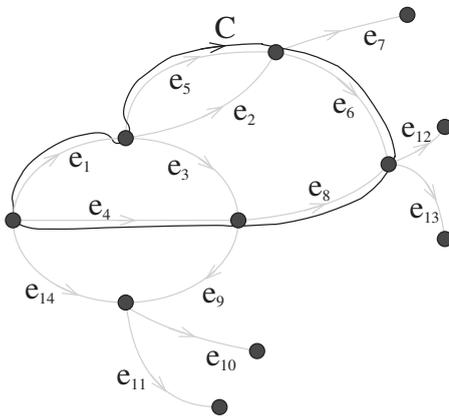


Fig. 2.8: A sample graph with a sample cycle.

If C is such a cycle, we can write it as a sequence of edges which are walked through regardless of their direction. A plus sign indicates the direction allowed by the FN, a negative sign the opposite. For instance, the loop in figure 2.8 can be written as

$$C = (+e_1 + e_5 + e_6 + e_8 - e_4).$$

In the following, we consider a simple sample graph in which two nodes can be connected by three different edges called e_1 , e_2 , e_3 . It is illustrated in figure 2.9.

In this graph, a number of cycles can be constructed, for example the five cycles represented in figure 2.10. They are denominated, respectively: $(e_2 - e_1)$, $(e_2 - e_3)$, $(e_3 - e_1)$, $(e_1 - e_2 + e_3 - e_2)$, $(e_1 - e_3 + e_1 - e_3)$.

Our aim is to study the complexity of a nodal graph from the point of view of its possible cycles. However, not all returning structures reveal information about this complexity. Consider, for example, the case where we walk some edge

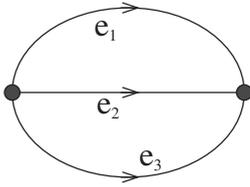


Fig. 2.9: A graph in which two nodes can be connected by three different edges.

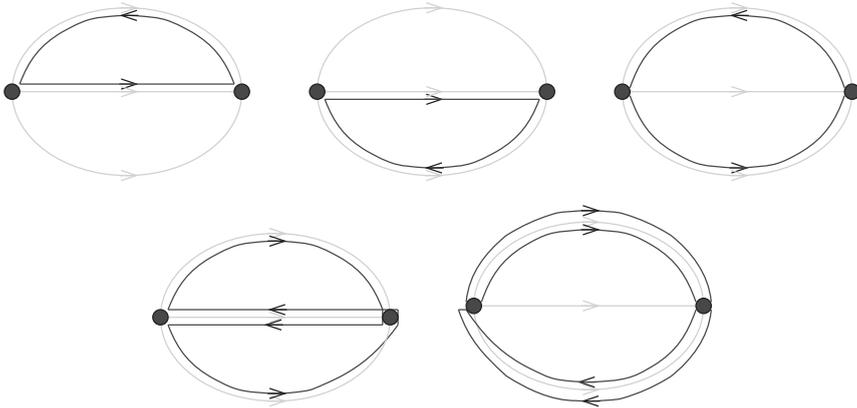


Fig. 2.10: Different cycles in the graph from figure 2.9.

forwards and backwards. In part one of this volume, such a situation is addressed as a ‘bi-directional’. It does not give us any information apart from the fact that the edge in question exists and that it is not uni-directional. Essentially, this adds nothing to the complexity of the graph. Complexity is about relations between different nodes in the graph, so only such cycles are of interest as are somehow woven into the graph and are not just attached like the ones shown in figure 1.9.

Therefore, we introduce the following rule: whenever the only difference between two cycles is that in the case of one, we walk some edge first forwards and then backwards, while in the case of the other we do not, then we say that these cycles are *equivalent*. This means that in the formal sum representation of cycles, terms of the form $+e_i - e_i$ can be left out.

Arithmetic with cycles

From an abstract point of view, we can perform ordinary arithmetics on cycles, i.e., we can add or subtract them just as we do with numbers. This is carried out in a straightforward way: if C_1 and C_2 are cycles with the same starting points, then we call the cycle that consists of walking C_1 and C_2 subsequently $C_1 + C_2$, and the cycle that consists of walking C_1 backwards is called $-C_1$. For instance, if we walk the cycle $(e_3 - e_1)$ backwards, we obtain the cycle $(e_1 - e_3)$, yielding, just as in ordinary algebra,

$$-(e_3 - e_1) = (e_1 - e_3).$$

The cycle that results from subsequent walks through the cycles $e_2 - e_1$ (forwards) and $e_3 - e_1$ (backwards) is the cycle $(e_2 - e_1 + e_1 - e_3)$, so we may write (cf. figure 2.11)

$$(e_2 - e_1) - (e_3 - e_1) = (e_2 - e_1 + e_1 - e_3).$$

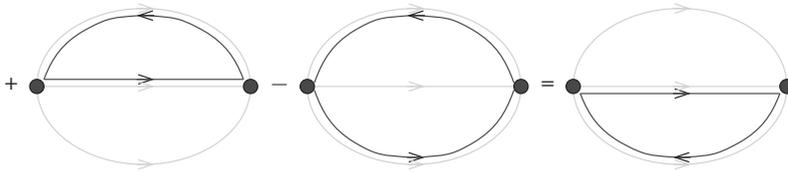


Fig. 2.11: Arithmetical rules for cycles.

This cycle is equivalent to $(e_2 - e_3)$, and we will equate equivalent cycles on the level of formal sums, that is, we will write

$$C_1 = C_2$$

if C_1 and C_2 are equivalent. In particular, we have that

$$(e_2 - e_1) - (e_3 - e_1) = (e_2 - e_3),$$

also following the usual algebra of numbers. Note that our definition of equivalence cancels out contributions from ‘bi-directionals’ as they lead back to just the same situation.⁹

⁹ However, the picture is different, if we include external aspects, as will be done soon.

We are now in a position to discuss the geometrical complexity of a nodal graph. This discussion will be guided by the following questions. Which non-equivalent cycles exist in the graph? Which arithmetical rules hold true for them?

2.6.2 Geometrical Classification: Homology Groups

Homology cycles

The above questions can be treated in an elegant way once some minor changes have been made. First, we enhance our notion of equivalence. So far, two cycles have been called equivalent if their formal sums are equal after the terms of the form $+e_i - e_j$ have been omitted. That is, we can simplify formal sums if consecutive edges cancel each other out. Now, in addition, we allow for the rearrangement of the order of the edges, that is we will claim that formal sums fulfill the commutativity principle $a + b = b + a$. Therefore, cycles are now equivalent if their formal sums are equal after rearrangement of the edges and canceling out of plus-edges with corresponding minus-edges. For example, we have the following equation (cf. figure 2.8):

$$(e_4 - e_3 - e_1 + e_{14} - e_9 - e_4) = (-e_1 - e_3 + e_{14} - e_9).$$

Second, we will concentrate exclusively on these sums. That is, we will no longer look at paths in the graph but only at formal sums. Of course, not every formal sum which is constructed arbitrarily is the formal sum of a cycle in the graph. So it would seem reasonable to consider only those formal sums which are associated with cycles. We will, however, widen this class slightly and consider also such formal sums as are closed in the following sense.

We define the boundary of some edge as a formal sum of nodes, namely, the node where it ends minus the node where it starts. And we define the boundary of a formal sum as the sum of the boundaries of the individual edges, where the plus and minus signs are taken care of. For the above example we have (the symbol ∂ denoting the boundary)

$$\partial(-e_1 - e_3 + e_{14} - e_9) = -\partial(e_1) - \partial(e_3) + \partial(e_{14}) - \partial(e_9).$$

In these formal sums, signs are distributed into the brackets. If, for instance, the following boundaries are given for the edges

$$\partial(e_1) = v_3 - v_1, \quad \partial(e_3) = v_2 - v_3, \quad \partial(e_9) = v_4 - v_2, \quad \partial(e_{14}) = v_4 - v_1$$

then we have:

$$\begin{aligned}
 & -\partial(e_1) - \partial(e_3) + \partial(e_{14}) - \partial(e_9) \\
 & = -(v_3 - v_1) - (v_2 - v_3) + (v_4 - v_1) - (v_4 - v_2) \\
 & = -v_3 + v_1 - v_2 + v_3 + v_4 - v_1 - v_4 + v_2 \\
 & = 0.
 \end{aligned}$$

The resulting 0 means formally that after rearrangement, each vertex with a plus sign cancels out a corresponding vertex with a minus sign. The interpretation is that we have just gone back to the vertex we started at. For this reason a formal sum of edges is called *closed* if its boundary is zero. Closed sums are also called *homology cycles*, and the collection of all homology cycles in a graph is called the *first homology group*. It is denoted by the symbol

$$H_1(NG)$$

and contains the collection of cycles, but it is slightly larger. The reason for this enlargement will become evident in the following paragraph.

Elementary cycles

The reason for the replacement of ‘loops’ by cycles is that for cycles the following holds true: there is a finite set of cycles, called *elementary cycles*, with the property that any given cycle can be constructed as a sum of the elementary cycles. In particular, for any given loop, we can construct a cycle C out of the elementary cycles that is equivalent in the above sense to the loop.

In addition, we require a set of elementary cycles to fulfill the uniqueness condition, that is: for every cycle, there is only one recipe to construct this cycle out of elementary cycles. These two conditions do not determine the set of elementary cycles uniquely. That is, there are several possible choices for such a set. In figures 2.12 and 2.13, two different sets of elementary cycles are shown for the above sample graph (figure 2.9).

However, the minimum number of elements is always the same. When we think of the homology group as an abstract space of cycles, this number is the dimension of this space. The procedure is much the same as for our well-known three-dimensional space \mathbb{R}^3 , where any vector can be composed of three ‘elementary vectors’, namely the unit vectors in the three directions x , y and z .

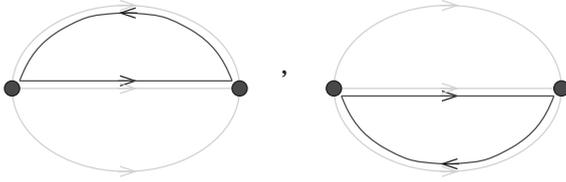


Fig. 212: One set of elementary cycles.

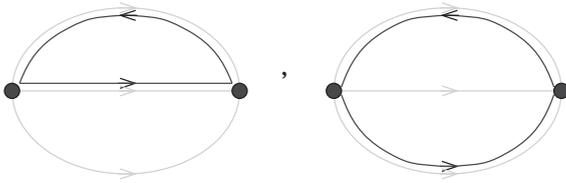


Fig. 213: A different set of elementary cycles.

In our case with cycles, the dimension is called the *homological dimension* of the graph and is written as

$$\dim(H_1(NG)).$$

As it is essentially this dimension that determines the structure of the homology group, the geometrical complexity of the underlying graph can be characterized solely by the homology dimension.¹⁰

As a benefit, in this representation the arithmetic for cycles (and, consequently, for loops) becomes simple: every cycle can be decomposed into a sum of elementary cycles. Each elementary cycle appears a specific number of times, each time either with plus or minus sign. We can abbreviate this and introduce coefficients counting the number of plus signs minus the number of minus signs for each elementary cycle. The addition of cycles then amounts to an addition of the corresponding coefficients.

We will give one example. Suppose that $\{C_1, C_2, C_3\}$ is a set of elementary cycles. From that set two cycles can be composed, say,

$$C_a = +C_1 + C_2 + C_1$$

10 Since many aspects of the theory have only been sketched briefly, the reader is referred to [Spanier] for a complete treatment of homology.

and

$$C_b = +C_3 - C_2 - C_2.$$

Rewriting this with coefficients reads

$$C_a = (+2) \cdot C_1 + (+1) \cdot C_2$$

and

$$C_b = (-2) \cdot C_2 + (+1) \cdot C_3.$$

Then, for the sum, we have that

$$C_a + C_b = (+2 + 0) \cdot C_1 + (1 + (-2)) \cdot C_2 + (0 + 1) \cdot C_3 = 2 \cdot C_1 + (-1) \cdot C_2 + 1 \cdot C_3.$$

2.6.3 Classification including Aspects: Cohomology Groups

The final task to be solved is the inclusion of the formal aspects into the topological structures presented in the last sections. It is especially the external aspects that have the potential to affect the overall structure of FNs.

Recall that aspects in general are assignments of changes both to the nodes and the edges in the graph. Now if we have an *internal* aspect, which assigns realizations of aspects to nodes, we can construct an assignment of changes to edges out of it by assigning to each edge the difference between the realization at its end and the realization at its beginning. We called this construction the differential of the internal aspect (cf. section 2.2.3).

External aspects are more general objects than differentials in the following way. Suppose that we have a graph in which it is possible to go from one point to another along two different paths. If we have an assignment of changes to edges then, since a path is a sequence of edges, we can assign a change to a whole path by adding up all the changes of the edges that constitute the path. If we do this addition in the case of a differential, then the result will be the realization at the end of the path minus the realization at the beginning of the path. Consequentially, this total change will always be the same for any two paths starting and ending at the same points.¹¹ Now for external aspects, things are different. In the case of external aspects, there are no realizations given at the beginning and the end of the path, and the differential form (cf. section 2.4.2) can assign anything to the edges – there is no reason to coincide for the total changes of two paths that con-

¹¹ A very general theorem stating this result for more complex geometrical objects is called Stokes' theorem. It can be found in [Bott and Tu].

nect the same points.¹² One could say that it is the difference of the total changes that distinguishes the differential form from a mere differential.

The aim of this section is the construction of an elegant scheme that records all these differences and links them to the geometrical properties of the underlying graph.

Deviations

If we have two paths connecting the same points, then we can, as above, form a loop by going one forwards and the other one backwards. The difference between the total changes of a differential form along the two paths will be called the *deviation of the differential form along the loop*. The general *deviation* of the differential form is the collection of all such deviations along loops. Collecting up these deviations we can build the space of all possible deviations of differential forms; in the sequel it will be called the *deviation space*.

The problem with these concepts is that there are many potential loops in the graph, and there is no handy way of recording them all. Again, the solution to this problem is to enlarge the range of data that has to be recorded. Instead of recording all deviations along loops, we record all deviations along cycles. The reason is that the space of all deviations along cycles has a far simpler structure than the deviation space itself. We will call the space of all possible deviations of differentials along cycles the *first cohomology group*. Its construction depends on the values the differential forms can have, i.e., on the space of aspect changes. The space of possible deviations of differential forms with values in the space of aspect differences $\Delta\mathcal{A}$ is called *first cohomology group of the nodal graph with coefficients in $\Delta\mathcal{A}$* , and it is denoted with the symbol

$$H^1(NG; \Delta\mathcal{A}).$$

This notation clarifies the fact that there is one such space for every aspect (or aspect difference). In addition, there is a standard space for which the coefficient space is just the set of integers. It is denoted with the symbol $H^1(NG)$.

The deviation of a particular differential form ω (which is the collection of all deviations along a particular cycle) results in a point in this space. It will be called

¹² Actually, this is clear from the very definition of external aspects: these are just the aspects similar situations differ in.

the *cohomology class* of ω and denoted with the symbol

$$[\omega].$$

Again, this space may be compared with the common \mathbb{R}^3 with any object (vector) being described by means of basic objects (unit vectors in the three directions) and appropriate coefficients. However, in our special case, the space of coefficients must not be chosen arbitrarily. It has to be equipped with certain additional algebraic features in order to be suitable for the further constructions. These features have been given the collective name ‘group property’ and will be introduced briefly in the following paragraph.

Group property

The group property of a space of aspect differences $\Delta\mathcal{A}$ assures that we can do calculations with aspect differences that are similar to the ones we can do with integers (since these also form a mathematical group).

Firstly, two elements δA and $\delta A'$ may be combined to form another element $\delta A''$:

$$\delta A + \delta A' = \delta A''.$$

Any change δA has to be *invertible* in the sense that there is another change $\delta \hat{A}$ such that we have

$$\delta A + \delta \hat{A} = 0$$

where we denote by 0 that element of $\Delta\mathcal{A}$ which does not change anything.¹³

In the above case, we call $\delta \hat{A}$ the *inverse change* for δA and denote it with the symbol

$$-\delta A.$$

Finally, the following rules have to hold for the addition of aspect changes (here, δA , $\delta A'$ and $\delta A''$ are just any three elements of the change space):

$$\delta A + \delta A' = \delta A' + \delta A \quad (\text{commutativity})$$

and

$$(\delta A + \delta A') + \delta A'' = \delta A + (\delta A' + \delta A'') \quad (\text{associativity}).$$

¹³ Remember that a change is an object that assigns new realizations to old ones, so that we have $0(a) = a$ for every realization a .

If all of the above conditions are met, we say that the space of aspect differences $\Delta_{\mathcal{A}}$ has the group property.

Oriented integral

Next, the notion of the deviation of a differential form along a cycle has to be made more precise in order to study the structure of the cohomology group. Remember that a cycle is a certain formal sum of edges, each appearing with a plus sign or a minus sign. The deviation of the differential form along the cycle is defined to be the corresponding sum of changes, that is, the change that results from adding up each change of the differential form along an edge that appears in the formal sum. If, in the sum, the edge appears with the plus sign, then we actually add the change of the differential form to the sum of changes, otherwise, we subtract it (meaning that we add its inverse¹⁴). The resulting deviation will be denoted by the symbol

$$\int_C \omega$$

where C is the cycle and ω is the differential form.

For a simple example, suppose that we are given a cycle with the following formal sum:

$$C = +e_1 - e_2 + e_6 + e_8 - e_4$$

and suppose that the space of aspect differences can be modeled by the space of integers, $\Delta_{\mathcal{A}} = \mathbb{Z}$ via the assignment

$$\omega_{\mathcal{A}}(e_i) = 2 \cdot i.$$

For instance, we have

$$\omega_{\mathcal{A}}(e_1) = 2, \quad \omega_{\mathcal{A}}(e_5) = 10, \quad \omega_{\mathcal{A}}(e_{10}) = 20, \quad \text{etc.}$$

Then, we calculate the following:

$$\begin{aligned} \int_C \omega_{\mathcal{A}} &= +\omega_{\mathcal{A}}(e_1) - \omega_{\mathcal{A}}(e_2) + \omega_{\mathcal{A}}(e_6) + \omega_{\mathcal{A}}(e_8) - \omega_{\mathcal{A}}(e_4) \\ &= 2 - 4 + 12 + 16 - 8 \\ &= 18. \end{aligned}$$

¹⁴ That is exactly what we mean by ‘oriented’.

Summing up: the oriented integral of a differential form along a cycle is the deviation of the form along that cycle. The collection of all deviations determines the cohomology class of the differential form. Now, things can be made more easy since every cycle may be represented as a formal sum of elementary cycles.¹⁵ According to the above definition of the oriented integral, the rule for computing the deviation along any cycle involves only the addition and its inverse operation in the change space. Beyond that, this operation fulfills the arithmetical rules due to the group property. As a result, we can compute the deviation of any cycle once we know its formal representation as sum of elementary cycles and the respective deviations along these elementary cycles.

In other words: if we know the deviation of a differential form along a full set of elementary cycles, we know it along any cycle!

We will, again, demonstrate this by a simple example: suppose that we have a set of three elementary cycles C_1 , C_2 and C_3 and in addition a cycle C given by

$$C = +C_1 - C_2 + C_1 + C_3.$$

Then, for any differential form ω , we have that

$$\int_C \omega = \int_{+C_1 - C_2 + C_1 + C_3} \omega = + \int_{C_1} \omega - \int_{C_2} \omega + \int_{C_1} \omega + \int_{C_3} \omega.$$

Thus $\int_C \omega$ can be computed out of the $\int_{C_i} \omega$ with the help of the formal sum representation of the cycle C .

Dimension of the cohomology space

Due to this fact, the cohomology space, that is, the space of all deviations of differential forms along cycles, is far less complex than it appeared in the first place. The number of parameters that completely determine a point in this space is just the number of elementary cycles. This is because the number of elementary cycles corresponds to the number of ‘elementary deviations’ which in their turn determine uniquely the cohomology class. In particular, we can think of the cohomology space as a space which has as many dimensions as there are elementary cycles. This also means that the dimension of the cohomology space is equal to the dimension of the homology space $\dim(H_1(NG))$ introduced above.

¹⁵ This is, again, the reason for using cycles instead of loops.

The cohomology class of a differential form is a point in this cohomology space, and we can think of the set of deviations over the elementary cycles as a set of ‘coordinates’. Therefore any cohomology class can be written in the form

$$[\omega] := \left(\int_{C_1} \omega, \dots, \int_{C_n} \omega \right)$$

with $\{C_1, \dots, C_n\}$ denoting a set of elementary cycles.

2.6.4 Conclusion

The foregoing section has been a study of the geometrical structure of representations of FNs. The result, on the one hand, is a parameter that gives a measure of the geometrical complexity of the nodal graph: the dimension of the homology space $\dim(H_1(NG))$.

On the other hand, the influence of the geometrical structure on arbitrary aspects has been quantified by reducing the respective cohomology classes $[\omega]$ to oriented integrals along a finite set of elementary cycles. This provides us with a scheme for classifying the external aspects according to the deviation if two different paths connecting the same nodes in the graph are taken. The result is, for each aspect \mathcal{A} , a so-called cohomology class, denoted by $[\omega_{\mathcal{A}}]$.

In this part, the discussion of loops, cycles, and elementary cycles has loomed large. This should not lead to the impression that circular structures or reversibility are key features of all FNs. They are not. On the contrary, as is evidenced by the material discussed in volumes 2 through 5, most FNs, whether fictional or non-fictional, rely on the multi-linear unfolding of spaces of possibility that do not entail any kind of ‘going back’.

Now we are in a position to account for the *overall* complexity of a given FN. All we have to do is to combine the properties on a local scale, namely the nodal power introduced in 2.3 and refined in 2.4 with the global properties just presented.

The FN can then be classified as a whole by a set of data

$$\left\langle ((P_n)_1, \dots, (P_n)_m), \dim(H_1(NG)), ([\omega_{\mathcal{A}_1}], \dots, [\omega_{\mathcal{A}_k}]) \right\rangle$$

where $(P_n)_1, \dots, (P_n)_m$ are the nodal power values of all the different nodal points 1, ..., m and $[\omega_{\mathcal{A}_1}], \dots, [\omega_{\mathcal{A}_k}]$ are the cohomology classes characterizing the different aspects 1, ..., k that are considered to be essential to the narrative.

The whole of this part is not meant to be a vain exercise in abstract mathematics, a kind of ‘glass bead game’ (Hermann Hesse). Its aim is to ensure on a rigid basis that all the diverse manifestations of FNs, as presented in this series, may be

regarded as an unified corpus. In our belief, that has been proven, and it has been worth the effort.

2.7 Appendix: Basic Mathematical Concepts

2.7.1 Sets and Functions

By a *set*, we mean any formal collection of objects. It will be denoted by two braces, between which the objects are listed, separated by commas. For instance, the set consisting of the objects ‘white’, ‘2’ and ‘♣’ will be written as

$$\{white, 2, \clubsuit\}.$$

The objects that are contained in a set are called the *elements* of the set. The assertion ‘ x is an element of M ’ will be written as

$$x \in M.$$

For example, we have that

$$white \in \{white, 2, \clubsuit\}.$$

Now if A and B are sets, we can construct new sets out of these two. First, we can form their *product*. This is the set of all pairs of objects, where the first element of the pair is an element of A and the second is an element of B . If, for example, A is given by

$$A = \{1, 2\}$$

and B is given by

$$B = \{red, green, blue\}$$

then their product is given by

$$\{(1, red), (1, green), (1, blue), (2, red), (2, green), (2, blue)\}.$$

The product will be denoted by

$$A \times B.$$

Moreover, we can construct the set which consists of all objects that are elements both of A and B . This set is called the *intersection* of A and B and it is denoted by

$$A \cap B.$$

The set of all objects that are contained in at least one of the sets A and B is called the *union* of A and B and is denoted by

$$A \cup B.$$

Finally, the set of all objects which are contained in A but not in B is denoted with the symbol

$$A \setminus B.$$

It is called the *difference set* of A and B .

A *function* from one set, A , to another, B , is an assignment of one object in B to each object in A . We will write

$$f : A \rightarrow B$$

as a shorthand for ‘ f is a function from A to B ’. If, in addition, we want to specify which object in B is assigned to which object in A , we use the symbol \mapsto , for instance

$$f : A \rightarrow B, 1 \mapsto red, 2 \mapsto red.$$

If $f : A \rightarrow B$ is a function and $a \in A$ is some element, then we denote the element in B that f assigns to a by $f(a)$. In the above example, we have that $f(1) = red$.

2.7.2 Basic Graph Theory

Graphs

A *directed graph* is a collection of points and arrows where each arrow connects two points. The points are called *nodes* or *vertices*, and the arrows are called *edges*.

The model of a directed graph consists of a set V (the set of vertices) and a set E (the set of edges), together with two functions

$$o : E \rightarrow V$$

and

$$t : E \rightarrow V$$

where o specifies the origin and t the terminus of each edge. Usually, the graph is then written in the form of a tuple, i.e., an ordered set,

$$(V, E, o, t).$$

If v is a node in a directed graph, then the number of edges that start at v is called the *degree* of v and is denoted with

$$\deg(v).$$

Paths

Let $G = (V, E, o, t)$ be a directed graph and let $v_1, v_2 \in V$ be two vertices. Then a *path* from v_1 to v_2 is a sequence of edges

$$\gamma = (e_1, \dots, e_k)$$

with the property that each edge terminates where the next begins, that is,

$$o(e_{i+1}) = t(e_i) \quad \text{for all values } i = 1, \dots, k - 1$$

and, of course, the first edge begins at v_1 and the last ends at v_2 . The set of all paths from v_1 to v_2 will be denoted with the symbol

$$\underline{P}(v_1, v_2; G).$$

2.7.3 Integration

In this section, a brief introduction to the concept of integration will be given. Only the basic ideas will be discussed, for a more detailed discussion, the reader is referred to the literature.¹⁶

Mean values

First, we will have to recall the idea of a mean value. Suppose that we are given some finite set of numbers, for example the numbers

$$2, 5, 17, 3, 10, 0.$$

Then their mean value is obtained by first computing their sum

$$2 + 5 + 17 + 3 + 10 + 0 = 37$$

¹⁶ See, for instance [Doob] or [Rudin].

and dividing the result by the number of summands:

$$37 : 6 = 6,167.$$

The mean value of the above set is 6,167. One might say that this number gives the value of an average element of the set.

Average values

Next, we consider a somewhat different problem. Suppose that some function is given on an interval of real numbers, for example the function that maps each real number between 0 and 1 to its square:

$$f : [0, 1] \rightarrow [0, 1] \quad , \quad x \mapsto x^2.$$

Then we may ask: which value does this function have *on average*?

There is some parallel to the above problem, because we ask for some sort of mean. In order to understand this connection, we slightly reformulate the computation of the mean value problem.

In the case of the mean value example, we can enumerate the numbers in the given set by the index numbers 1 to 6 (that is, 2 gets number 1, 5 gets number 2 and so on until 0 gets number 6). Then we can define a function G which assigns to each index number the corresponding number:

$$G(1) = 2, \quad G(2) = 5, \quad G(3) = 17, \quad G(4) = 3, \quad G(5) = 10, \quad G(6) = 0.$$

Then, the sum of the numbers is the sum of the values of G for all possible arguments

$$G(1) + \dots + G(6)$$

which will be written more briefly in the form

$$\sum_{i=1}^6 G(i).$$

This is again divided by the number of summands, that is, the number of possible i 's in the preceding representation,

$$\sum_{i=1}^6 1.$$

The mean value is then equal to

$$\frac{\sum_{i=1}^6 G(i)}{\sum_{i=1}^6 1}$$

and this is the average value of the function G on the index set $\{1, \dots, 6\}$. Mean value computation is thus the same as average value computation for functions which have a finite set of arguments.

Integral and area

In order to compute the average value of a function of real values (this means that it has a non-finite set of arguments), we have to modify the above idea. Looking again at the function G , we draw a coordinate system where, on the horizontal axis, the numbers $i = 1, \dots, 6$ are indicated, whereas on the vertical axis, the possible values $G(i)$ are shown. Then, we draw a bar chart to represent the function G , that is, above each index number a bar of width 1 and height corresponding to the value of G at this index number is drawn. The result can be seen in figure 2.14. The sum of the values of G , $\sum_{i=1}^6 G(i)$ is the same as the area below the bar chart.

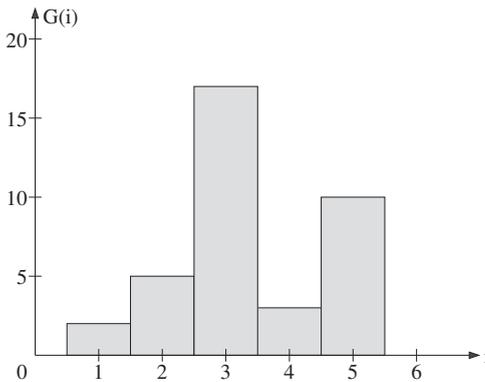


Fig. 2.14: The sum of the values of G is the same as the area below the bar chart.

For the computation of the mean value in the above example, we need a second sum, $\sum_{i=1}^6 1$, which counts the number of arguments. This can be represented in a similar way if we draw a bar chart for the function which assigns to each index number the value 1. This is done in figure 2.15. The average value of G is then the quotient of the two areas.

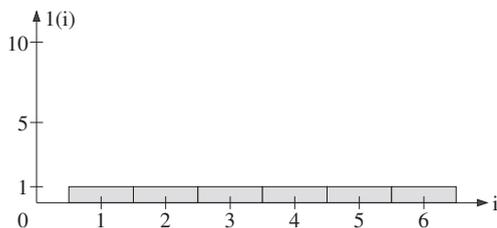


Fig. 2.15: The number of arguments is the area below a trivial bar chart.

The reason for writing an extremely simple computation in such a complicated way is that the concept of an area below a graph can now be applied to real functions. The *integral* of a real function f , which is in some way equivalent to the number of values, is defined as the area between the graph of f and the x axis. If S is the source interval of this function, we denote the integral with the symbol

$$\int_S f(x) dx.$$

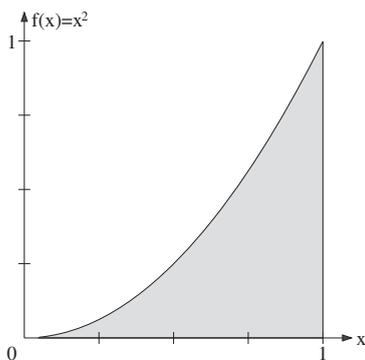


Fig. 2.16: The integral of a function is the area between the graph of the function and the x axis.

In figure 2.16 the integral $\int_{[0,1]} f(x) dx$ for the function $f(x) = x^2$ is illustrated. The average value of a function f over some interval is then the quotient of the integral of f over this interval and the integral of the constant function 1 over this interval,

$$\frac{\int_S f(x) dx}{\int_S 1 dx}.$$

Computation

Now that we have defined the integral, how can we compute it? The bad news is that this is not always possible in an obvious way. However, for the reader who is familiar with the concept of the derivative of a function, one useful tip should be mentioned: it is the fundamental theorem of calculus.¹⁷

If H is a function which has the property that its derivative $H' = h$, then we have that:

$$\int_{[a,b]} h(x) dx = H(b) - H(a).$$

Thus, if we want to compute the integral of a function, it suffices to find another function which has the given function as its derivative. In our case, in which we are interested in the function $f(x) = x^2$, we note that the function $F(x) = \frac{1}{3} \cdot x^3$ has f as its derivative. Therefore, the integral of f over the interval $[0, 1]$ is given by

$$\int_{[0,1]} f(x) dx = \frac{1}{3} \cdot 1^3 - \frac{1}{3} \cdot 0^3 = \frac{1}{3}.$$

For the computation of the second integral, where the function that has to be studied is the constant function $h(x) = 1$, we note that $H(x) = x$ has h as its derivative, so we have that generally

$$\int_{[a,b]} 1 dx = b - a.$$

So the integral of a constant function along an interval is the length of that interval.

The average value of f over $[0, 1]$ is therefore given by

$$\frac{\frac{1}{3}}{1} = \frac{1}{3}.$$

Integrals in higher dimensions

The idea of integration can be carried over to higher dimensions. Let, for instance,

$$F : [0, 1] \times [0, 1] \rightarrow [0, 1]$$

¹⁷ It is a special case of Stokes' theorem that has been mentioned above.

be a function defined on the subset $[0, 1] \times [0, 1]$ of the two dimensional space. We obtain a graphical representation of this function if, in a three-dimensional coordinate system, we draw, above every point in a horizontal plane, the value of the function at this point. The result is called a function surface. The integral of the function over the region $[0, 1] \times [0, 1]$ is then the volume between the surface and the coordinate system. This is sketched in figure 2.17.

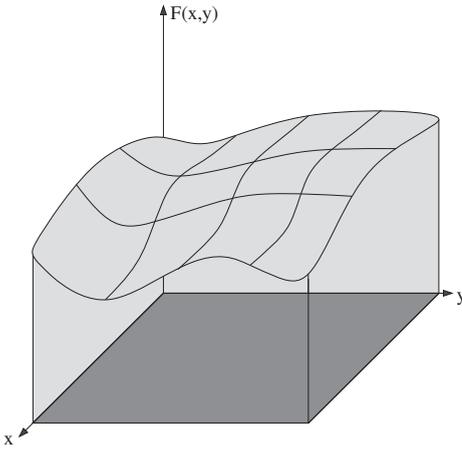


Fig. 2.17: The integral of the function is the volume under the function's surface.

The integral of the constant function 1 over some region is the surface area of this region (in our case, this is $1 \cdot 1 = 1$). More generally, the volume of an n -dimensional region is the same as the n -dimensional integral of the constant function 1 over this region.

The *average value* of a function over a region can then be defined as the quotient of the integral of the function over this region and the region's volume.

3 Future Narratives: The Media-Historical Moment

3.1 The Historicity of 'Future'

"[I]n or about December, 1910," Virginia Woolf famously remarked in her essay "Mr. Bennett and Mrs. Brown" of 1924, "human character changed." (320) Although some of the typically apodictic attitude is taken back by her cavalier continuation – "I am not saying that one went out, as one might into a garden, and there saw that a rose had flowered, or that a hen had laid an egg. The change was not sudden and definite like that. But a change there was, nevertheless; and, since one must be arbitrary, let us date it about the year 1910." (320) –, it still seems it is far easier to make such sweeping claims (a "disputable" assertion, she calls it herself) than to substantiate them, especially if, as in the case of Virginia Woolf, one can never be entirely certain whether her necessarily "arbitrary" dating was motivated by the London Post-Impressionist exhibition which opened in November 1910, or rather, as is suggested by the remainder of her paragraph, by the more disturbing fact that about that time, 14 years ago, her servants began to become irritatingly uppity.

But the really interesting aspect of her assertion, it seems to me, is less the capriciously exact dating of the change or the casual lack of precision of the term "human character", but the choice of that term over the expected 'human nature'. It is true that Woolf's essay is basically about "character-creating" (Arnold Bennett's phrase, as quoted by Woolf 319) in fiction and about why what was (barely) good enough for Edwardian novelists just would not do for practitioners of the craft after 1910 – that alone justifies the choice of 'character' over 'nature'. But when Woolf says, "Mrs. Brown [the 'imaginary' real-life person that older novelists are allegedly never quite interested in] is eternal, Mrs. Brown is human nature" (330), then we begin to sense the crucial difference between the two terms: obviously less essentialist than 'human nature' (which is often imagined to be a-historical and never-changing), 'human character' seems to suggest a certain leeway, some space for change, and a spread of variation. It is a concept that, however fuzzy its definition, allows for development and for history and, what is more, it is a concept that – since we also know of de-historicized conceptualizations of 'character(s)' (for example, Theophrast's *Characters*, though not La Bruyère's continuation *Les caractères de Théophraste*) – even hints at its own historicity: ideas of 'human character', just like human character itself (whatever it may be), have a history, Woolf implies, they are not stable and unchanging.

Curiously enough, as with 'character', so with 'time'. For, even if we leave aside binary concepts as, e.g. Henri Bergson's measurable 'fragmented time' vs.

la durée, or geological (or 'deep') time vs. historical time, or quotidian common clock-time vs. Einstein's *Eigenzeit* of physical systems moving at hugely different speeds (which really only makes sense within the framework of his theory of relativity and lies outside the realm of direct human experience; which is why Helga Nowotny's use of the term in her much praised study is a non-literal, metaphorical transposition of a scientific term into the sphere of the social, where Einstein's precise use evaporates), we are still left with historically fundamentally different conceptualizations of how time behaves – and these fundamentally different conceptualizations almost determine how the future is imagined to behave. Humankind's ideas of the future are historical, and the term 'future' only makes sense if it is historicized.

In spite of that, it seems to be agreed that the two most basic and widespread conceptualizations of time (no matter in which period and historical guise they come) are that it is either seen as linear or cyclical – and both approaches can point to examples from nature as we understand it, because there seem to be both cyclical and linear processes, recurrences and trajectories of no return. What these two conceptualizations have in common, however, is that they imagine time as 'movement in space', or, more generally, any kind of *Zustandsänderung*, any change in the state of things. No matter whether time's arrow flies in a straight line or returns like a boomerang, our default position as humans seems to be to invariably define one of Kant's *Anschauungsformen* in terms of the other: time and space cannot be derived from experience – rather, they are the inevitable preconditions of experience. And since that is so, it comes as no surprise that we tend to think of time in terms of space (though interestingly enough we find it hard to think of space in terms of time – this most fundamental relationship is patently slanted and asymmetrical; cf. Bode, Labbe "Introduction" and Bode "Theoriethorie").

If spatiality is what conceptualizations of time have in common, their differences are equally obvious: linearity implies *difference*, a cyclical form implies *sameness* and *recurrence*. Just like linearity can be either progressive or degenerative, so cyclicity can be seen as either consoling or depressing. But regardless of what these evaluations are, the difference between these two models is the difference in their ideas of what is to come, *the difference in their ideas of 'future'*. In the first case, the future will be different from the now (no matter whether better or worse), in the second, it will be the same, sooner or later, but more likely so if you take the long view. That is, cyclical models of time have no *qualitative* idea of the future as different, as realized changes, as Δ , but rely instead on the quantitative idea only of 'later than X' (with X being now), and of a period of time that has lapsed without making much of a difference. More of the same, only later, whereas linearity implies 'later *and* different', or, more precisely, 'later *because*

different', since time is measured in changes in space that add up to a significant difference.

As Mircea Eliade has shown with an overwhelming richness of material, the myth of eternal return (*Mythos der ewigen Wiederkunft* or *Wiederkehr*) is ubiquitous and pervades all cultures of all ages, long before Friedrich Nietzsche discovered this belief in eternal cyclicity as the panacea for doomed mankind in his pessimistic *Also sprach Zarathustra*. On the other hand, the myth most formative for Western civilization is a myth based on linearity: Christianity's belief in the creation, fall, and redemption of mankind bespeaks linear thinking, although the exegetic linking of the New and Old Testaments (e.g. reading Joseph's rescue from the pit as a prefiguration of Christ's ascension) indicates vestiges of a 'return' or 'repetition' model, though again the overall pattern of *Heilsgeschichte*, especially in its Puritan reading of the 'fortunate fall', suggests, of course, a dialectical process and progress: after salvation, we do not return to the same level that we set out on. We've been upgraded.

The dialectical process, however, is not a fair and equal mix of the linear and the cyclical, just as the spiral isn't. Giambattista Vico's philosophy of history and of the evolution of mankind is a good case in point. As it complements *corso* with *ricorso*, it seems to be downright cyclical at first, bending the process of history back upon itself and thereby exhibiting a great charm for conservatives; but it leaves circular thinking behind as soon as it becomes obvious that the second run (*ricorso*) through the three ages of mankind (the divine, the heroic, and the human) is only the latter part of the *Menschwerdung der Menschheit*, the ascent of man, just like the substitution of the divine by the heroic, and of the heroic by the human, were not like so many stages in a fall from a golden age, but, quite the contrary, stages in an evolution – the historical evolution of mankind – that exactly knows *no return* (cf. in general Peter Burke's classic introduction to Vico). Mankind moves decidedly *not* in "vicous cicles", as James Joyce, alluding to Vico in *Finnegans Wake*, would have it (cf. Burke 7). Rather, if you cross the linear with the cyclical, you get a spiral, but in that spiral it is the *difference* element of the linear that is preserved and becomes dominant, not the defining trait of pure cyclicity, viz. recurrence. Small wonder Karl Marx loved Vico's *Scienza Nuova*, though a Romantic confrontation should remind us of the fact that the mere *form* of such a conception of time allows, of course, for different fillings: Thomas Love Peacock's mock-serious *The Four Ages of Poetry* suggests that twice mankind had to run through a cycle of ages at whose end stood the rationalization of all human activity and the end of poetry and the imagination – an idea that so infuriated P.B. Shelley that he, in turn, wrote his *Defence of Poetry*, claiming that, quite the contrary, mankind's only salvation in this utilitarian age lay in giving it more of

“the poetry of life” (530) and that, dialectically, the darkest hour is just before the dawn.

But if what Christianity, Vico, Peacock, Shelley, and Marx have in common is their idea of a future that is qualitatively different, and not just more of the same, when exactly does the historical differentiation enter that was promised earlier on, indeed claimed to be inevitable? Thus far, we haven't seen much of a *historicized* concept of 'future', but rather a seemingly timeless dichotomous opposition between linear and cyclical (true, crossed by two kinds of evaluation, which gives you a matrix of four, but still, that classification is systematical, not historical).

In “From the Future to the Extended Present” – the core chapter of *Time: The Modern and Postmodern Experience*, which is the English translation of her original German *Eigenzeit* – Helga Nowotny, largely following Hans Blumenberg's *Lebenszeit und Weltzeit*, treats of “[t]he disappearance of the future and the extension of the present taking its place” (11), which she links to Reinhart Koselleck's '*Verzeitlichung der Geschichte*' and the acceleration of time¹ as experienced in the 18th century, but also to Blumenberg's insight that, in my words, the expansion of world accentuates the discrepancy between all there is and the time I have to experience it (so that the ratio of what I can appropriate out of all there is is constantly diminishing). The future draws closer to the present (an idea that I, for one, find particularly difficult to understand, since the future is always already, one should think, as close to the present as can be and, in fact, constantly morphing into the present); and the future, instead of being a space of possibility and opportunity, shrinks to a mere “extended present”, which absorbs part of what was, for a time at least, believed to be the prerogative of the future: to contain progress, but now in the limiting sense of the word. Nowotny even speaks of “the abolition of the category of the future” (53), which, as a critique of *instrumental* Enlightenment (in the sense of Max Horkheimer and Theodor W. Adorno)

¹ An unfortunate coinage in the first place, since it supports the illusion that, like in instances described and explained by the theory of relativity, time can actually accelerate or slow down in the human and historical sphere as well, which it can't. Just like people who say that temperatures are 'hot' or 'cold' (rather than 'high' or 'low'), it is a confusion of the measuring unit with the thing that is measured: processes can accelerate or slow down – time, in our human sphere, doesn't. And even the more accurate observation, made by Koselleck, that from the 18th century on everything seems to be happening so much faster, so that the individual is attacked by events, as it were, from behind, is the view of somebody who sits with his/her back to the engine – *entgegen der Fahrtrichtung*: itself indicative of a feeling of loss of control, it has undoubtedly its objective material basis in the experience of life in our society. For it is exactly the negation of agency that lets the cone of possibility shrink to the dictate of determined linearity, that folds space into line and that, for the disadvantaged, makes future only *erfahrbar* as soon as it is no longer future, but has become solidified into event.

seems acceptable, though in a society as future-obsessed as ours, it also smacks of the deliberately counter-intuitive. Now, for Nowotny, this “disappearance of the future” coincides with a new merger of the linear and cyclical conceptions of time: “The extended present, which can no longer be conceived in a linearly open, continual future, must therefore necessarily re-evaluate and absorb the body of cyclical time.” (54) But, absolutely contrary to the examples of crossings of linear and cyclical conceptions of time given above, this new mix here, or so says Nowotny, lacks everything that used to define the spiral model (of progress or decline, as you will have it): it curiously and sadly lacks what is defining of linear conceptualizations of time and what is usually preserved in cross-breeds of the Christian and Vico kind: oddly enough, this concept of time has no qualitative idea of ‘future’ as a space of difference.

I believe a different kind of historicization of ‘time’ and ‘future’ is possible, because, stuck with the old dichotomy of linear vs. cyclical and a dialectics between them that, according to Nowotny, has come to a halt (with the resulting elimination of the future, even as a category), we miss out on a third conceptualization of time that began to bud in the 17th century and bloomed and blossomed at the turn of the 18th century: in addition to (uni-)linear time and cyclical time, we begin to see in that period the first stirrings of the idea that time may be *multi-linear*, producing a *space of possibilities* or a *cone* of possible consequences of the present moment. This new idea of time first shows in a consequent, fundamental re-conceptualization of ‘future’ – if you will, you see the smoke of that reconceptualization before you hear the shot: a new understanding, a new definition of ‘future’ redefines ‘time’. There isn’t just linear and cyclical – there is also *multiple*. There are *futures*, in the plural.

And when did it all begin? Helga Nowotny implies it all began when, “[a]t the turn of the twelfth to the thirteenth century”, (quoting Adolf Holl) “people in some European cities [...] wanted to know the time.” (16) As LeGoff put it, God’s time gave way to the time of the traders and, continues Nowotny, to the idea that the future is “open to the human creative capacity.” (11)

Our story does not begin so early, and, in the spirit of our project, it doesn’t have just one starting point, but many: there are a number of phenomena from different fields of human activity that, if seen as related, form a conspicuous cluster around 1700, or, more precisely, between 1660 and 1720.² We are, I am sug-

² In spite of his opening remark that a new idea of the future emerged in the 17th and 18th centuries (9), Hölscher later (47ff.) surprisingly identifies the period between 1770 and 1830 as that of the ‘discovery of future’. And although Hölscher also speaks of future as a *Zeitraum*, this has nothing to do with the cone-like concept of the future as a space of possibilities that NAFU uses to define the multiplicity of future against the linearity of the past.

gesting, not looking at mono-genesis, but at poly-genesis – we're looking at the emergence of a new idea of the future as *open and multiple*, an idea that manifests itself in many different forms, which, however, can be regarded as instances of one and the same sea-change, of one and the same change of paradigm. These phenomena (whose list could easily be extended) are

- the invention of the probability calculus and the development of probability theory;
- modern-style insurances;
- projects, investments, the stock market;
- the re-definition of truth in the Enlightenment project of the London coffee-houses (a.k.a. the *Urszene* of the 'public sphere' of middle-class society);
- the rise of the modern realist novel.

Bullet points 1 through 3 have been interpreted as attempts to subject and control the future, and it would be foolish to deny that this aspect accrues to them. But curiously enough, the very attempt to subject and control the future does, at this point in time, not necessarily presuppose the notion that the future is not determined, not predestined, that we have a say in it, that the future crucially depends on how we act now. Because for a considerable period of time this new notion is still being dominated by persistent ideas of determinism, be it natural or divine – which, dialectically, was a good thing, because these persistent ideas then served as a basis for attempts to discover the hidden 'laws' that rule what will 'most probably' follow from a given situation.³ In other words: the idea that the future is open and multiple could, for a time, still be eclipsed by the notion, usually coming with a lot of ideological baggage, that nothing completely random could happen in this universe. But the beginnings of the notion that the future is open

³ Franklin (284) mentions an interesting phase in the Puritans' evolving stance towards determinism, Predestination, and drawing lots: "The random processes involved in drawing lots were the subject of a substantial debate in moderate Puritanism around 1600. The extreme Puritans had condemned games of pure chance on the grounds that the outcome of a cast is a special determination of God and, though usable for serious matters like choosing magistrates by lot, was not to be taken in vain for casual gaming. Against this, Thomas Gataker in his *Of the Nature and Use of Lots*, of 1619, argues that the outcomes are natural, not providential: "[...] Neither can any man say certainly that there is ordinarily any special hand of God, in the shuffling and sorting of [scrolls or tickets], crossing the course of nature, or the natural motion of the creature, and so causing those to lie higher and so nearer at hand, that would otherwise have lien lower, and those to lie lower and so further from hand that would otherwise have lien higher.'" In other words: since God is not concerned with these individual drawings, one doesn't trouble him if one does them for not so serious purposes. And if the outcomes are simply determined by "the course of nature", then it's interesting to find out what the probabilities of nature's course are.

and multiple can be traced even and especially in the first attempts to subject it to reason, to govern it through the knowledge of its laws. One could therefore say that in these early reconceptualizations of ‘future’ it is imagined as open and multiple, yet not totally random. Any present situation is seen as one that allows for more than just one continuation. It is, if you will, understood as a node. And how the present situation will continue depends upon an interplay of objective conditions and probabilities on the one hand and of human agency and insight on the other – in other words: it depends, up to a point, upon us, possibly on me. When I step in, with my knowledge of objective probabilities and with my capacity to act upon my knowledge, it’s a game changer and the whole story morphs into a Future Narrative, because there is no longer just one future waiting for me, like the next, predictable stop on a line. We’re no longer talking uni-linear continuations. We’re talking *space of possibilities*.

The following five sections, corresponding to the five bullet points given above, will be about these early stirrings and manifestations of a new idea of the future, the final section will sketch why it took so long for Future Narratives to materialize, why, if all the ingredients were at hand around 1700, the point of take-off for this new corpus of meaning-enabling, node-based structures lies in the last third of the 20th century and not, as one would expect, 270 years earlier. Evidently, not all the ingredients were at hand around 1700, and the title of this concluding part 3 already points to the missing catalyst: it was, in all likelihood, for media-historical reasons.

3.2 The Probability Calculus

The modern concept of probability emerged between 1660 and 1720. In contradistinction to previous ideas of probability, it is a mathematical concept. And it is pertinent – not only, but especially so in connection with the emergence of new ideas about the future and the rise of Future Narratives – that probability theory originates in thinking about games of chance, or gambling. In fact, all three points – that exact window of time; a mathematical approach to probability; and gambling as the point of entry – and the interrelatedness of these three points are essential for an understanding of the radical novelty of the modern conceptualization of uncertainty and chance and the concomitant reconceptualization of ‘future’.

Every history of probability theory gives you the same familiar portrait gallery: from the breakthrough in the correspondence of Pascal and Fermat in the 1650s through Christiaan Huygens, Jakob (Jacques/James/Jacob) Bernoulli and Pierre Rémond de Montmort to Abraham de Moivre’s *Doctrine of Chances* (1718). Within

those roughly 60 years, we observe the forging of isolated and fragmented observations and insights regarding chance and probability into “a coherent theory of probability” (Hald 4) – within six decades it is done.

The classic study of this development is, of course, Ian Hacking’s *The Emergence of Probability: A Philosophical Study of Early Ideas About Probability Induction and Statistical Inference* (1975), a study that claims, or so the blurb to the second edition of 2006 says, that before the mid-seventeenth century there was no real concept of probability in Europe and then proceeds to investigate possible reasons for its sudden emergence:

A philosophical history must not only record what happened around 1660, but must also speculate on how such a fundamental concept as probability could emerge so suddenly. [...] We should [...] try to find out how probability became possible at all. We do not ask how some concept of probability became possible. Rather we need to understand a quite specific event that occurred around 1660: the emergence of our concept of probability. (1, 9)

Only in 1660 and soon afterwards did many previously unrelated or non-existent ideas hang together as if they were one – and as they have remained. Probability, as we know it, emerged then, and not before. (XXIII)

The point bears repetition because the reception of Hacking’s trailblazing work has not been uncontroversial: unlike James Franklin’s magisterial *The Science of Conjecture: Evidence and Probability before Pascal* (2001), Hacking’s *The Emergence of Probability* is not a survey of every kind of evidential or probabilistic reasoning (legal, medical, moral, commercial, etc.) before Pascal, both inside and outside Europe, but, quite the contrary, a historically specific anatomy of a concrete and deep-running paradigm shift (although it seems to me that Hacking in his new 2006 introduction unnecessarily foregrounds his Foucauldian credentials). When Hacking asks provocatively, “Where was the dog that did not bark? Where was probability before 1640?” (XV), his point is not that there wasn’t the word or some idea(s) associated with it (cf. his chapter 3, “Opinions”) – it is rather that after 1650 we can observe an intellectual change, a new episteme, or as Hacking prefers to phrase it, quoting Herbert Butterfield, “[Europeans] put on a different kind of thinking cap” (XVI), before he puts this paradigm shift into a larger context:

No one doubts that something important happened to probability around 1650, just as to ever so many other cardinal ideas. I urge the stronger thesis that there was a coming into being, *all at once*, of a certain organization of concepts, which *persisted*. The tensions in that new system of thought arose in part from a submerged residue of the preceding arrangements with which there was a radical break.

I too presented a before-and-after picture. Before 1650 or so, there was virtually none of our present web of probability ideas. Then of a sudden:

- Nations began to raise income by selling annuities, which demanded, but did not always receive, actuarial competence.
- People of power and influence attended to the statistics of births and deaths derived from data that had long been available, but never used.
- The mathematics of gaming appeared as a topic in its own right.
- There arose a new model for assessing evidence in legal disputes.
- The reliability of testimony was calculated, the possibility of miracles having happened in the past, as reported, was measured.
- There were new proofs of divine benevolence. Bizarre to our eyes – except that the authors showed that they well understood how to test statistical hypotheses from the word go, a conception that had never existed in human thought before. (XVI, emphases added)

And at the core of this decidedly *post*-Renaissance discourse (cf. Hacking 17)⁴ on probability is the new *mathematical* treatment of *games of chance*. Often one has the feeling that Hacking and his detractors (to Franklin one would have to add, most prominently, Garber and Zabell and, with some qualifications, Lorraine Daston) are talking at cross-purposes, because even Franklin admits that “[gambling] proved to be the first part of probability to be mathematized” (289) and that counting and numerical quantification of probabilities were introduced in the 1650s, not before (326, 327). There is simply no denying that, from the point of view of the history of Mathematics, the link between probability theory and games of chance is a solid and secure one (cf. for example, Hald 4). It is a historical fact.

Therefore, from the point of view of a cultural history of newly emerging concepts of ‘future’, the question is not, ‘How long did, say, judicial concepts of probability prevail in the eighteenth century?’ – ‘probability’ meaning here, for example, ‘How *credible* is a witness’s report of an event that has taken place or is supposed to have taken place’, which is, after all, a *retrospective* kind of ‘probability’ that answers to the question, ‘Do I or do I not believe that this has occurred in this way?’ In the same sense, John Locke’s chapter “Of Probability” in his *Essay Concerning Human Understanding*, which defines mere probability as the opposite of knowledge that is certain, “lay squarely within the *premathematical* tradition of probability” (Daston, *Probability* 45, emphasis added).⁵

⁴ For reasons of simplicity, all page references preceded by ‘Hacking’ are to *The Emergence of Probability*; there are no quotes from Hacking’s *The Taming of Chance*.

⁵ Although Hacking’s study sports Lorraine Daston’s excessive praise on its blurb – “There are books that can change your life, and this is one of them.” –, she is consistently critical of his foregrounding of mathematical probability, insisting throughout her own work that, on the contrary, “more than any other single factor, *legal doctrines* molded the conceptual and practical orien-

Rather, the decisive question is, What exactly is it about games and in particular about games of chance – otherwise known as gambling – that makes them such objects of interest to philosophers and mathematicians? It is, in short, exactly what they have in common with Future Narratives: it is their systematic production of ludic nodal situations.

When you are engaged in a game of chance, you do not know what will happen next. That is the thrill of it – and it is a good thing that the situation is framed as ‘inside a game’, because that rules out some (though not all) undesirable real-life consequences of ‘what happens next’. The present situation has more than one continuation and you do not know which of them will materialize – but in some games it would improve your chances to win if you knew whether all continuations were equally likely or some more probable than others.

Take the very simple example of a bet on how many heads a tossing of two coins will yield. One might think that because there are three possible outcomes – no head, one head, two heads – the chances of each must be 1 in 3. Not so. If you look at all possible outcomes of one tossing of two coins, you find there is one combination that gives you no heads (tail, tail), one that gives you two heads (head, head, of course), but there are two out of four possible combinations that give you one head (head, tail and tail, head). So the chances of a tossing yielding one head are not 1 in 3, but 1 in 2. You can bet on that.

This, however, presupposes that you think of outcomes in terms of ‘numbers of ways’ to get there. In other words: you think in terms of combinations and *sequences*, rather than in terms of abstract events (no head, one head, two heads). This again means that you imagine the future as a “space of possibilities” (cf. chapter 3, “Finding Your Way through a Space of Possibilities” in Mlodinow) that has room for different paths to arrive at various outcomes, which, other things being equal, increases the likelihood of outcomes that have a higher number of paths leading to them, or as Galileo Galilei indicated in his “Thoughts about Dice Games” (1583): “*The chances of an event depend on the number of ways in which it can occur.*” (quoted in Mlodinow 63)

tation of the classical theory of probability at the levels of application, specific concepts, and general interpretation.” (*Probability* 6, emphasis added) Or even more pointedly: “The calculus of probabilities was just that: a calculus applied to extant legal approaches to partial certainty.” (47) Or: “But the fact remains that throughout the eighteenth century, mathematical probability was less a theory than a set of applications, and these applications often betrayed their legal pedigree in both problem and approach.” It seems to me that this astonishing claim, which can only raise eyebrows in mathematical circles, is partly due to the polysemy of ‘probability’ – the probability of a witness’s report being true is not the probability of an outcome in a game of chance –, partly to a confusion of principle and example (see below).

But the path for this insight had been paved by Gerolamo Cardano (1501–1576), who, somewhat unfairly, has been curtly dismissed from Hacking’s *The Emergence of Probability* (cf. 55, 56). It is true that Cardano, in addition to being a leading Mathematician and physician of his time (he was chair of Medicine at Pavia university), was also an astrologer, an eccentric, a heretic (who suffered badly at the hands of the Roman Inquisition) and somebody who had perfected the art of predicting a person’s fate from their facial warts. But it is also true that Cardano, an inveterate gambler himself, made two of the most important contributions to probability theory before Pascal and Fermat. The first is what we have just encountered in the coin-tossing example, viz. the idea of, in modern parlance, a *sample space* of possible outcomes, the staking out of which gives a solid basis for your calculation of probabilities.

Leonard Mlodinow gives an elucidation of the concept as presented in chapter 14, “On Combined Points”, of Cardano’s *Book on Games of Change* (original: *De Ludo Aleae*), which treats card games, dice, backgammon and the throwing of astragali (i.e. the knucklebones of sheep or other animals, cf. Franklin 290):

The term *sample space* refers to the idea that the possible outcomes of a random process can be thought of as the points in a space. In simple cases the space might consist of just a few points, but in more complex situations, it can be a continuum, just like the space we live in. Cardano didn’t call it a space, however, the notion that a set of numbers could form a space was a century off, awaiting the genius of Descartes, his invention of coordinates, and his unification of algebra and geometry.

In modern language, Cardano’s rule reads like this: *Suppose a random process has many equally likely outcomes, some favorable (that is, winning), some unfavorable (losing). Then the probability of obtaining a favorable outcome is equal to the proportion of outcomes that are favorable. The set of all possible outcomes is called the sample space.* (50)

Even if Cardano did not use the word ‘space’ explicitly, to think of outcomes in terms of points that can be reached by a *number* of paths already presupposes a spatial idea of the future as a *cone of possibilities* that emanates from any present situation and is defined by all possible continuations from that node.

De Ludo Aleae, written in the 1520s and probably reworked some time in the 1560s (cf. Franklin 298, Hald 36–41), remained unpublished until 1663, but Cardano’s second contribution to probability theory was published during his lifetime and it is mentioned here because it provides another instance of how, in an attempt to calculate the probability of different continuations, the future is conceptualized as a *space of possibilities* that contains *various* paths that, in turn, lead to different or to the same outcomes. Probability theory presupposes the present situation as a node and tries to assess the respective probability of

all possible continuations. It presupposes the future as sample space or *Ereignisraum* – which is definitely not as a uni-linear continuation of the present (which would not be a *space*, but a *line*; cf. also Franklin 298–300).

The problem of the ‘interrupted game’ is an old one (cf. Franklin 291–296, who cites medieval manuscripts) and one of the few instances in which a legal matter can only be resolved justly through mathematical calculus⁶ – a problem eventually solved by Pascal and Fermat in 1654 (cf. Hald 35–36, 54–63, Franklin 306–313) –, but Cardano in his *Practica Arithmetica* of 1539 (!) was the first to steer in the right direction, even if he failed to come up with the correct formula, or division rule. The problem is this: suppose a game of chance between two or more players were interrupted prematurely, what would be a fair division of the stakes between them, provided they had no chance ever to resume the game at this point? Evidently, any fair or just division of the stakes would depend on the probability of each player’s winning the game if it were continued until the end. Now, the originality of Cardano’s approach consists in his realization that who is likely to win does not so much depend on what has happened so far as on what has to happen so that one of the two can win. One might argue that this is just another way of putting it, but it isn’t.

Before Cardano, Fra Luca Pacioli’s rule said that “the stakes should be divided proportionally to the gains already made.” (Franklin 296) Cardano rejects this: imagine a game in which one needs 19 points to win. Player A has gained 2 points, player B none when the game is interrupted. According to Pacioli, all the stakes should go to A. Grossly unfair, says Cardano, “considering how far it is from the end of the game.” (Franklin 298)

The point, obviously, is not how you got there (Past Narrative), but what your relative chances are for a speedy and successful ending of the game (Future Narrative). The point is not what *has happened so far*, but the likelihood of what *has to happen* so that you win. In a way, Cardano turns his back on Past Narratives and entitlements derived from them. Instead, he faces the future space of possibilities, upon the likelihood of which certain justified expectations and claims can be based (we’ll encounter that idea again when we turn to the invention of the stock exchange). Cardano’s move is a defining moment in the history of prob-

6 When Daston characteristically claims that “[t]he first two generations of mathematical probabilists – Blaise Pascal, Pierre Fermat, Christiaan Huygens, Johann de Witt, Nicholas and Jakob Bernoulli – solved problems framed within the context of aleatory contracts” (in Krüger, Daston, Heidelberger 240), systematically ignoring the Maths-gambling nexus, she reminds me of someone who argued that arithmetic was basically a subdivision of agriculture, for it dealt with problems like: if you have seven eggs and take away three, how many have you left? Games of chance are *examples* of mathematical probability. If you *frame* a mathematical problem in the form of an aleatory contract, that doesn’t mean your prime interest is in the law.

ability theory because he reconceptualizes ‘future’ as an unknown, though calculable quantity of paths and outcomes. In Cardano, the future becomes a space that, up to a point, can be subjected to calculation – which means that it can be controlled (again: up to a point) and colonized: because it is exactly that – a space of possibilities, ready to be exploited.

For the purposes of this brief sketch, we can bypass Christiaan Huygens’ *De Ratiocioniis Ludo Aleae* (1657), or *Calculating in Games of Chance*, although it is the first *published* work of mathematical probability theory (the Pascal-Fermat correspondence then being still unpublished), with its intriguing three theorems and eleven problems, making up Huygens’ 14 so-called ‘propositions’ (cf. Hald 65–78), which were extensively and productively discussed by the next generation of probability theorists. Nor do we have to go into *La logique ou l’art de penser* (1662) of the authors of Port Royal – the first book to actually use the word ‘probability’ to denote something measurable (cf. Hacking 73) – or Pierre Rémond de Montmort’s *Essay d’analyse sur les jeux de hazard* (first 1708, with a significantly enlarged edition in 1713) – in Anders Hald’s opinion “the first published comprehensive text on probability theory, [...] a considerable advance compared with the treatises of Huygens (1657) and Pascal (1665) [= *Traité du triangle arithmétique*].” (290)

Nor is it necessary, it seems, to here delve deeply into the debate about objective and subjective probabilities: the former designate “properties of chance setups and chance events”, the latter “are used for measuring the degree of belief in a statement or a proposition about things or events; they thus refer to our imperfect knowledge or our judgment and not directly to the things or events about which these statements are made.” (Hald 245) Small wonder that, although Jakob Bernoulli is responsible for the clear distinction, mathematicians (except maybe Bayesians and followers of Bruno de Finetti – cf. Hacking 146–147; see, however, Daston, *Probability* 188–225) have little use for the latter, though economists, psychologists, and experts in political science have. As Ian Hacking put it, “One is directed at facts, at the relative frequency with which different types of events occur. [...] The other is directed at the degree to which you are confident of something you are not sure about” (XIV) – a duality that in the early stages of probability theory was not always kept apart, a trend undoubtedly helped by the fact that the word ‘probability’, not only before *La logique*, was then confusingly still largely used for the latter, not for the former (cf. Hald 246).

Jakob Bernoulli, however, is absolutely essential in our context because of another distinction he clarified, viz. that between *a priori* and *a posteriori* probabilities – it is a distinction vital to the dichotomy of risk-seeking v. risk-averting activities, or, to put it metonymically, games of chance on the one hand and the security-craze that feeds and drives insurance businesses, among other things.

Jakob Bernoulli (1654–1705) was arguably the greatest mathematician in a family not exactly short of mathematical genius: there were his brothers Johann (Jean, John) and Nikolaus (Nicolas, Nicholas), plus a father and a grandson (of Nikolaus) of the same name, not to forget Daniel Bernoulli (he of the St. Petersburg paradox), son of Johann and thus Jakob's nephew. Jakob Bernoulli's main work, *Ars Conjectandi*, was eventually published in 1713, eight years after his death. Before de Moivre's *Doctrine of Chances* (1718; cf. Hald 397ff.), it is the pinnacle of early eighteenth-century probability theory, so much so that even today Bernoulli's name outshines all others and Hacking can say authoritatively (though others would contest the assessment), "The story of the emergence of probability theory comes to an end with the publication of *Ars Conjectandi* in 1713." (166) "It was", consents Lorraine Daston, "the most important mathematical work on probability until Laplace's treatise on the subject a century later." (*Probability*, 34)

Bernoulli's reasoning for probability *a posteriori* goes like this: if you have a jar filled with 3,000 white pebbles and 2,000 black pebbles, then you can calculate that the probability of blindly drawing a white pebble from the opaque jar is 3 to 2. But what if you do not know the exact ratio of white to black pebbles? How many drawings from the jar would it take (please do not forget to return each pebble to the jar after having noted its colour) to establish the ratio of pebbles within a margin of 2%?

His calculation shows that 25,550 trials would suffice to reach that 'moral' or *practical* certainty which allows you to say *a posteriori* that the ratio is indeed 3 to 2 just as if you had known this ratio *a priori* (cf. Bernstein 116–124). (Please note that this is more than 20,000 trials more than if you had simply taken out the pebbles and counted them without returning them to the jar. The point is that this isn't 'really' about pebbles and jars – it is about unknown ratios in general.) Now, that is an incredibly high number of trials for something that can never amount to absolute certitude – rightly is it therefore called Bernoulli's 'law of large numbers', though its exact meaning is often missed: it is true that Bernoulli states that "the relative frequency of an event will be nearer the truth if based on many rather than on few observations" (Hald 225): "[T]he more observations that are taken, the less the danger will be of deviating from the truth" (quoted in Hald 257). However, this curiously enough does not allow you to make concrete predictions for individual trials (or maybe not so curiously, since also in the case of *a priori* probabilities the chance of tossing a head for each new throw of the coin is always 50:50, no matter how often you have already tossed a head):

Jacob Bernoulli's theorem for calculating probabilities *a posteriori* is known as the Law of Large Numbers. Contrary to the popular view, this law does not provide a method for validating observed facts, which are only an incomplete representation of the whole truth. Nor

does it say that an increasing number of observations will increase the probability that what you see is what you get. [...]

All the law tells us is that the average of a large number of throws [or drawings, or trials] will be more likely than the average of a small number of throws to differ from the true average by less than some stated amount. [...]

The Law of Large Numbers is not the same thing as the Law of Averages. Mathematics tells us that the probability of heads coming up on any individual coin toss is 50% – but the outcome of each toss is independent of all the others. It is neither influenced by previous tosses nor does it influence future tosses. Consequently, the Law of Large Numbers cannot promise that the probability of heads will rise above 50% on any single toss if the first hundred, or million, tosses, happen to come up only 40% heads. There is nothing in the Law of Large Numbers that promises to bail you out when you are caught in a losing streak. (Bernstein 122, 123)

Bernoulli's calculus is for situations of uncertainty and ignorance. He was the first "to investigate how many repetitions are required before we may be confident of our estimates." (Hacking 149) He found safety in large numbers. However, correctly understood, his law of large numbers never said anything about an *identity* of *a priori* and *a posteriori* probabilities, only something about approximations that could be regarded as sufficiently reliable (which again is a flexible gauge).

The good news is that therefore most sceptical objections brought forth, most notably by David Hume in *A Treatise of Human Nature* (1739/40), against the inductive method (like: there is never any sufficient number of observations that would allow you to make a generalization of the kind of 'All swans are white.')

cannot be levelled against Bernoulli – to repeat, his point is *not* that the predictability of each new trial is enhanced by the number of trials. It's only that you get a more adequate idea of the whole sample if you try more often (and then you might eventually pick the odd black swan).

The bad news, however, is that most situations in everyday life are situations that call exactly for an *a posteriori* assessment of the probability of unknowns, not for the relatively easy task of ascertaining the *a priori* probability of knowns. Especially since Bernoulli aimed at "a *general* theory of rational decision under uncertainty" (Daston, *Probability* 44, emphasis added), his urn model was, as Leibniz argued brilliantly, an oversimplification at best:

What if the mix of balls contained in the urn changed with time? What if the number of balls were infinite? What if no determinate ratio existed among the various types of balls? Bernoulli rejected the last possibility out of hand: meteorological perturbations and human diseases could only appear indeterminate with respect to limited human knowledge – God created only determinate entities. (Daston, *Probability* 238)

So, Bernoulli's theorem is not as uplifting as his calculations of *a priori* probabilities in games of chance, for while it is true that “[w]e owe to Bernoulli the important distinction between probabilities which can be calculated a priori (deductively, from consideration of symmetry) and those which can be calculated only a posteriori (inductively, from relative frequencies)” (Hald 247), we have to face the fact that in real life most of the time we do *not* know beforehand – though we would very much like to use our retrospective conjectures to fend off what we fear threatens us in the future. Insurances thrive on that: out of the many paths that multiple futures hold for us, we should like to insure ourselves against the ones that, if not most likely, are felt to be the most disastrous *if* they happen.

3.3 Insurances

The history of insurances has to be put into the larger context of the history of human risk management, as Peter L. Bernstein points out at the very beginning of his fundamental study *Against the Gods: The Remarkable Story of Risk*:

The revolutionary idea that defines the boundary between modern times and the past is the mastery of risk: the notion that the future is more than a whim of the gods and that men and women are not passive before nature. Until human beings discovered a way across that boundary, the future was a mirror of the past or the murky domain of oracles and soothsayers who held a monopoly over knowledge of anticipated events.

This book tells the story of a group of thinkers whose remarkable vision revealed how to put the future at the service of the present. By showing the world how to understand risk, measure it, and weigh its consequences, they converted risk-taking into one of the prime catalysts that drives modern Western society. (1)

But to approach the history of insurances in this way gives also rise to questions like, “Why is the mastery of risk such a uniquely modern concept? Why did humanity wait the many thousands of years leading up to the Renaissance before breaking down the barriers that stood in the way of measuring and controlling risk?” (Bernstein 11) – questions that ultimately aim at the identification of a cluster of sufficient or necessary conditions for the emergence of modern insurances: Why then? Why not earlier or later? Why, to let the cat out of the bag, not in the Renaissance properly speaking, but in the 1680s and the following decades? For that is exactly the time period we have to look at – the time when ‘future’ was redefined and new-style insurances were discovered as a tool to control and colonize it, just like any other space of possibilities:

One significant area of development in financial services was the provision of insurance, marking not only a business opportunity but an important wider change in attitudes towards risks – that they could be calculated and hedged rather than left merely to chance or Providence. Much of this development was in fire insurance, some in marine insurance, relatively little in life insurance (though about sixty life insurance societies were founded 1696–1720). (Hoppit 332–333)

As early as in the 13th and 14th centuries, German and Dutch cities sold life and perpetual annuities as a means to raise money (cf. Franklin 269ff., Hald 118). But the underlying maths – or rather the maths upon which annuities *should* have been based (a calculus of mortality rates and rates of interest) – wasn't taken into account, just like proto-insurance-like contracts (e.g. 'aleatory contracts') were not based upon what, in modern times, was recognized as the most basic of insurance calculations: "The premium of an insurance is simply the expectation of loss – the probability of loss multiplied by the size of the loss – plus a margin for the seller's profit." (Franklin 273) In fact, before the late 17th century "the difference between betting and insurance was not clearly understood" (Franklin 276) and "[t]hough seventeenth-century marine insurance became sophisticated in its organization, it did not become more theoretical in its calculation of premiums, which remained *intuitive bets* very responsive to war and rumors of war." (Franklin 278, emphasis added)

While this makes sense with regard to losses by hard-to-predict disasters like shipwreck or war, it makes less sense, in retrospect, with regard to demographic data that lend themselves more easily to risk calculations once you have established their key parameters, like birth rates, death rates, life expectancy, age distribution within a population, etc. But just like mercantile Renaissance insurances in the Mediterranean were, as Cornel Zwierlein has shown convincingly (cf. 50–55), still basically only an accounting trick that testifies to the 'presentism' of these merchants, opposed to the 'primacy of the future' that would later be foregrounded by lawyers (cf. Zwierlein 63, 72), so vital statistics would first have to be discovered as something upon which calculations could be based in the first place, before the idea of calculation-based annuities and life insurances could gain ground.

In retrospect, but only in retrospect, it seems all too easy. But before insurances could become what they are today, life and reality first had to be regarded as the real-life models for Bernoulli's jar of pebbles – as something that allowed you, after so many trials, to arrive at *a posteriori* probabilities, upon which, in turn, you could base your future calculations.

John Graunt's *Observations Made Upon the Bills of Mortality* (1662) is the first attempt to statistically analyze the London bills of mortality, which had been

published weekly since 1604, but had never been regarded, in combination with registered births and christenings, as raw data for the calculation of mortality rates (and, later on, for the calculation of life expectancy). Nine years later, Jan de Witt bases his calculation of life annuities on vital statistics from the Dutch Republic (the original Dutch translates as *Value of Life Annuities in Proportion to Redeemable Annuities*) and calculates for the first time at which rate of interest annuities would be profitable to sell – though Anders Hald is probably correct in remarking that “[t]oday we are inclined to read de Witt’s report as a mathematical paper. It is, however, a prime minister’s attempt to convince the General States that the price of annuities should be raised from 14 to 16 years’ purchase.” (130) Or maybe both, mathematical paper *and* political move?

For after all the mathematical apparatus is still impressive, and even if pioneers like Graunt (having to rely on deeply flawed data – like: illegitimate children were not registered in the parishes; the ages of the deceased were not recorded before 1728; neither could the impact of immigration into London be factored in, but only guessed at), I say, even if pioneers like Graunt got it wrong in so many different ways (e.g., assuming a uniform mortality, cf. Hacking 121), what is important is the principle that for the first time mathematics is applied to demography and that on the basis of statistically validated *ex posteriori* probabilities the proper calculation of annuities and life insurances can begin; which does, of course, not mean that it is always practised or, if practised, properly carried out from that point in time onwards – far from it: Hacking speaks of “the disastrous history of annuities in Britain” (113) and Bernstein records the interesting case of Richard Price’s *Observations on Reversionary Payments* (1771), a mathematical actuary treatise based upon statistics from London and Northamptonshire, whose errors, as it were, held two different futures, one for insurances and another for the state:

Price’s book contained serious, costly errors, in part because of an inadequate data base that omitted the large number of unregistered births. Moreover, he overestimated death rates at younger ages and underestimated them at later ages, and his estimates of migration into and out of Northampton were flawed. Most serious, he appears to have underestimated life expectancies, with the result that the life-insurance premiums were much higher than they needed to be. The Equitable Society flourished on this error; the British government, using the same tables to determine annuity payments to its pensioners, lost heavily. (131)

The fact that Price – a powerful Unitarian minister, a notoriously radical politician and a well-known mathematician – was commissioned by the Equitable Society to write the book (cf. Mlodinow 109–110) should not make us suspicious: *honi soit qui mal y pense*.

It may be true that for a surprisingly long time life insurances in particular were associated with gambling or betting (like: an ethically dubious bet on or against the early death of the insured person) and that in most of Europe life insurances were illegal until the 19th century (cf. Daston, *Probability* 123, 163; Daston in Krüger, Daston, Heidelberg 237ff.). But the association with games of chance does not speak *against* insurances as instances of probability calculus, but rather, as the history of probability shows, very strongly *for* it – and *in England*, significantly, life insurances were not only legal at the end of the 17th century, they were thriving all through the following centuries.

If Lorraine Daston says “the Equitable [Society’s] phenomenal financial success owed as much to the neglect of probability and statistics as to their use” (*Probability* 176), that may be correct because, following Price, they got their maths wrong – but at least they tried to apply maths to these matters, even if, by modern standards, their insurance maths were crude and faulty (but still delightfully profitable for them...). Daston dates the mathematization of insurances only in the 19th century (cf. Daston, *Probability* 163ff; and generally Daston in Krüger, Daston, Heidelberg) and therefore much later than other historians of probability. But even she does not deny that the “new attitudes toward the control of the future” began to be seen in the late 17th century and that there was a “feverish London insurance market [in] the mid-eighteenth century.” (Daston in Krüger, Daston, Heidelberg 244) The “domestication of risk” (Daston in Krüger, Daston, Heidelberg 249ff.) did not begin with the foundation of the Equitable Society in 1762, and the foundational principle of all modern insurance, viz. to seek security in high numbers (both of policy takers and of statistical data upon which calculations can be based) is one that points unmistakably to the mathematical probability of Huygens, Graunt, de Witt, Bernoulli and de Moivre (for de Moivre and insurances, see Hald 398–399), even though, as Hacking shows in his 1990 monograph *The Taming of Chance*, the full-scale probabilisation of thinking admittedly is a 19th-century phenomenon.

In a more recent study under the title of *Der gezähmte Prometheus: Feuer und Sicherheit zwischen Früher Neuzeit und Moderne* (2011), Cornel Zwielerlein has clinched the case for the period of 1680–1700 as *the* epochal watershed that indicates an entirely new attitude to the management of risk and to the assessment of future(s) which can indeed be identified as a form of ‘colonization of the future’ (an expression that Zwielerlein takes from the Danish geographer Torsten Hägerstrand, cf. 72, 306).⁷ This “Epochenschwelle” (10) or “Epochenschnitt” or “Epochenwechsel” (40) around 1680/1700 is absolutely central to this monumen-

⁷ Unless stated otherwise, page references in this section are to Zwielerlein’s *Der gezähmte Prometheus*.

tal and painstakingly researched history of fire insurances, which is as much a cultural and economic history as it is a history of modern mentalities, because what Zwierlein traces are the early stirrings and first manifestations of a process of “securitization” (15) that defines a new normal of security and then proceeds to classify catastrophes as unwelcome and irregular interruptions and disturbances of that ‘normal order’, against which one should and could secure oneself:

Im Grundansatz geht es darum, dass die Aufklärungszeit hier, eher verdeckt hinter den großen Schlagwörtern der Epoche, eine ‘sichere Normal-Gesellschaft’, ja eine sichere Normal-Welt als Ideal aber auch als Leitbild der alltäglichen Praxis konstruiert, dessen Ausfluss, aber auch Formationselement nicht zuletzt Versicherungen sind. ‘Unsicherheiten’, ‘Unglücke’, Naturkatastrophen werden als Ausnahme von der Regel dieser sicheren Normalwelt definiert. Erst so fallen sie als Regelungsgegenstand von Politik und Wirtschaft auf. (262)

To take the history of fire insurances as a pertinent example of the history of human security is, of course, a most fortunate choice for a variety of reasons. For one, the fires of great cities bridge the divide of natural v. cultural disasters and provide therefore a paradigm for how a society envisages and processes that which is not cultural, but natural, though again undeniably made possible by society and mediated by its forms of material and semiotic reproduction; then it is most interesting to note that the emergence of fire insurances historically coincides with the so-called ‘fire gap’, that is, a remarkable discrepancy between the incidence of great fires on the one hand and the rise of urban population on the other (cf. 74ff.) – the *decline* of actual fire danger and the relative decline of events of damage coincides with a *rise* in the number of insurance policies against that diminishing threat, which alone speaks for a *fundamentally altered attitude towards (in-)tolerable risks*; thirdly, fire insurances happen to be the first modern institutions for managing culturally mediated ‘natural’ catastrophes:

Dass der Umgang mit der Brandgefahr und ihrer Schadensnachsoorge aber durchaus eines der historisch besten Beispiele ist, um zu dieser allgemeineren Problematik einer Geschichte von *human security* zu gelangen, liegt nicht zuletzt in der Tatsache begründet, dass die ersten Institutionen serieller gesellschaftlicher Katastrophen- und damit Unsicherheits-Beobachtung nun einmal Feuerversicherungen waren und damit die Matrix für spätere strukturell vergleichbare Institutionen darstellten. (366)

Therefore:

In allen Bereichen – bei der Visualisierung offenbar mit einem gewissen zeitlichen Vorlauf – drängte sich dabei eine Epochenschwelle um 1700 auf. Mit diesem Zeitpunkt beginnt in Mitteleuropa schon die Aufspreizung des *fire gap*, auch wegen der Umstellung auf Schlach-

ten- statt Infrastrukturzerstörungskriege: Die Konjunktur der Großbrände nimmt nun ab. Auch auf den Ebenen von Kultur und Administration erscheint 1680/1700 als eine Epochenchwelle, die offenbar nicht von ungefähr auch mit dem Moment der gleichzeitigen, der Form nach unterschiedlichen Entstehung und Einführung von Feuerversicherungen in England und Deutschland zusammenfiel. Von der Wahrnehmungsseite her betrachtet, scheint dies der Moment zu sein, von dem ab Stadtbrände und Feuerkatastrophen in eklatant zunehmendem Maße als Durchbrechen der Normalität, als Ausnahme von einer Regel verbucht wurden. Es wird ein wichtiger Gegenstand der folgenden Kapitel sein, zu zeigen, wie sich mit dem Überschreiten dieser Epochenchwelle der Sicherheitsregime im Grunde eine Art Wahrnehmungsmodus der Welt etabliert, der überhaupt erst einen Normalfall von Sicherheitszustand konstruiert. (198)

Admittedly, though insurances against fire partake in the general trend of the quantitative registration of the world,⁸ until the 19th century the probability calculus plays a minor role here, compared to life insurances (cf. 43, 305). But that is no scandal: the frequency of urban fires is a classic case of Leibniz' jar with a *variable*, changing ratio of black and white pebbles. Given that, it is only natural that fire insurers relied more on experience (Zwierlein 207: "grobe Erfahrungswerte[]"), trial and error, and rules of thumb (cf. 305, 363). This more Bayesian, flexible approach to probability may even have been more adequate to a situation in which the relevant data continued to shift and change, so that an abstract formula like 'Risk is the product of the probability of a damage and the amount of damages' would have been quite out of place anyway as long as your data didn't allow you a reliable calculation of exactly that probability of damage (though you could be quite sure of the amount of damages).

Zwierlein is extremely compelling in showing why it was in the 'laboratories' of London and Hamburg (1681, 1676, respectively) that we first encounter modern-style fire insurances (cf. 199–244) and even in speculating why, although proto-forms of insurance could be found in the Italian Renaissance, it is only in Protestant northern Europe that this new type of insurance is burgeoning (cf. 244–261, especially 244, 251).⁹ It is in the case study of London in particular that it becomes evident how, against the backdrop of the Great Fire of London in 1666 and the ensuing housing boom, Nicholas Barbon, a real estate tycoon, using sta-

⁸ "Es ist weiter auf ein wichtiges Element hinzuweisen, das für die gesamte Praxis und Theorie der 'sicheren Normalwelt' unverzichtbar ist, nämlich die zunehmende Erfassung der Welt in quantifizierender Form, als Zahlenwerte." (262)

⁹ "Betrachtet man die unterschiedlichen, kurz untersuchten Bereiche verschiedener Typen von Versicherung, verschiedener europäischer Regionen und die unterschiedlichen Bereiche von Theorie und Praxis, so kann man grob schematisieren:

- bis ins 16. Jahrhundert ist die Prämienversicherung ein fast ausschließlich im mediterranen, 'katholischen' Raum gängiges Element des maritimen Handels.

tistics, “Proto-Probabilistik” (200) and political leverage, founded the first ‘Fire Office’ in 1781 as a joint-stock company – owning only three years later that “[t]he Insuring of Houses being a New Design, *it is impossible to make a certain guess*” (quoted in Zwierlein 204). Add to this the well-established financial and fiscal revolutions of the late 17th century (cf. Zwierlein 219, invoking Peter G.M. Dickson, *The Financial Revolution in England: A Study in the Development of Public Credit, 1688–1756*, and Douglas C. North, Barry R. Weingast, “Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England”, *The Journal of Economic History* 49 [1989], 803–832), and what you get is a singular mix of factors and conditions that favour this innovative approach to risk management:

Das Laboratorium der Sicherheits-Innovationskultur ‘London/Barbon’ und damit die Konstellation, die die Emergenz der Versicherungen in diesem Bereich ermöglichte, ergab sich also aus der Koinzidenz

- der wissenschaftshistorischen Bedingungen einer öffentlich akzeptierten Kombination aus praktischem Empirismus und mathematischer Frühprobabilistik
- dem Zufall des Großen Brands von 1666, der den spekulativen Hausbau auslöste, dessen Boom wie die *financial revolution* in die Zeit ab etwa 1680 fiel
- der Entstehung des frühkapitalistischen Finanzmarkts in den 1680ern/1690ern, der einer Absicherung der Werte benötigte; die Sicherheit lief hierbei fast ausschließlich über bebauten Grundbesitz, dessen Wert durch Versicherung stabilisier- und steigerbar war. (222)

In other words: “Für London wurde deutlich, dass die Phase nach dem Großbrand 1666 gerade durch die außergewöhnliche Koinzidenz des Bau-Booms, der Bau-Spekulation und der *financial revolution* geprägt war. Nie zuvor in

-
- ab etwa 1680 werden Tendenzen zur Universalisierung und Diversifizierung der Sicherheitsproduktion durch (Prämien-)Versicherungen [sic] irreversibel, und dies ausschließlich im protestantisch-nordeuropäischen Raum.
 - Dabei erfolgt die Sicherheitsproduktion durch Institutionen, die Untertanen/Bürger versicherungsförmig zur Eigenvorsorge verpflichten, vor allem im *lutherischen* Bereich in dominant *staatlicher* Form (Sklavenkassen in Hamburg, Lübeck, Dänemark, während Entsprechendes in Bremen und den Niederlanden fehlt; kameralistische Feuerkassen in Hamburg und den lutherischen Territorien, während Entsprechendes im katholischen und im calvinistischen Europa fehlt).
 - Die Sicherheitsproduktion durch größere Handelsgesellschaften (Aktiengesellschaften, *mutual societies*) erfolgt zunächst ausschließlich im calvinistisch geprägten Raum.
 - Entgegen mancher Aussagen in der Literatur spielt ab 1600 im gesamten nordeuropäischen Raum das Problem der Vereinbarkeit von göttlicher Providenz und menschlichen Versicherungsaktivitäten keinerlei Rolle mehr.” (257–258)

der europäischen Geschichte trafen frühkapitalistischer Habitus und Denken, exzessiver Häuserbau und Versicherungsdenken aufeinander.” (306)

And it is in that curious correlation of “Gefahrerwartung, Risikomessung und Sicherheitsproduktion” (350) that we recognize a distinctly modern re-configuration of the future – a re-configuration which has been our theme song throughout this part: different from space-oriented proto-insurances,¹⁰ new-style insurances are oriented towards the future (“‘Versicherung’ umfasst [in der aufklärerischen Versicherungspraxis und -konzeption] eine (mehr oder weniger) starke Zukunftsorientierung des Denkens[.]” 312), or, to translate this into our terminology, they presuppose the future as a time-space with variable paths and multiple continuations. Like any other space, the future as time-space allows, indeed asks for cultivation, whose return will further increase the wealth of the nation.¹¹

Both the risk-taking of games of chance and the risk-aversion of insurance have their common root in the *temporalization of future time*. Less paradoxical than it may sound upon first hearing and mildly echoing Reinhart Koselleck’s ‘*Verzeitlichung der Geschichte*’, ‘temporalization of future time’ means nothing less than that, like the past, the future can now be imagined as a transversable space – one that, however, does not only contain the one road that you have travelled so far (Past Narrative), but the many roads that you have not (yet) taken (Future Narratives): the future becomes, by definition, multiple.

The new, that is, post-1680 concept of insurance is characterized and made possible by the lifting of a curtain that had veiled the future as navigable, controllable space. To colonize that space of possibilities would be the major project of the age.

10 “Es ist zu zeigen, dass ‘Versicherung’ in Mittelalter und Renaissance zunächst dominant etwas ganz anderes, wenig zeitbezogenes [sic] war.” (45, cf. 72)

11 “2. ‘Versicherungen’ der Aufklärungsepoche umfassen einen starken moralischen Aspekt individueller und kollektiver Verantwortlichkeit, an der Erhaltung des Besitzes anderer mitzuwirken. Für dieses Ziel sollten Gemeinschaften neu geformt werden [...].

3. ‘Versicherung’ umfasst als Ziel der Handlung ein Element der Erhaltung – der Gegenstand der Erhaltung ist der Wert des Besitzes (besonders von Gebäuden).

4. ‘Versicherung’ umfasst auch als Ziel der Handlung ein Element der Entwicklung, das eine Art von ‘Fortschritt’ und ‘Wachstumsdenken’ impliziert: Der Wohlstand der Nation wächst in dem Maße, in dem ihr Kredit wächst, denn durch das Versichern von Häusern vergrößert sich ihr Wert.” (312–313)

3.4 Projects and the Stock Market: Great Expectations

When Daniel Defoe published *An Essay upon Projects* in 1697, he referred to his own time as “*The Projecting Age*”. (7) The first to admit that past ages had also known their degree of projecting and inventing, he nevertheless insisted, in his opening paragraph, that the present exhibited a new quality in inventive projecting:

Necessity, which is allow'd to be the Mother of Invention, has so violently agitated the Wits of men at this time, that it seems not at all improper, by way of distinction, to call it, *The Projecting Age*. For tho' in times of war and Publick Confusions, the like Humour of Invention has seem'd to stir; yet, without being partial to the present, it is, I think, no Injury to say, the past Ages have never come up to the degree of Projecting and Inventing, as it refers to Matters of Negoce, and Methods of Civil Polity, which we see this Age arriv'd to. (7)

Buoyed by the “economic euphoria” (XIX) and the “new economics” (XXII) after the Glorious Revolution of 1688, this feverish, future-oriented, speculative activity had been going on for long enough a time to give its practitioners a bad name – and Daniel Defoe, as one of its victims, knew what he was talking about: declared bankrupt in 1692, he had spent some time in prison after a bad investment and afterwards had gone into hiding from both authorities and creditors. Still, Defoe maintained, there's good and bad everywhere, and as much as he distances himself from those that bear “*the Despicable Title of Projector*” (1), because they are only intent upon getting money out of others and for that purpose cheat and trick them, so his true heroes, the merchants, are projectors of the other kind – enriching the nation, rather than only themselves, they are the true icons of “the general Projecting Humour of the nation” (1):

If Industry be in any Business rewarded with success, 'tis in the Merchandizing part of the World, who indeed may more truly be said to live by their Wits than any people whatsoever. All Foreign Negoce, tho' to some 'tis a plain road by the help of custom, yet it is in its beginning all Project, Contrivance, and Invention. Every new Voyage the Merchant contrives, is a Project; and Ships are sent from Port to Port, as markets and Merchandizes differ, by the help of strange and Universal intelligence; wherein some are so exquisite, so swift, and so exact, that a Merchant sitting at home in his Counting-house, at once converses with all Parts of the known World. This, and Travel, makes a True-bred Merchant the most intelligent Man in the World, and consequently the most capable, when urg'd by Necessity, to Contrive New Ways to live. And from hence I humbly conceive, may very properly be deriv'd the *Projects*, so much the Subject of the present Discourse. And to this sort of men 'tis easy to trace the Original of banks, Stocks, Stock jobbing, Assurances, Friendly Societies, Lotteries, and the like. (8–9)

This portrait of the intelligent merchant as the epitome of the projecting age contains all the essential ingredients of the new kind of activity: in the beginning there is *novelty*, *adventure*, *risk*, and *originality*. The projector does not tread familiar ground or beaten tracks. The new routes are yet unexplored, they are multiple paths through unknown territories – and at the same time multiple paths through the unknown space of future time. If this “general Projecting Humour of the Nation” prevails, then “New Ways to live” will emerge, by necessity. It is an age of unheard-of possibilities. And Defoe loves it.

But although he asserts that speculation, to be acceptable and not detrimental to investors and the national economy at large, must somehow be tied to a real increase in productivity and the creation of real value – “But the Honest Projector is he, who having by fair and plain principles of sense, Honesty, and Ingenuity, brought any Contrivance to a suitable Perfection, makes out what he pretends to, picks no body’s pocket, puts his Project in Execution, and contents himself with the real Produce, as the profit of his Invention.” (18) –, he also admits that, since nobody can exactly *know* what the outcome of a project will be, it is in reality impossible to draw a clear line, beforehand, between good and bad projects and unwise to declare the more risky ones illegal from the start (11):

There is, ’tis true, a great difference between *New Inventions* and *Projects*, between Improvement of Manufactures or Lands, which tend to the immediate Benefit of the Publick, and Employing of the Poor; and Projects fram’d by subtle Heads, with a sort of *Deceptio Visus*, or *Legerdemain*, to bring people to run needless and unusual hazards: I grant it, and give due preference to the first, and yet Success has so sanctifi’d some of those other sorts of Projects, that ’twou’d be a kind of Blasphemy against Fortune to disallow ’em [.] (11)

Even 300 years after its publication, Defoe’s *Essay upon Projects* makes fascinating reading, presenting as it does a catalogue of or blueprint for radical social and economic reform, involving “Banks and Commerce, Social Welfare, and Education.” (XXVII) Maybe its most interesting aspect today is how Defoe conceives the relationship between the public and private sectors. Some of his projects, like the reform of the English highway system, suggest large-scale privatization, though within a rigorously defined legal framework. Others ask for centralization and a state monopoly, such as when he demands a central bank (“*One Bank-Royal*”, 25) that controls the volume of money in circulation, or when he proposes that all seamen of the kingdom – no matter whether in the military navy or in the merchant navy –

shou’d be the King’s hired Servants, and receive their Wages from him, *whoever employ’d them*; and no man cou’d hire or employ them, but from him: The Merchant shou’d hire them of the King, and pay the King for them; nor wou’d there be a Seaman in *England* out of

Employ, which, by the way wou'd prevent their seeking Service abroad: If they were not actually at Sea, they wou'd receive Half-Pay, and might be employ'd in Works about the Yards, Stores, and Navy, to keep all things in repair. (123)

Others still, like his proposal for a pension-office (in fact, a fully-fledged social security system that provides, among other things, hospitalization, retirement benefits and subsistence allotments for the disabled), presuppose a state-regulated private business.

As in his chapters on insurances, on bankruptcy regulation, or the setting up of various academies – from the English equivalent to the *Académie française* (established in 1635) to his most progressive project, an academy for women (cf. 108ff.) –, the drift of his ‘inventions’ (and they display astonishing detail, right down to how a highway must be laid out) is always the same: outsource projects to the private sector wherever possible, if what is necessary for the common good can be reached more efficiently by private enterprise than by public spending – but make sure these businesses are clearly operating within rules and regulations dictated by common interest; and keep such projects centralized and state-run as by their nature cannot or should not be outsourced. The logic has a distinctly Keynesian ring: we allow you to do your private business as long as this is the operating mode that promises to yield most efficiently what society as a whole needs. As a safeguard for the common good, one needs rules and regulations.

But underneath that logic there is another, more fundamental one: all of Defoe's projects take their origin from a present problem, discontent, deficit, or abuse. Defoe's remedy is then based upon a careful and clear analysis of the present situation and a weighing of the options that are available (this weighing is not necessarily always explicit, but if it's not, it's implied in the argumentative rejection of possible objections).

In other words: Defoe's ‘projects’ are projections in the original sense of the word – planned or proposed undertakings that are a ‘throwing forward’ of ingenious designs into the time-space of the future. It seems a pleonastic thing to say, but of course these projects are *not yet* – that is why they are still *projects* and not yet put to the test of reality. They are of a utopian nature, but of the temporal, not the spatial kind of utopia. Which is also why they are *multiple*. Utopias of the spatial kind and those of the uni-linear temporal kind are the children of Past Narratives (‘This is how we got here.’). The projects of the Projecting Age, individually and in their sum, are of another kind because they unfold and open up the space of all that is *not yet*, but *could* be – these ‘nowheres’ are to be discovered in a new kind of exploration which, though it borrows its imagery from the geographical one, explores another dimension altogether, as the 20th-century editors of Defoe's *Essay upon Projects* remark at the very end of their helpful head-

note: “Not only is Defoe [King] William’s political apologist; he is also William’s utopian visionary in an age where ‘nowheres’ are not removed to the unchartable hemispheres of *terra incognita*, but discovered and improved by the raw wits of the projecting genius.” (XLII)

Like the Bank of England (founded in 1694), the London stock exchange formed part of the new financial and economic landscape that allowed the unprecedented flourishing of projects. Speculation thrived on private borrowing, national debt, and deficit spending – everyone who had the money (and many who hadn’t) saw something on the horizon and was ready to invest in a future that held the promise of being significantly better than the dire present.

But the role of the stock exchange in all this is easily overestimated, if you look at it only in terms of quantity. Originally founded in 1571 as the Royal Exchange and modelled upon stock exchanges in Antwerp and northern Italy, it moved through a series of coffeehouses before it found new lodgings of its own after the Great Fire of London and gained in significance as trading increased. But as there was, as of now, “no formal or clearly organized capital market” and “[t]he credit and debt necessary to lubricate the market economy was ad hoc, unplanned, and came from no single source” (Hoppit 331, 332), so relatively few businesses were, in fact, joint stock companies and those that were were mainly chartered companies founded in the 16th and 17th centuries “on the basis of having a monopoly of or control over trade to a given part of the globe” (Hoppit 321), such as the East India Company, for example. But the number of joint stock companies was rapidly growing: from six in 1689 to 93 in 1695, and in 1720 alone over 190 new joint stock companies were launched (cf. Hoppit 337; M. Ellis 171). There was also an interesting replacement taking place: of the original 93 in 1795 only 21 were still operating in 1717 (cf. Hoppit 337). But significantly enough, over the same period of time the overall capital evaluation of joint stock companies rose from £ 4 million to £ 20 million (see also Hoppit 337).

Regulated by Act of Parliament in 1697, the stock exchange proved central if for one distinctive feature, that feature being a qualitative one: *it traded in futures*. Just like ‘projects’ were, in a way, a wager upon the future (Hoppit 336) –

[...] much projecting was highly speculative. [...] Such speculation also bears witness to the strength of a certain type of entrepreneurialism, of a willingness to step outside the ruts of accepted practice, and the existence of a nascent investing public, even if the skills of projectors were more akin to those of the showman than the hard-headed business man and many investors were naive and poor risk assessors. (Hoppit 336) –,

so trading at the stock exchange wasn’t and isn’t, as some will still have it (cf. *Encyclopedia Britannica*, s.v. Stock exchange), reflecting the true investment value of a company: rather, what is traded at a stock exchange is *expectations*.

And no matter whether such trading and such investments are based upon an ascetic Protestant work ethic of denial – “rooted in the ability and willingness to forgo current consumption in order to invest in more productive processes” (Hoppit 313) – or whether “[t]he rich were gambling with surplus wealth rather than leaving it idle” (Porter 219), the pattern remains the same: searching for improvement at home and abroad, projectors and investors were “fully alive to a sense of their own future” (Plumb 24, cf. 28) and the whole scene was vibrating with that sense of opportunity. Moving into the first two decades of the new century, Roy Porter remarks: “[...] the early century was a time of hectic activity in the City. Because the Bank of England seemed to have secured credit by linking investment with Government, speculations in shares and above all investment in Government securities soared to new peaks. More companies were floated. The many new patents taken out indicate great expectations.” (219)

The Bank of England was, of course, a private institution (not Defoe’s *One Bank-Royal*) and its directors often were also directors of the great joint-stock companies that had gained government monopolies and whose shares were traded at the stock exchange (cf. Plumb 25). Which doesn’t mean that there were no conflicts of interest and no contradictions in early capitalism – of course, there were. In 1718, for example, the South Sea Company, economically lying in the doldrums and desperately looking for new capital, outbid the Bank of England in privatizing the national debt of the United Kingdom. Its shares rose inordinately, as everybody who had some money to spare fell into an investment craze. But in September 1720 the ‘South Sea Bubble’ burst (cf. Hoppit 335–338), because its value at the stock exchange was ridiculously inflated. Many were ruined, among them Sir Isaac Newton, who lost a large part of his fortune, apologizing: “I can calculate the motions of heavenly bodies, but not the madness of people.” (quoted in Orrell 221) Rightly are these recurrent phenomena of the capitalist stock market called ‘bubbles’. The South Sea Bubble was not the first,¹² certainly not the last, but definitely the biggest speculative bubble of the new economy (and throughout the 18th century it remained *the* point of reference for economists as the archetypal economic disaster, much as the 1755 earthquake of Lisbon, the archetypal natural disaster, was for moral philosophers) – of an economy *trading expectations*, rather than the real value of a real economy.

What ‘projects’, credit-giving institutions and the stock market – all emerging and burgeoning in that decisive period between 1660 and 1720 – therefore have

¹² As Franklin (282) points out, “the first of the great modern speculative bubbles [was] the [Dutch] tulip mania of 1636–37.”

in common is that, like in a game of chance, but also like in insurance business,¹³ a bet is made on the future course of things. “[C]redit”, says Roy Porter, “enabled business to expand by trading upon expectations” (204), the stock market (as today) traded in nothing but expectations, and projects were all about how one expected the world to improve once this or that were implemented or put into practice. What is shared by all these endeavours is the idea of the future as a space of possibilities, as a navigable space defined by multiple paths. But this idea of the future as a space that can be controlled, colonized, and exploited has also a real space in late 17th-, early 18th-century London – it is the space that Jürgen Habermas in his habilitation thesis identified as the site of origin of the (bourgeois, or middle-class) public sphere: viz., the London coffeehouse.

3.5 The Coffeehouse and the Idea of Truth-as-Process

The first London coffeehouse was established in 1652 and run by one Pasqua Rosee, a manservant to a London merchant with interest in the Levant. It may not have been the first coffeehouse in England, or for that matter, in Christendom, because there is some evidence (contested lately, cf. M. Ellis 25ff.) that Oxford had a coffeehouse two years earlier, owned by a local Jew named Jacob (cf. Westerfrölke 5). But in any case Pasqua’s set a trend, and around 1700 London was rumoured to have some 3,000 coffeehouses, although historical research shows that 500 may be closer to the mark (cf. M. Ellis 172, Heise 131) – still, a remarkable number for a city of half a million.

Coffeehouses were distributed unevenly over London: they clustered in the commercial centre of the City, around Exchange Alley, Lombard Street, etc., but also in the area of Covent Garden and along Russell Street. In a way, they *were* the commercial and intellectual centre of the capital: far more than just public places where you would sip that new, hot, bitter brew, London coffeehouses were, first of all, locations for business transactions. We noted that the Royal Exchange, before it moved to lodgings of its own, conducted its trading in a number of London coffeehouses. Likewise, insurance businesses were first set up in coffeehouses. The

¹³ “Wagering, as now practis’d by Politics and Contracts, is become a Branch of *Assurances*; it was before more properly a part of gaming, and as it deserv’d had but a very low esteem; but shifting sides, and the War providing proper subjects, as the contingencies of Sieges, Battels, Treaties, and Campaigns, it increas’d to an extraordinary Reputation, and Offices were erected on purpose which manag’d it to a strange degree and with great Advantage, especially to Office-keepers; so that as has been computed, there was not less gaged on one side and other upon the second Siege of *Limerick*, than Two hundred thousand Pound.” (Defoe 67)

history of Lloyd's is paradigmatic: Lloyd's was the coffeehouse where merchants, ship-owners, and insurers met. The 'boxes' of later-day underwriters still remind of the coffeehouse origins of insurance, and not only of maritime insurance (cf. Daston, *Probability* 164). (In Slaughter's Coffeehouse in St. Martin's Lane you could meet Abraham de Moivre, fled from France for religious reasons, helping, when his tutorials in maths were over, gamblers and insurance brokers with their problems; cf. Bernstein 125–126; Hald 400).

At the same time, coffeehouses were the news agencies of the day: it was here that the latest news (political, economic, financial, whatever) was spread, discussed, weighed, sifted, and published as well: for the London coffeehouse is also the birthplace of modern journalism. Even before the moral weeklies of Joseph Addison and Richard Steele, newspapers, which thrived especially after the lapse of the Licensing Act in 1695, had their sources and origins in the coffeehouse and were, at least partly, even produced there – not printed, of course, but copy was written at coffeehouse tables and then sent to the printer's, just like letters to the editor could be sent to a specific coffeehouse address, as the seat of the editorial office.

The London coffeehouse between 1660 and 1720 is therefore not only a manifestly *public* space, it is also a location in which the most progressive practices and discourses of the day – practices and discourses that in later ages would be relegated to separate private and business spheres again – converge in a totally unprecedented way. Small wonder then that the London coffeehouse has been identified as the site where, for the very first time, the public sphere of modern bourgeois society constituted itself. It is in the exchange of commodities as well as in the exchange of opinions that early bourgeois society constitutes itself and reflects upon itself in the process of its self-constitution.

Undeniably, the moral weeklies of the early 18th century, most notably *The Tatler* (1709–11) and *The Spectator* (1711–12), are *the* prime media in which this self-reflection takes place. The enormous success of these periodicals, which were soon to be reprinted in book form and left their indelible mark on 18th-century intellectual culture, was due to the fact (which was not just a conceit or a fiction – pace M. Ellis 192) that it was produced exactly where its original readership spent a considerable part of their day: sitting in their coffeehouse, Addison and Steele had their fingers on the pulse of the age, and it was the pulse of commerce, of business activities, of mercantile adventures, of projects, inventions, politics and the stock market. It is true – why else call these periodicals '*moral weeklies*'? – that there is in these publications a strong emphasis on improving morals and manners, on refining taste and propagating moderation. This new bourgeois public is looking for guidance, but this guidance is not, as it were, handed down to them: Addison and Steele and their fictitious counterparts, Mr

Isaac Bickerstaff and Mr Spectator, are on eye-level with their readership, they reflect the sentiment of the most progressive part of society and “talk to the public about itself” (T.H. Green quoted in Watt 56). When Addison in *Spectator* no. 10 writes, “It was said of *Socrates*, that he brought Philosophy down from heaven, to inhabit among Men; and I shall be ambitious to have it said of me, that I have brought Philosophy out of the Closets and Libraries, Schools and Colleges, to dwell in Clubs and Assemblies, at Tea-Tables and in Coffee-Houses”, he does not claim the same philosophical stature as Socrates, but he draws attention to the prime medium of self-enlightenment and self-emancipation, the moral weekly mirroring its audience.

The age witnesses the public *Selbstverständigung* of the emerging, rising middle class. And there can be no doubt about what its political and economic ideals are. Of all the fictitious characters in the equally fictitious Spectator Club, it is unmistakably Mr Andrew Freeport, the merchant and defender of commerce, who comes closest to the paradigm of a perfect man (cf. S2 and S174),¹⁴ not the slovenly country squire Roger de Coverley, an amiable, but somewhat out-of-touch Tory. As Steele sings the praises of “the industrious part of mankind” (S552), so Addison has an allegorical dream-vision of the Bank of England, in which it is almost apotheosized, although its health tellingly depends upon the allegorical figures of Liberty and Monarchy, Moderation in Religious Matters, and the Genius of Great Britain (S3), and Mr Spectator is in total raptures about the Royal Exchange:

There is no Place in the Town which I so much love to frequent as the *Royal Exchange*. It gives me a secret Satisfaction, and, in some measure, gratifies my Vanity, as I am an *Englishman*, to see so rich an Assembly of Country-men and Foreigners consulting together upon the private Business of Mankind, and making this Metropolis a kind of *Emporium* for the whole Earth. [...] As I am a great Lover of Mankind, my Heart naturally overflows with Pleasure at the sight of a prosperous and happy Multitude, insomuch that at many publick Solemnities I cannot forbear expressing my Joy with Tears that have stoln down my Cheeks. For this reason I am wonderfully delighted to see such a Body of Men thriving in their own private Fortunes, and at the same time promoting the Publick Stock; or in other Words, raising Estates for their own Families, by bringing into their Country whatever is wanting, and carrying out of it whatever is superfluous. [...] For these Reasons there are not more useful Members in a Commonwealth than Merchants. They knit Mankind together in a mutual Intercourse of good Offices, distribute the Gifts of Nature, find Work for the Poor, add Wealth to the Rich, and Magnificence to the Great. (S69, Ross 437, 438, 439)

¹⁴ S and T stand for *The Spectator* and *The Tatler*, respectively, the number for the number. Direct quotes are taken from Angus Ross’ selection.

These little fictions are political through and through – their form may be partly literary, but that is only a vehicle for the discursive self-formation of an enlightened and highly politicized public.

The reason why I go into this is that Jürgen Habermas in his highly commendable *The Structural Transformation of the Public Sphere* – enlarging upon an idea of Hans Speier that it was in coffeehouses, “popular as centers of news-gathering and news dissemination, political debate, and literary criticism [that] [t]he English middle classes began to accomplish their own education” (381) and that “[p]ublic opinion is a phenomenon of middle-class civilization” (379) – identified the London coffeehouses as the site of origin of the public sphere, while insisting time and again that London coffeehouse culture and discourses were first primarily *literary*, before they eventually turned *political*:

Even before the control over the public sphere by public authority was contested and finally wrested away by the critical reasoning of private persons on political issues, there evolved under its cover a public sphere in apolitical form – the *literary* precursor of the public sphere operative in the political domain. It provided the training ground for a critical public reflection still preoccupied with itself – a process of self-clarification of private people focusing on the general experiences of their novel privateness. [...] The public sphere in the political realm evolved from the public sphere *in the world of letters*; through the vehicle of public opinion it put the state in touch with the needs of society. [...] [T]he coffee houses in their golden age between 1680 and 1730 and [in France] the *salons* in the period between regency and revolution [...] were centers of criticism – *literary at first, then also political* – in which began to emerge, between aristocratic society and bourgeois intellectuals, a certain parity of the educated. [...] Thus critical debate *ignited by works of literature and art* was soon extended to include economic and political disputes, without any guarantee (such as was given in the *salons*) that such discussions would be inconsequential, at least in the immediate context. [...] In the *Tatler*, the *Spectator* and the *Guardian* the public held up a mirror to itself; it did not yet come to a self-understanding through the detour of a reflection on works of philosophy and literature, art and science, but through entering itself into “literature” as an object. Addison viewed himself as a censor of manners and morals; his essays concerned charities and schools for the poor, the improvement of education, pleas for civilized forms of conduct, polemics against the vices of gambling, fanaticism, and pedantry and against the tastelessness of the aesthetes and the eccentricities of the learned. He worked toward the spread of tolerance, the emancipation of civic morality from moral theology and of practical wisdom from the philosophy of the scholars. The public that read and debated this sort of thing read and debated about itself.¹⁵ (Habermas 29, 30–31, 32, 43; emphases added)

¹⁵ This must be one of the most baffling passages in *The Structural Transformation of the Public Sphere*. For, granted that the reading public reflects upon itself as a object of literature, what is this but a reflection of itself by the detour of literature?

Apart from the fact that to a literary scholar of the generation of '68, this dissociation of the literary and the political seems curious, to put it mildly, I beg to radically differ on this point because this reading is simply not supported by historical evidence.¹⁶ English coffeehouse culture is political, radical, and egalitarian right from the beginning, and a full fifty years before Addison and Steele even begin. And when they begin, they continue this tradition, even if in quasi-literary form. The literary dimension does not precede the political, which, or so says Habermas, emerges only later, it is (if one wants to uphold that somewhat simplistic distinction at all) exactly the other way round: the coffeehouse, right from the beginning, is the public space of the *political* self-constitution of the English middle-class – the hottest arena of its economic and ideological self-reproduction.

And the reason why this is important is that, in the context of the emergence of a new idea of the future as a space of multiple possibilities, the discourses practised in that newly emerging public sphere produce a new idea of *truth-as-process* that is not only political through and through, but also a practice that proleptically points to realizations of Future Narratives that, at that historical moment, are still eclipsed by the medial possibilities of the day.

Anyone could enter a coffeehouse as long as they were male (the only females allowed were the coffee-maids), had the time and at least a penny to spare. For the entrance fee was one penny and at the cashier's you could buy coupons or tokens for 1/2 to two pennies for the 'dishes' of coffee you meant to consume (cf. Heise 93). You could stay in the coffeehouse for as long as you wanted and freely peruse the newspapers on display. There was free seating, irrespective of rank and wealth, and the rules of conversational engagement were egalitarian:

It is just over three hundred years since the first coffee-houses were opened in England, bringing together all ranks for the first time in a truly democratic assembly, and enabling people to lay aside something of that reserve so characteristic of our nation. In doing so, the people had sensed a common danger, first in the tyranny and military dictatorship of Cromwell, and later in the profligacy that characterised the Court of the Restoration period. Until coffee-houses were available for sober debate and discussion, only the taverns had existed as a place for social intercourse, and this at a time when the vice of drunkenness prevailed. It was in the early coffee-houses that the great struggle for political liberty was really fought and won. [...] A man on entering was free to take any vacant seat and to engage his neighbour in conversation. If unable to read, he was able to hear the news read out aloud from the Government's *Gazette* by one of the company; or he could listen to the poets as they read and discussed their work, or hear the informed opinions on the latest play. The current gossip, the latest political scandal, the fashionable quack-doctor, all these provided subjects of conversation; and to the poor scrivener and apprentice the coffee-house offered,

16 For a longer discussion of this see Bode, "Addison and Steele".

in addition, a welcome retreat that was both comfortable and economical. [...] No attempt was ever made, at their introduction, to bar or restrict entry of anyone; the coffee-houses were “levellers”, and one penny was all that was needed by any man, rich or poor, to gain entry. (A. Ellis XV, 45)

It was this seating policy that corresponded to and fostered the prevalent style of debate – a debate among equals, on eye-level, that of necessity presupposed the recognition of the partner in conversation as one of equal rights:

Arriving in the coffee-house, customers were expected to take the next available seat, placing themselves next to whoever else has come before them. No seat could be reserved, no man might refuse your company. This seating policy impresses on all customers that in the coffee-house all are equal. Though the matter of seating may appear inconsequential, the principle of equality this policy introduced had remarkable ramifications in the decades to come. From the arrangement of its chairs, the coffee-house allowed men who did not know each other to sit together amicably and expected them to converse. In the anonymous context of the city, in which most people are unknown to each other, this sociable habit was astonishing. Furthermore, the principle of equality established by the seating arrangements recommended equality and openness as the principle of conversation. (M. Ellis 59)

If debate is not dominated by differences in status or wealth, then sober *reason* and the force of the better argument will ultimately decide the case, as Steele ideally depicts it in *Spectator* no. 49:

When the Day grows too busie for these Gentlemen to enjoy any longer the Pleasures of their *Deshabilé*, with any manner of Confidence; they give Place to Men who have Business or good Sense in their Faces, and come to the Coffee-house either to transact Affairs, or enjoy Conversation. The Persons to whose Behaviour and Discourse I have most regard, are such as are between these two sorts of Men: Such as have not Spirits too Active to be happy and well pleased in a private Condition, nor Complexions too warm to make them neglect the Duties and Relations of Life. Of these sort of Men consist the worthier Part of Mankind; of these are all good Fathers, generous Brothers, sincere Friends, and faithful Subjects. Their Entertainments are derived rather from Reason than Imagination: Which is the Cause that there is no Impatience or Instability in their Speed or Action. You see in their Countenances they are at home, and in quiet Possession of the present Instant, as it passes, without desiring to quicken it by gratifying any Passion, or prosecuting any new Design. These are the Men formed for Society, and those little Communities which we express by the Word *Neighbourhoods*. [‘The coffee-house’, Ross 288]

As early as at the end of the Commonwealth, radical republican debate ruled in coffeehouses – although James Hamilton’s (he of *The Commonwealth of Oceana*, 1559) ‘Rota Club’ at the Turk’s Head (cf. M. Ellis 42ff.) is, of course, an unfortunate example for the tradition we are interested in, because, being a *club*, it stands exactly for that kind of exclusivity that is not characteristic of the coffeehouse.

Still, “[w]ith hindsight, it was possible to see that through the crucible of 1559 [end of the Rota Club, with Hamilton’s subsequent arrest] they [the coffeehouses] had found a new role in the popular imagination, established as the people’s forum, where ordinary folk met to debate affairs of state.” (M. Ellis 55)

This was continued after the Restoration of 1660 and the relationship between the Stuart court and the free debaters in the coffeehouses remained a strained one, to say the least. A climax of sorts was reached in late December 1675 when Charles II issued a *Proclamation for the Suppression of Coffee-Houses* – the royal proclamation is singular in English history for it had to be revoked within ten days, because the outrage and protest against the closing of the coffeehouses was so fierce (cf. A. Ellis 92–93, M. Ellis 86ff.). Coffeehouse sedition continued after the aborted proclamation (cf. M. Ellis 100ff.). From then on the idea that coffeehouses – alongside their importance for business – were primarily a public space for free speech was securely anchored in the minds of that very same emerging, deliberating public which identified the *space* with the *practice*: “The defence of the coffee-houses, it was understood, was a defence of freedom of speech.” (M. Ellis 105)

And again it is the (ideal) neglect of rank, order, and wealth that paves the way for the supreme reign of the rules of discourse:

No one should be excluded from the discussion, nor should anyone have precedence by a quality they brought with them from outside such as status, wealth, power, or strength of arms. All speakers are considered equal and within the collective fiction of the coffee-house hierarchy is erased. The cost of this equality of access, [Paul] Greenwood suggests [in “The RULES and ORDERS of the Coffee-House”, 1674], is that all who enter agree to behave by his ‘Civic Orders’, the rules of discussion within the house. (M. Ellis 61) –

or, as I would say, it is the other way round: rational discourse requires formal equality of all participants.

The public use of reason is the medium through which an enlightened public creates itself:

The bourgeois public sphere may be conceived above all as the sphere of private people come together as a public; they soon claimed the public sphere regulated from above against the public authorities themselves, to engage them in a debate over the general rules governing relations in the basically privatized but publicly relevant sphere of commodity exchange and social labour. The medium of this political confrontation was peculiar and without historical precedent: people’s public use of their reason (*öffentliches Raisonement*). (Habermas 27)

This public use of reason presupposes a *formal* equality of all that take part in the debate, thereby denying any difference that may exist outside this specially

cordoned space or differences that may in effect be there because they are part and parcel of an individual's profile. Just as in trading, the *formal* equality of the partners that sign a contract must be presupposed so that any commercial or legal transaction can take place at all – which is no denying of the fact that both in commercial and legal transactions, as well as in discursive exchanges, differences between the partners do, in fact, exist. But these inequalities are, as it were, formally suspended and negated, so that the preconditions of the possibility of rational discourse can be established.

There are at least three relevant aspects here: first, like in Immanuel Kant's "Beantwortung der Frage: Was ist Aufklärung?", the *public* use of reason is the medium for the self-creation of both an enlightened individual and an enlightened public. This, in turn, cannot be conceived in any other way than as a *process*. This public brings itself forth through its practice; it is the self-creation of a politically mature ('mündige') public:

Daß aber ein Publikum sich selbst aufkläre, ist eher möglich; ja es ist, wenn man ihm nur Freiheit läßt, beinahe unausbleiblich. Denn da werden sich immer einige Selbstdenkende, sogar unter den eingesetzten Vormündern des großen Haufens, finden, welche, nachdem sie das Joch der Unmündigkeit selbst abgeworfen haben, den Geist einer vernünftigen Schätzung des eigenen Werts und des Berufs jedes Menschen, selbst zu denken, um sich verbreiten werden. Besonders ist hiebei: daß das Publikum, welches zuvor von ihnen unter dieses Joch gebracht worden, sie hernach selbst zwingt, darunter zu bleiben, wenn es von einigen seiner Vormünder, die selbst aller Aufklärung unfähig sind, dazu aufgewiegelt worden; so schädlich ist es, Vorurteile zu pflanzen, weil sie sich zuletzt an denen selbst rächen, die, oder deren Vorgänger, ihre Urheber gewesen sind. Daher kann ein Publikum nur langsam zur Aufklärung gelangen. Durch eine Revolution wird vielleicht wohl ein Abfall von persönlichem Despotism und gewinnsüchtiger oder herrschsüchtiger Bedrückung, aber niemals wahre Reform der Denkart zu Stande kommen; sondern neue Vorurteile werden, eben sowohl als die alten, zum Leitbände des gedankenlosen großen Haufens dienen.

Zu dieser Aufklärung aber wird nichts erfordert als *Freiheit*; und zwar die unschädlichste unter allem, was nur Freiheit heißen mag, nämlich die: von seiner Vernunft in allen Stücken *öffentlichen Gebrauch* zu machen [...]. (Kant, "Aufklärung" 56–57)

[D]er *öffentliche* Gebrauch seiner Vernunft muß jederzeit frei sein, und der allein kann Aufklärung unter Menschen zu Stande bringen; der *Privatgebrauch* derselben aber darf öfters sehr enge eingeschränkt sein, ohne doch darum den Fortschritt der Aufklärung sonderlich zu hindern. [...] Wenn denn nun gefragt wird: Leben wir jetzt in einem *aufgeklärten* Zeitalter? so ist die Antwort: Nein, aber wohl in einem Zeitalter der *Aufklärung*. (Kant, "Aufklärung" 60)

Secondly, since the equality of the partners in debate is a purely formal one that merely guarantees the preconditions of the possibility of rational debate, it

follows that we are only looking at the idea(l) of a discourse of equals, a discourse free from all repression:

The parity on whose basis alone the authority of the better argument could assert itself against that of social hierarchy and in the end can carry the day meant, in the thought of the day, the parity of “common humanity” (“*bloss Menschliche*”). *Les hommes*, private gentlemen, or *die Privatleute* made up the public not just in the sense that power and prestige of public office were held in suspense; economic dependencies also in principle had no influence. Laws of the market were suspended as were laws of the state. Not that this idea of the public was actually realized in earnest in the coffee houses, the *salons*, and the societies; but as an idea it had become institutionalized and thereby stated as a objective claim. (Habermas 36)

Steele’s Mr Eubulus (S49) is ‘only’ an ideal debater to be emulated, not a reality; and of course the *Spectator*’s fictional coffeehouse is an *imaginary, utopian space*, which is, however, superimposed on the real coffeehouses, in which this fledgling discourse spreads its wings. It is the space opened up by the language of these essays¹⁷ and by the rules of rational discourse – a discourse that emerges and unfolds to the same degree that a lack or difference between actual practice and ideal is still registered. In other words, it is through the discursive processing of the coffeehouse debating culture that the new public sphere is not only mirrored, as is often believed, but it is *transcended*, because it beholds in that reflection a likeness of what it could ideally be, but is not yet.

The third and most important aspect of this is structurally akin to the first two in that it involves process, difference, and ‘not yet’. Corresponding to the process of self-enlightenment and to the imaginary space opened up by the recording of the difference between present practice and ideal objective, the period between 1660 and 1720 witnesses a fundamental re-definition of ‘truth’. Under these rules of discourse, truth can no longer be imagined as something that is pre-given, pre-established, and as something that can be arrived at – because it is already *there* – if you only have a map, some directions and a compass. Rather, truth is now, quite practically, re-conceptualized as something that is the *outcome* of certain discursive practices; which means: it is not yet ‘there’, it is still in the making, it is evolving, it is produced.

Habermas says, “the same process that converted culture into a commodity (and in this fashion constituted it as a culture that could become an object of dis-

¹⁷ “The importance of *The Spectator* is that it creates a language that can articulate this model of society. It creates a vocabulary and set of conventions which are vehicles for this model; it formalises a particular perception of society through the shaping power of language, through the power of discourse to shape what we see in the world.” (Ketcham 170)

cussion to begin with) established the public as in principle inclusive” (37), or, in the original German, “führt [...] zur prinzipiellen Unabgeschlossenheit des Publikums.” But it should be added that, more importantly, this leads to a *non-closure of the discursive process*. Any truth that can be arrived at in this medium can only be provisional, because there is no natural ending to any such debate as long as somebody can still raise a rational objection – for then the debate is open again.

I am not arguing that proponents of the New Science (following Bacon and Newton) or of Enlightenment philosophy were no longer searching for the One Truth. They evidently were. What I am arguing is that, as scientific experiments are carried out in the backrooms of coffeehouses and scientific debates are held there, in which – in total contrast to the sessions of the Royal Society – everybody can take part, because they are open to all (cf. M. Ellis 157ff.),¹⁸ *the terms of inquiry* are so changed that the mechanism of *the discursive production of knowledge* is now in full view and what it produces is undeniably heterogeneous, contradictory, subject to interpretation and open to debate.

The ideas of free trade and free, unrepressed discourse have in common, among other things, that *exchange* (of commodities, of opinions) increases prosperity. But they are dissimilar in that the sphere of the former can be quantified, whereas the value of a wealth of ideas cannot be ascertained in such a crude mechanical way. The value created by free exchange of ideas, especially if they relate to what is not (yet), to projects, undertakings, realizations of visions and inventions, resides, *prima facie*, in the *quality of differing continuations* of the present moment. What matters is *what kinds* of differences all these differences make. There is no denying that, in the model case of England between 1660 and 1720, it is in the coffeehouses as the first manifestations of *bürgerliche Öffentlichkeit* that an ideal self-emancipation of the rising middle class takes form (cf. Speier; Heise 129–130), which, due to the new dispensation of the *formal* equality of all participants, effectively *negates* all the heterogeneity it sucks in. However, at the same time that very heterogeneity, which is simultaneous, is then, as it

18 “The coffee-house became one of the key spaces in which the New Science could be debated by the wider public. As Thomas Hobbes and others complained, the Royal Society only admitted as members men who already believed in the results and the methodology of the experimental philosophy. [...] By contrast the coffee-house was genuinely open to all: ideas that could be proved true there could be proved anywhere. Science in coffee-houses was always more public, more debated, less abstract and more demonstrative. [...] In the coffee-houses men of science, learning and scholarship found they had unprecedented access to all kinds of knowledge: commercial, literary, mechanical, theological. Unlike the narrow confines of the Schools, whether university, church or club, the coffee-house opened the whole world of learning to its clientele. To a seventeenth-century mind, entering a coffee-house was like walking into the Internet.” (M. Ellis 157–158)

were, spouted into a future that cannot be but open, undecided, and realizable only in a multiplicity of ways. In other words: by denying difference, rational discourse shoehorns multiplicity into a formal equality, which can then, since no open, rational debate knows an end (let alone its own end), only produce truths, in the plural, that can, at best, be regarded as ever so many provisional steps towards an ultimate truth – at best, I say, because at any given point in time the various truths will not appear as lying in one straight line, but as dispersions that open up a *space of possibilities* and make it impossible to think of just *one* trajectory. Intent upon ‘getting it right’, this *selbstaufklärerischer Diskurs* retains an idea of truth as a *point*, but in its *practice* (and later on in theory as well) it can ‘only’ produce trajectories, lines, multiple paths that open up and unfold a multi-dimensional *space*. As in probability theory, gambling, insurances, projecting, and stock-jobbing, so in public discourse: Past Narratives are increasingly complemented, but by no means yet substituted by Future Narratives.

As we imagine de Moivre, Addison, and Steele among the stockbrokers, newsmongers, and insurance agents of the London coffeehouses, we must not forget one last piece of this jigsaw puzzle of the times. It is provided by another coffeehouse regular, a man who published his own periodical, *The Review* (which he ran from 1704 until 1713), and whom we have already encountered, in prison and at large, as the author of *An Essay upon Projects*: Daniel Defoe – the man who, approaching 60, arguably wrote the first modern, realist, bourgeois novel in English: *Robinson Crusoe* (1719).

The question is, Why should the advent of that most successful genre of *Past Narratives* be of any import whatsoever to the emergence of the idea of the future as a space of multiple continuations? But it is – through its overwriting of reality with a secondary textual reality, an overwriting that paradoxically and characteristically *denies* any difference between its fiction and reality.

3.6 The Plot Thickens: The Modern Realist Novel

It is easy to see why there is literature about giants and dwarfs, hobbits and elves, dragons, unicorns and talking animals, witches and wizards, vampires, superheroes, time-travel, endless promiscuous sex without remorse or, for that matter, about the one true love: all of this hardly exists in reality, and that is exactly the reason why we find so much of it in fiction. Fairy tales and myths, fables and fantasy, SF, romance, and pornography supplement reality with something we do not find in it, or not sufficiently. *That* is why there is that kind of literature in the first place.

What then about *realist* fiction? We have grown so accustomed to the realist paradigm in fiction that we hardly feel any more the scandal of its initial emergence and hardly ever fathom its constitutive puzzle: why should there be *fictional* literature that pretends to be about reality, about something that already exists? It seems a most needless and superfluous thing, an unnecessary duplication. And yet, it's been around for some three hundred years and it is, in spite of all the non-realist subgenres of the novel, still paradigmatic for the genre as a whole – so much so that often examples of the other, non-realist subgenres are criticized for their lack of verisimilitude or their improbability: as if that were not exactly their *raison d'être*. They are produced and read *because* they are not realistic.

The evolutionary advantages of realist fiction, however, become obvious once we identify its defining features against the backdrop of pre-modern non-realist fiction.¹⁹ On the title-page of *Robinson Crusoe*, the name of its author does not appear. Rather, the text is presented as an autobiographical account by Robinson Crusoe. Not only are all conceivable markers of fiction omitted, but the 'editor' of the volume even expressly dismisses any suspicion that it might after all be an invented story. Consequently, what we read is impossible to differentiate from an account of a real shipwreck (such as that of Alexander Selkirk) and lonely survival on a tropical island. The fake is perfect: fiction is camouflaged as fact.

This literary mimicry can, of course, only succeed if all the parameters of longer narratives are aligned with potential readers' perception of reality, so that readers don't stumble over any discrepancy, any difference from their day-to-day world and thus become suspicious. *Robinson Crusoe* achieves this with such ideal perfection that Ian Watt, in his classic study of the beginnings of the bourgeois-realist novel, *The Rise of the Novel* (1958), uses it, among other 18th-century novels, to develop the ideal type of his concept of 'formal realism'. So what defines 'formal realism', as opposed to non-realistic forms of narrative such as romances, chivalric tales, fables, myths, and so on?

1. *Original plots*. That much is obvious: I won't be able to sell anyone my story as 'true' if its content has clearly been known for centuries and only been reworked in my telling. The content of the story must be *new*. This rejection of traditional, supposedly timeless content and subject matter coincides with a marked emphasis on *individual, new, singular experience*. The specific, not the universal is the order of the day.
2. From this it follows that the characters in the 'formal realist' novel are *special, individualized* people, not allegorical figures, not mere stereotypes, not white knights saving damsels in distress from fire-spouting dragons.

¹⁹ An extended version of this line of argument can be found in Bode, *Novel* 28–63.

3. If a story is about individual, unique experience, then it is important *when* it took place. In contrast to its predecessors, the realist novel *historicizes* its content. Fairy tales, fables, and myths establish themselves in a timeless space, because what they want to say is not bound to concrete circumstances. Chivalric tales and romances, too, are ‘frozen’ in a medieval era that lacks any historical dimension, undergoes no development, and is the vehicle for communicating (supposedly) universal or eternal truths about human existence. That necessarily presupposes ahistoricity: the specific, singular case is not essential to such narratives. But Robinson Crusoe was born in 1632, and Clarissa Harlowe dies at 6.40 p.m. on Thursday, September 7th – it’s easy enough to work out the year. Once the particulars have been set out like this, it doesn’t matter whether the events of the novel take place in the reader’s present, the immediate past, or the historical past – the characters inhabit *one and the same time-continuum* as the reader. The events of ahistorical narrative texts, on the other hand, take place in a kind of time warp, without connection to our time.
4. What is true about time is equally true about *place*. The place of action in non-realist texts can’t be found in an atlas, and doesn’t need to be. ‘Formal realism’, however, pretends to place its characters in *our* three-dimensional world – ‘I was born in the year 1632, in the city of York’, begins *Robinson Crusoe* – and unfolds in *this* space. No matter if the plot takes place far, far away – we nevertheless share *the same space-continuum*.²⁰
5. To these four parameters noted by Ian Watt a fifth has to be added: *the principle of causality*. For in the realist novel everything that happens must, of course, be explicable in realistic terms – there’s no place for miracles, acts of God, or other supernatural interventions. The laws of our world must also be the laws of the fictional world, if the latter is to be understood as a part or continuation of the former.

In a historical perspective it is now obvious what could be gained by discarding a literature of ‘universal’ validity in favour of a literature that celebrates the specific and the particular: a literature of universal validity assumes static, unchangeable relationships. The more human relationships change, the more frequently people will be confronted by questions and problems that simply *couldn’t* have arisen previously. They then recognize themselves less and less in a literature that does not contain precisely what they are now challenged by: radical change, revolu-

²⁰ It is certainly one of the mistakes of non-literary readers of realist literary texts to think in a kind of inversion of conclusion that therefore the locations where their characters roam must be found in an atlas; but that is a category mistake in decoding – see below.

tion, and new, disconcerting experiences. The modern European realist novel picks people up where they are: in the midst of this radical change for which there are (still) no prescriptions or recipes (and never will be, apart from transcendent ones), because it is historically (always) singular. There are no further rehearsals – we're already in the premiere, the first and last performance simultaneously, as in life, so in the story. And indeed this is what the modern novel in this historically specific situation offers its readers – typical, yet individualized characters under typical circumstances: look what happened to one of you under these particular, concrete conditions and what came of it. The modern realist novel is a part and a reflex of this enormous, unique social, economic, and cultural *unleashing*, the unprecedented freedoms and possibilities of which it reflects as much as its risks and pitfalls. It can't possibly pretend that nothing has changed, and it doesn't. And in reflecting and promoting this novelty, it proves to be the most protean of all literary genres.

True, significant sections of the reading public will seek security in a literature that is exactly innocent of all that, or which steadfastly ignores change: such readers turn to escapist romances and chivalric tales (or their modern-day equivalents) – and understandably so: human beings cannot bear very much reality.²¹

So, just like non-realist fiction, realist fiction responds to a need, and it is a need it can only hope to satisfy if it keeps the distance to common reality as small as possible and if it denies, or plays down, any difference between itself and reality – which is the same as saying: it somehow denies its own fictionality. I will come back to this point after having dealt with a foreseeable objection: if one takes not *Robinson Crusoe*, but *Don Quixote* (1605, second part 1615) as the first modern European novel, then it is absurd to say that the new genre tries to deny its fictionality – quite the contrary:²² *Don Quixote* highlights and foregrounds its fictionality and the fact that it is fabricated to such a degree that, before long, we do not know which of its three authors, if any, we can trust.

That creates an interesting tension: on the one hand, *Don Quixote* waves good-bye to Don Quixote's favourite reading matter, the chivalric novel, and it continuously insists on the vital importance of the dichotomy of fact and fiction, of fiction and reality. For its main theme, of course, is the debilitating danger that results from confusing fiction with reality, from the inability to distinguish

²¹ That is why I cannot agree with Elena Esposito when she says that “[m]oderne Fiktion ist immer realistisch, und gerade deshalb wurde sie als Fiktion anerkannt[.]” (76) Modern fiction isn't always realist, and why it is recognized as fiction if it is realist, is a puzzle, and not matter of course.

²² Again, for an extended discussion of this see Bode, *Novel* 28–33.

between the two – *that* is Don Quixote’s malady and that of the reader who cannot tell the two apart.

On the other, the present reader of *Don Quixote* is also warned not to trust the realist account of the adventures of the knight of the sad countenance – so the fact within a fiction has to be identified as a fabrication, a fake, if you will. The novel is realist, but unreliable (which, by the way, is not a contradiction – unreliability may in fact be one of the trustworthy hallmarks of a radically conceived realism). The apparently realistic construction of fiction, the *fabrication* of the ‘reality’ of this novel, is, in fact, a *theme*, arguably *the* theme of this novel. In other words: *Don Quixote* is as ostentatiously fiction as *Robinson Crusoe* denies that it is – and both are, of course, fakes.

Between the two of them, novels of the type of *Robinson Crusoe* on the one hand and of *Don Quixote* on the other open up the space of possibility of the modern realist novel: to engage with the specificity of the present you had better minimize or downright deny any difference between your fiction and reality; at the same time, any attempt to write such realist fiction can be exposed (if it doesn’t do so itself) as a (more or less credible) fabrication – the fabrication of a reality that looks confusingly similar to the real thing (which may, after all, be another such construction), but whose ontological and truth status is highly questionable, if one is not totally naïve. Surprisingly, *both* the denial *and* the foregrounding of the fictionality of realist fiction underscore its tenuous relationship to reality. For that is still what *Robinson Crusoe* and *Don Quixote* have in common: their point of reference is *reality as it is*. And that is their new quality.

However, these novels are, of course, also *auto-referential*; that is, once you have identified them *as fiction*, they are decoded in a special way, they are given special treatment in that their literal [sic!] meaning is understood as only a pointer towards a special ‘literary’ or ‘secondary’ or ‘deeper’ meaning, which is the *real* meaning of this text that has to be found out through exegesis and interpretation. Then Crusoe’s 28-year sojourn on his lonely island is not just *that*, but it stands *for something else*.²³ And this *something else* is what the novel is essentially about.

While it could be argued that this *literary* decoding is not something you subject everyday signs to, so that the parallel between reality and realist texts stops there, it was, however, something that a significant part of the English public at the end of the 17th and the beginning of the 18th centuries was systematically trained to do. Protestant and especially Puritan circles may have been opposed to art, drama, and fiction, because they all detracted people from what should have been their central care in life: saving their souls. But they also trained

23 And *that* is why you cannot locate Robinson’s exile on any map. See above.

their people, day in, day out, to read not only episodes from the Bible, but also their own lives *allegorically* – as saying one thing, meaning another: everything could be significant, everything could mean not just itself, but something else too, which would then make it a *sign*. So, not only the Holy Scripture, but life itself was understood as *doubly encoded* – possibly *multiply* encoded. Which is why when Defoe gave his first novel such a realist outfit that it looked exactly like a non-fictional autobiographical account of a shipwreck, he could still rely on his audience's ability to see it *both* as factual *and* pointing towards something else. To say that literature has secondary meanings because it is auto-referential, whereas life hasn't, is just not true for all audiences.²⁴ In any case, it wasn't for the English reading public that was given the first realist novel. It was Defoe's masterstroke to launch a fiction that denied it was fiction, but which would still be subjected to the same exegetical decoding techniques that would further on be the special preserve of 'literary' readings.²⁵ This may well be one of the most underestimated aspects of the secularization of modernity.

Now, what makes the modern novel such an incredibly powerful narrative genre is, among other things, the strong emphasis on the principle of causality that was already mentioned. It is, of course, only an *effect* that is created *retrospectively* and through narration – but hey, that is what narration is for: *the conversion of contingency into the (illusion of narrative) necessity*.²⁶ That is what the modern realist novel is particularly good at: to evoke a totality of a world that bears a striking, sometimes uncanny resemblance to ours, but that, in contrast to ours, seems to offer a semblance of meaning, of purpose, of coherence – and if only these dimensions of meaning are evoked, thematized, or questioned. That is why, after all, we have all these *Past Narratives*: so that they give us the illusion of something meaningful.

This very fact seems to rule out the modern European novel as it historically materialized in the 18th and 19th centuries as an appropriate carrier for *Future Narratives*. And evidently it wasn't. They're just so dissimilar – they're veering off in different directions. But we must be cautious, while telling this tale, not to construct a retrospective necessity of this evolution. The better question to ask might be: why exactly did the novel around 1700 take this turn to *Past Narratives*, with its foregrounding of meaningful necessity and a narratively mediated purpose-

²⁴ The question whether, if you regard life as auto-referential, it might attain a second or literary meaning as well and thereby gain an aesthetic or ironic lustre, cannot possibly be discussed here. But the Romantics and Nietzsche seem to have been of that opinion, at one point or another.

²⁵ Cf. Bode, *Novel* 38–41.

²⁶ See above, part 1.2; cf. also Molesworth on the illusion of causation and a teleology in the 18th-century novel.

fulness? For the case could be made, and it will, of course, be made here, that alongside probability theory, insurances, projects, the stock market, and the new notion of truth-as-process, the modern European realist novel is *indeed* another strong indicator that between 1660 and 1720 the Western idea of future is radically re-defined. How so? And once that one is settled: why *didn't* it go down that road itself, but only *pointed* in the direction?

First, how so? An 'as if' duplication of reality (cf. Esposito 7–12) allows you a parallel run of (a selection of) the data of reality – it is, if you will, like computers connected in parallel that process simultaneously what they are fed as 'reality'. Realist fiction, in sum, can be said to offer *different continuations of present states*. And so that we can recognize in the first place that these are indeed different continuations of present states, the fiction *has* to be realist – for (this is almost tautological) if it weren't, nobody would think that this *was* an *alternative* (fictional) continuation of a present state. The difference between the world of, say, medieval romance and the reality of 1719 is simply too big. Narrow the difference and it dawns upon the public, sooner or later, that this 'as if' indicates that *'this here' could be different*.

Therefore, although the modern European realist novel is as deeply saturated with *Past* Narratives as can possibly be, it also testifies to the new idea that – though the present can be seen as the outcome of relatable cause-and-effect chains – it is also 'only' a probable state,²⁷ alongside which other probable (or equally improbable) states can then be imagined. Once you realize that the present is not eternally the same, but that reality itself is changing, and radically so, it all of a sudden makes sense to write what otherwise could only be regarded as, at best, an unnecessary duplication and, at worst, a flat contradiction in terms: *realist fiction*. Inadvertently, the emergence of the modern European realist novel, that powerhouse of *Past* Narratives, opened not a Pandora's box or a can of worms, but it opened up the prospect of reality as *multiple*: (f)actual on the one hand, probable and possible on the other.

But this binary still ran on *parallel* tracks (a good thing in itself); realist fiction was understood as an alternative reality to 'real' reality – probable, but not actual. The binary only had to be turned by 90° so that it could be understood as the dividing line between past and future, the present as conversion line of virtual contingency into actuality. That is how the realist novel was powerfully

²⁷ In contrast to Elena Esposito, I should like to maintain that, although, seen from any present, future reality may appear as an improbable case – “Die Realität ist unwahrscheinlich, und das ist das Problem. [...] Es ist wahrscheinlich, dass gerade das Unwahrscheinliche eintritt, und damit ist das Wahrscheinliche nur wenig realistisch.” (50) –, *once it is actualized*, it is not any more improbable than other possible states, but *less* so – because it evidently is *the case*.

conducive to the idea that the present is not only the terminating point of a web of cause-and-effect relationships, but also the cliff that allows a view of a space of future possibilities – the future as an ocean navigable by different routes, not only in a uni-linear way.

Why then, if all the ingredients for the large-scale emergence of *Future Narratives* were apparently there around 1700, did it not happen? Why did we have to wait until the last third of the 20th century for take-off? As indicated above, the answer we propose is: it was *for media-historical reasons*. Because the index medium of that former period, the printed and bound book – while it doesn't, of course, rule out Future Narratives – is not exactly conducive to them either. The rest is (media) history.

3.7 Future Narratives and Historical Mediality

It seems a very past-narrative kind of thing to say that the possible emergence of FNs around 1700 was impeded by the physicality of the index medium of that period, the printed and bound book. And it is a very past-narrative kind of thing to say, inevitably so. And there's nothing wrong with it as long as the implied teleology is flagged out as one that is retrospectively constructed from a present point in time, and for heuristic reasons. Nothing wrong with it – except that it is always an overambitious claim to say that one is able to identify the one factor that forestalled the emergence of something that *could* have happened, if only it hadn't been for that particular culprit. It is especially overambitious if, as is the rule in the humanities that work historically, you have no exact parallel case. Under these conditions you cannot really prove your case. All you can do is to try and make a convincing case by persuasion. And as part of that persuasive strategy one would also have to backpedal a bit and modify the explanation to a hypothesis that would have the advantage over other hypotheses of telling a good tale, one that gives sense, meaning, and direction to a sequence of events.

To claim more would also be counterproductive and self-defeating in a most deplorable way: because we know, once the idea of the *possibility* of FNs around 1700 has been established and validated, that this possibility remains bubbling under and then increasingly tries to realize and materialize itself. And it is exactly this *striving against certain medial forms* that makes this phenomenon so fascinating – a fact all too easily obscured if one plays the historical blame game.

When we set out with our *Narrating Futures* project, it seemed an obvious idea to complement the volume that sketches out a *general* theory and poetics of FNs with several others that would show how FNs are characteristically refracted through the different media. We have stuck with this plan and the result of it are

volumes 2 to 4 of this series, with the corpus investigated in volume 5 constituting an interesting borderline case.

What even the most cursory overview of the media history of the last 250 years or so will reveal is that this *systematic* layout displays also an unmistakable *media-historical dimension*. As FNs push through the media of printed book, film, video, and DVD to fully orchestrated electronic media in which most sophisticated, multi-path games and simulations can be run, we can perceive that the space of possibilities for FNs is becoming wider and wider. In other words: the history of the evolution of FNs can itself be told as a PN with the implied telos of increasingly producing structures that, in turn, increasingly enhance the nodal power of nodes within these FNs.

But not only that: we also see that the evolutionary drive of FNs not only transcends media demarcations, but redefines or even totally obliterates them. And could it be otherwise? If genres and media are historical, why should their boundaries be eternally stable and ahistorical?

It would be a great disservice to research to underestimate what can be learnt from a detailed, theoretically informed study of FNs in pre-electronic media, for it is exactly here that we can observe what is possible and what isn't, given the materiality of a certain medium. If FNs by necessity need a medium, we must never forget that the medial constraints work on the concrete form which any FN can attain at a given point in time. Enabling and constricting at the same time, media are the riverbeds in which the evolutionary flow of FNs can run. The richness of the material presented in the following volumes and their profusion of substantial readings testify to our conviction that, if the general idea of a FN can be established from the overall corpus of narratives that have at least one node, it is, of course, in its concrete medial realizations – and only there – that we find its intriguing reality.

It is easy to see why any discussion of the possibilities and restraints certain media hold for FNs should be reserved for the following volumes of this series. But maybe it makes sense to turn one's back to the future one last time and to take the long, the very long view, and try to ascertain what exactly we are looking at when we claim to be looking at a totally new corpus, expressive of our recently won capability to envision and experience the future as open, undecided, and multiple. Let us do a quick and totally irresponsible run-through of the future-relevant medial changes in the history of mankind, unabashedly partisan. And let us begin – why not? – some 30,000 to 100,000 years before our time (if not earlier...).

The medium of spoken human language constitutes a breaking out of, or an escape from, the *prison-house of the present moment*. Once we have speech, we are no longer confined to what is immediately around us. We are no longer con-

fined to just pointing at objects that are presently there, that is, *here*. Instead, speech allows us to also speak about things that are *no more* as well as about things that are *not yet*.

But that means, at the same time, that language allows us to speak not only about objects, but about *concepts*. Not, for example, about that one particular table over there in the corner and at which I can point – but about tables in general, or anything in general. And not only does it allow us to form concepts that are abstractions from physical objects, it also allows us to form abstractions that have no concrete, unified physical counterpart in outward reality, that is, no object that you could point at if you wanted to indicate one specimen of that class, like an instance of ‘table’. Think of ideas like freedom, justice, love, or fear; or relationships like ‘bigger than’ or ‘smaller than’ or ‘equal’; or negations; or causal relationships, etc. Spoken human language not only liberates us from an eternal present, it is also the indispensable precondition for conceptual thinking.

So even in a non-philosophical or non-religious way, there is truth in the phrase, “In the beginning was the word.” (*Gospel of John*, 1.1.) But when did all this begin? When do we date the origin of language? Experts like Palaeolinguists – but also experts from the fields of Biology, Socio-Biology, Anthropology, and Neurology – are unanimous in saying that the origin of human language is extremely difficult to date, one of the reasons being that only the bone structures are preserved in human fossils. Therefore, although the size of the jaw and of the oral cavity may be measured if these are preserved, we still have no exact idea of the form and size of the tongue, larynx, and pharynx of our pre-historic ancestors. Reconstructions of human speech organs based on human fossils are largely hypothetical, and the evidence is never 100% conclusive.

While it is unlikely that *Australopithecus* (a hominid living some 4–5 million years ago) could speak, the evidence for Neanderthal man (70,000 – 35,000 B.C.) is ambiguous. And when experts say that human speech emerged either some 50,000 to 30,000 years ago (Cro-Magnon man, Upper Palaeolithic) or maybe some 100,000 to 20,000 years ago, the very magnitude of the spans of time we are looking at already indicates how unsure we are about this.

The whole picture is further complicated by the fact that some physiological developments that had been thought essential for human speech formation, like the descent of the larynx, turned out to be not that essential after all: a descended larynx, for example, can also be found in other life forms (like maritime mammals, or large deer) that don’t have something like human language. But if such speech organs are not the decisive factor – logically: not sufficient, though necessary –, what is the decisive factor? Let us put this on the backburner, for the moment.

What we *can* say, however, is that the development of human speech organs comes with a whole army of *disadvantages*: less efficient breathing, less efficient chewing, and less efficient swallowing. As David Crystal argues, “The survival value of speech must be considerable to compensate for such deficiencies.” (291) There has got to be something to balance off these evolutionary disadvantages, something really big and of high survival value, and there is: it is the advantage to be able to communicate with others in a totally revolutionary way – efficient, quick, differentiated, precise, and in a time-space that has developed different dimensions.

Humanity has passed the test of time (so far), for all the disadvantages mentioned by Crystal are more than just balanced off by this one great, overarching advantage that human speech offers: by language, we have triggered a *social and cultural evolution* that builds upon biological evolution, with the one big difference that this social and cultural evolution, made possible by language, runs incomparably faster than any biological evolution, because it is not based on chance mutations and deep-time selection. It is an evolution to the power of *n*. That is why the origin of human language is the point of take-off in the evolution of mankind, which from this point on is no longer solely a biological evolution, but a cultural one – it is the beginning of *history*.

But when is a language a human language? Is there really such a radical difference between our way to communicate by manipulation of signs on the one hand and various animal languages on the other? Enormous progress has been made in the teaching of other primates, who can then manipulate signs that are given to them. But we have no uncontroversial evidence that these primates are more than just able to reproduce something they’ve been taught, that they are able to creatively form or develop such language systems themselves, that is, that they are able to creatively invent sounds or objects that stand *for something else*. And, or so it seems, they cannot form *new* meaningful sequences, *new* sentences. That seems to be the defining difference: humans can creatively form correct and meaningful sentences *that we have never heard before*.

What is more: even taught primates cannot ask *questions*. It is not at all a complacent idea, but a radically critical one to ponder that the answer to the question, ‘What makes a language a human language?’ most probably is: it is the capability to produce new sentences that have never been formed before (which means: to be creative) *and* the capability to ask *questions*. That is what makes you human. To speak new sentences (not just to mechanically reproduce known ones) – and to question.

But there is still one essential element missing with regard to the accelerated cultural evolution of mankind. The main reason why we cannot really date the origin of language is, of course, that we have no written records of that time.

And that is exactly the missing component: *writing*, the transcription of oral signs into symbols marked on paper or some other surface – the transcription of the medium of human speech into another medium.

About that dating we can evidently be more sure, though the time-gap, even under the most optimistic assumptions, is still considerable: “Human language seems to have emerged within a relatively short space of time, perhaps as recently as 30,000 years ago. But that still leaves a gap of over 20,000 years before the first unequivocal evidence of written language.” (Crystal 291) Or should we not say *far* over 20,000 years? For even if language comes in 30,000 B.C. at the latest, then we still have to wait for at least some 26,000 before the first signs of writing occur: first fully developed systems of writing can be identified ca. 3,200 B.C. in Mesopotamia, possibly 3,400 B.C. in Egypt, and around 1,200 B.C. in China.

What exactly is the evolutionary advantage of writing? In short, it can be said to consist in creating a *language to the power of two*. Oral communication already frees us from the prison-house of the present moment, but not totally so, for, before long-distance communication, you could only talk to somebody who was within hearing distance. It is only through this transposition of one medium (human speech) into another (writing) that language is no longer dependent on the co-presence of another, which means that, for a second time, the confinement of simultaneity is exploded – this time on the reception side. The new medium constitutes a second breaking-out of the prison-house of the present moment, because, unlike spoken language, the new medium preserves and stores. Knowledge can now be passed on irrespective of the co-presence of the partners in communication. A tradition can begin that, unlike orally passed-on tradition, does not have to rely on the physical contemporaneity and co-presence of your addressees. And from that point on, when humanity did not have to rely solely on co-presence any longer, the space of communications expanded enormously, for it now contained everything that had ever been committed to writing *and* was within my reach (note: we’re still talking pre-electronic times). This alone accelerated the speed of the cultural evolution of mankind like nothing had done before. Every new generation could stand upon the shoulders of a giant – the giant being the cultural achievements of their civilizations as committed to a material medium and preserved there. Let us face it: biologically, our outfit is still pretty much like 30,000 to 50,000 years ago – we may be less furry, we may have fewer teeth –, but basically, we’re still the same. The difference between us and our ancestors is basically in the cultural knowledge that we have accumulated and that has been passed on in human society *by virtue of writing*.

It is not essential for my line of argument, but interesting to know that the large-scale introduction of that unprecedented medial revolution came in for

some fairly heavy criticism in ancient Greece, and by no less a person than Socrates. As recorded in Plato's *Phaidros*,

Socrates had three reasons against writing:

1. Spoken language is alive – it is dynamic, it displays intonation, melody, rhythm, emphases, modulation, etc. By way of contrast, written language is dead. And written words cannot be held to account – you can't talk back to a text, you can't discuss with a text. Therefore, the written text strikes at the core of Socrates' philosophical practice, which aimed at bringing out the truth in a *dialogue* between teacher and student.
2. Writing destroys your memory. You write something down and then you forget it. Writing is a great obliterater.
3. In writing, we lose control over language, control over how this or that is correctly to be understood, because if everybody reads for themselves, then everybody can make up their own mind what it means. Socrates was worried about that, because he believed in the One Truth.

Compare this last point to Kant's idea that it is exactly in the *communal, public use of reason* – a practice planted, however, in a *script* culture, if there ever was one – that the self-emancipation of both individual and body politic can take place, and it becomes obvious that, from the point of view of power and interpretational hegemony (*Deutungshoheit*), script cultures and communities have both centripetal and centrifugal tendencies. On the one hand, dominant sections of script cultures would love to have a monopoly on readings, but that invariably has proved hard to implement. Even monotheistic religions like the Mosaic faith, Christianity, or Islam have produced various sects and denominations that each base their right to separate existence on differing interpretations of one and the same text. This is not to say that religious wars do not have their causes in inequalities and injustices – they do –, but they are also wars of hermeneutics, wars about the right to read differently.

Considering the plurality of modern society, reflected in a plurality of texts and in a plurality of readings of these very texts, it is hard not to agree that Socrates, in a way, was right: of course, reading and writing for everyone opens a box with largely unforeseeable consequences. At the same time, one should not forget that Socrates was sentenced to death because he based virtue in the individual, so that, not in this respect alone, Kant can be seen as bringing Socrates to completion. Writing is definitely not a medium for purveying the One Truth; however, for a long time, because of its accessibility and built-in tendency to individuation, it has been *the* medium for spreading multiple truths and encouraging truth-as-process.

The *Narrating Futures* research project has never been about how different media affect the human brain – such questions have remained outside the scope of our inquiries. However, if we try to ascertain how conducive different media are to producing nodal structures, how easily they lend themselves to this, it is pertinent to also register to which extent a certain medial use transforms, in turn, the one medium we use to engage with the world and our position in it: viz., the human brain, especially so if this feedback concerns the human brain's capability to produce *futures*. Let it not be misunderstood as an (unnecessary) last-ditch defence of the 'outgoing' medium of writing (and its complement of reading), when I summarize brain research into the effects of reading, into how the different parts of the human brain are activated, stimulated, and changed by reading, as follows:²⁸ brain scans show there is no other activity that stimulates the human brain as much as reading. Reading is like visiting a mental fitness studio – you develop mental muscles, as new connections between your brain cells are formed and the speed at which you respond to stimuli increases significantly. As reading happens so much faster than speaking, the immediate cognition of symbols, or automatized reading, gives us time for high-speed thinking (cf. 54); the physiological basis for this, the myelination of the axons of neural cells in the brain (the impulse from the neuron is emitted the faster, the more myelin the axon has) is laid between ages 5 and 7 – that is when 'the high-speed internet in your brain' is built (cf. 94–95). Fluent reading unites all the cultural, biological, and intellectual stages in the evolution of reading, and at the same time it recapitulates all the cognitive, linguistic, and affective evolutionary stages in the natural history of the reader (cf. 143). There are significant differences between brains that read and brains that don't. Reading triggers the building of structures in your brain that otherwise simply would not exist (cf. 161–162).

These are structures that the human brain forms as it engages with 'things that are not there', with the abstract medial representation of other medial representations. For in the most basic sense of the word when we read *what* we read about is never 'there', or *here*, just as language gives us the chance to speak about things that are *not* – not any longer or, much more fascinating, *not yet*.

Now is the time to return to the question raised above, the one about the essential speech organ of humans, the one that makes the difference. It is *the human brain*. In part 1.18 of this volume, we gave a quote from Daniel Gilbert's enticing *Stumbling on Happiness* which shall here be repeated:

²⁸ This largely follows Maryanne Wolf's *Proust and the Squid: The Story and Science of the Reading Brain*; page references in this section are to this monograph.

For the first few hundred million years after their initial appearance on our planet, all brains were stuck in the permanent present, and most brains still are today. But not yours and not mine, because two or three million years ago our ancestors began a great escape from the here and now, and their getaway vehicle was a highly specialized mass of grey tissue, fragile, wrinkled and appended. This frontal lobe – the last part of the human brain to evolve, the slowest to mature and the first to deteriorate in old age – is a time machine that allows each of us to vacate the present and experience the future before it happens. (15)

That is why the human brain is an “anticipation machine” (Daniel Dennett) and why “making future” is the most important thing it does. That is the absolutely indispensable neurological precondition for speech, not the other speech organs (that we share, to a degree) with other animals – speech organs are necessary, but not sufficient: what you need is a sufficiently developed nervous system. Then, and only then, can you have language – and the future, which is all there isn’t and never was.

But the time-line we’re looking at is crucial. Some 2 to 3 million years ago, we developed frontal lobes and thereby, for all we know, the capability to leave an eternal present. But we wanted the medium to communicate that new dimension of existence. We wanted it for a very, very long time. Because only some 50,000 to 30,000 years ago, we developed language, able to express that which cannot be pointed at. And only some 5,200 years ago (i.e., around 3,200 B.C.) we developed writing. Two media, one building upon the other to geometrically increase its communicative power, that are designed to deal with *what is not there* – and what that entails: our fears as well as our hopes. (And the irony of getting it wrong most of the time.)

Today, new media transport these fictions of the human mind, all these discourses on *things that are not*, but that can be *imagined* – “the human mind’s imaginings” (P.B. Shelley, “Mont Blanc”). Imagination – *Vor-stellung* – is all about things that are not ‘really’ there. Today, we have the medial possibilities to communicate not only about uni-linear processes, but about the future time-space that is filled, indeed opened up and unfolded by multiple continuations. We have, at long last, the media to express and demonstrate and experience the multiplicity of that imagined space: *futures* – the multiplicity that at any moment feeds through the needle’s eye of any present node to morph into actuality. For this, language and writing have been absolutely indispensable prerequisites (without them, we would not even know what we talk about when we talk about ‘spaces of possibilities’ – would we?). But it is likely that not for the first time in the evolution of mankind a medium had been lacking for a certain (albeit here rather *short*) period of time, when the need had already been apparent for a while. The media-historical moment of the emergence of a fully blown corpus of *Future*

Narratives is exactly the lapse between their initial abstract possibility (around 1700) and their breakthrough emergence in the latter third of the 20th century.

Quite decidedly, the world is *not* everything that is the case. The world is not simply the sum total of everything there is and everything there ever was. We left that stage 3 million years ago. Don't trust people who tell you otherwise. They're still sitting up in their trees. The world is everything there *is*, ever *was* – and *will be*. It is present, past, *and* future. And that third part may well be the most exciting one. It's the one that our brains started to produce long before they found a linguistic medium to communicate it to others. It isn't so long ago that we discovered the future doesn't have to be linear, just because, retrospectively, we imagine the present to be a point in time that could be reached by one route only. It doesn't have to be. And we are looking for new media to express this. We are looking for media that allow us *the narrating of futures*. If 'making future' is what defines us as humans, then research into *narrating futures* is right where it's at: *it is looking right at the core of what it means to be human.*

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