

Limitless as a neuro-pharmaceutical experiment and as a *Daseinsanalyse*: on the use of fiction in preparatory debates on cognitive enhancement

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Abstract *Limitless* is a movie (released in 2011) as well as a novel (published in 2001) about a tormented author who (plagued by a writer's block) becomes an early user of an experimental designer drug. The wonder drug makes him highly productive overnight and even allows him to make a fortune on the stock market. At the height of his career, however, the detrimental side-effects become increasingly noticeable. In this article, *Limitless* is analysed from two perspectives. First of all, building on the views of the French novelist Emile Zola, the novel is seen as the report of a closely monitored experiment. Subsequently, building on the phenomenology of Ludwig Binswanger, I will show how the cognitive enhancement drug not only boosts the protagonist's information processing capacities, but also modifies his experience of space and time, his sense of spatiality, his way of being-in-the-world. On the basis of these (complementary) analyses I will indicate how genres of the imagination (such as movies and novels) may play a significant

role in assessing the societal implications of emerging technological developments such as neuro-enhancement, especially during the preparatory or anticipatory stage.

Keywords Cognitive enhancement · Neuro-enhancement · *Limitless* · The experimental novel · *Daseinsanalyse* · Neuro-ethics · Philosophy of Technology · Philosophical anthropology

Introduction

Limitless is a movie (released in 2011) about a tormented author named Eddie Morra (Bradley Cooper) who lives in Manhattan and is plagued by a mid-life crisis. After having finally received his first book contract for a novel, he runs up against a writer's block. Seated in front of his laptop, in his destitute apartment, while his publisher is becoming increasingly impatient, he keeps waiting for inspiration, but nothing happens. To make matters worse, his girlfriend decides to dump him. While taking a stroll, Eddie bumps into his one-time brother-in-law named Vernon Gant, a former drug dealer. In a bar, Vernon offers Eddie a tiny white unmarked tablet, a designer drug¹ known as NZT, which Vernon claims to be FDA approved and about to become legally available.² Reluctantly, Eddie takes the drug, but the

This paper is based on lectures presented in Oslo, Nijmegen, Apeldoorn and Cascais and profited from discussions with Pieter Lemmens, Roshan Cools, Trijsje Franssen, Laurens Landeweerd and others.

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¹ “There’s a lot of hype about smart drugs—you know, enhance your cognitive performance, develop rapid mental reflexes, all of that—but most of what we call smart drugs are just diet supplements, artificial nutrients, amino acids, that kind of thing—designer vitamins if you like. What you took was a designer drug” (Glynn 2001/2011, p. 41).

² It doesn’t have a name yet—I mean it’s got a laboratory tag, but that’s just letters and a code. They haven’t come up with a proper name for it yet. They’ve done all the clinical trials, though, and its FDA approved (idem, p. 14).

effects are astonishing. The visual world becomes much more noticeable and intense, notably that “sparkling third dimension”, the city at night (p. 21). He feels like a different person (p. 36) and all of a sudden, his writer’s block is cured. Instead of “freezing up” (p. 36) in front of his computer screen, he becomes a prolific author overnight, producing something like 11,000 words of lively prose a day. As Vernon points out to him, NZT (or MDT, as it is called in the novel) is a cognitive enhancement drug, allowing users access to their full brain capacity, instead of the usual 10 or 20 %. When shortly after their meeting Vernon is killed by an incensed client, Eddie manages to secure a substantial portion of Vernon’s pills and decides to drop novel-writing in order to play the stock market, where (due to his astonishing capacity for processing enormous amounts of information at a very high pace) he quickly makes a stellar career,³ until he is invited by Carl van Loon (Robert De Niro), one of the big names of the New York money scene, to come and work for him. While being involved as a key financial expert in one of the biggest mergers in New York corporate history, working his way through financial and legal files of staggering complexity and size (“long sections of dense type, endless pages of tables and charts and graphs”, p. 138), the side-effects of his wonder drug begin to become noticeable as well, in the form of nausea, a diffused sense of time, and black-outs. Gradually, it dawns on him that he has become an NZT-addict. In fact, the movie begins in media res, with Eddie standing in front of his luxury penthouse, on the top floor of a Manhattan skyscraper, deliberating whether he should jump—apparently the only route of escape out of an impossible cul-de-sac.

As a movie addressing cognitive enhancement, *Limitless* is far more intriguing and multi-faceted than this brief resume may perhaps suggest. Moreover, the movie is based on a novel entitled *The Dark Fields*, written by Alan Glynn and published in 2001 (while being republished as *Limitless* in 2011). Taken together, as complementary documents, *Limitless* the movie and *Limitless* the novel provide an interesting window into the various issues raised by cognitive enhancement. Not only because they make these issues accessible and tangible for broader audiences of non-experts in a lively and entertaining fashion, but even more so because (as I will argue in this paper) they open up important dimensions that allow us to add some extra depth to the philosophical and bioethical debates that have evolved so far. In other words I will show how movies/novels such as *Limitless* can play a crucial role in “preparatory ethics”, assessing fields of technology (such as

cognitive enhancement) that are still in their infancy (Ferrari et al. 2012).

My analysis of *Limitless* will notably focus on two key aspects. First of all, in the movie, but even more so in the novel, the vicissitudes of Eddie Morra as a designer drug-addict are literally presented as a scientific field study—as an extramural *experiment*. In various ways and on various occasions, the main protagonist is staged as a human subject in a psycho-pharmaceutical research trial, whose mental and physical responses to prolonged drug intake are meticulously monitored, not only by himself (as the author of the autobiographical retrospect which the novel purports to be), but also by a big pharmaceutical company who uses individuals like Eddie as human ‘test animals’ in their informal (and illegal) pre-clinical trials. To analyse this dimension, I will notably build on the work of Émile Zola (1840–1902) who, in an essay entitled *The experimental novel*, claims that, in terms of basic structure and design, novels and experiments have much in common, exposing key protagonists to a variety of stimuli and conditions in a systematic manner, while carefully registering their responses (Zola 1880/1923). Seen from this perspective, *Limitless* exemplifies Zola’s concept of the ‘experimental’ novel, while addressing topical scientific issues of today.

Moreover, in outlining the impact of the wonder drug NZT on human functioning, both the movie and the novel not only focus on the brain as a kind of supercomputer that is presently being opened up with the help of MRI-scans, neuro-pharmaceuticals and similar developments—thus becoming exposed to our desire to improve ourselves. Along more phenomenological lines, these documents also focus on Eddie Morra’s way of being-in-the-world, notably his experiences of space and time. It is shown how, rather than merely boosting our intelligence and information processing capacity, NZT as a designer drug also affects the sense of spatiality and temporality of its consumers. In the course of the movie/novel, it is the protagonist’s sense of space and time that is being dramatically modified. Thus, the focus of movie and novel gradually shifts from *brain to world*. In order to analyse this dimension, I will notably build on Ludwig Binswanger’s phenomenology of spatiality (Binswanger 1942/1962, 1949). Whereas the experimental dimension allows us to read the novel from a third-person perspective, closely following the research subject’s responses to the various conditions to which he is exposed, the spatial-temporal dimension allows us to assess the movie/novel from a first-person perspective, reading it as the account of a *Daseinsanalyse* rather than as an experimental trial. Indeed, it is the combination of these two complementary perspectives that will allow us to determine the basic relevance and ‘message’ of *Limitless* for current debates.

The structure of the article is as follows. First of all, I will briefly outline the existing scholarly debate on

³ Armed with his laptops (plural), he seemed “some kind of Frankenstein monster, [unleashed] into Cyberspace” (p. 96), a “one-man panzer division” (p. 98).

cognitive enhancement, paying special attention to the views of Peter Sloterdijk (“[Introduction](#)” section). Subsequently, I will interpret movie and novel from an experimental perspective, building on the conceptual framework of Émile Zola, as outlined above (“[Cognitive enhancement: a brief overview of the scholarly debate so far: post-humanism, bio-conservatism and the work of Peter Sloterdijk](#)” section). Next, I will subject movie and novel to a *Daseinsanalyse*, building on the conceptual framework of Ludwig Binswanger (“[Being on MDT: Limitless as an informal neuro-pharmaceutical experiment](#)” section). And finally, I will combine both perspectives to address the question how genres of the imagination (such as movies and novels) may further (or even ‘enhance’) our preparatory philosophical and bioethical deliberations over cognitive enhancement issues (“[Limitless as seen from a phenomenological perspective](#)” section).

Cognitive enhancement: a brief overview of the scholarly debate so far: post-humanism, bio-conservatism and the work of Peter Sloterdijk

Until recently, the debate over cognitive enhancement (or neuro-enhancement, I will use both terms as synonyms in this paper) was dominated by two diametrically opposed views. While ‘post’ or ‘trans’-humanists such as Bostrom (2005) and Bostrom and Sandberg (2009) embraced the idea of a radical re-sculpturing of human nature through the application of science and technology, the so-called ‘bio-conservatives’, including authors such as Habermas (2003) and Kass (2003), principally opposed technological interventionism, highlighting the risks and dangers involved for humanity. More recently, this polarised debate, often focussing on dramatic and fairly futuristic utopian or dystopian thought experiments, has tended to give way (in the bioethical literature at least) to more realistic, perhaps even trivialised deliberations, focussing on the occasional intake of smart drugs (such as ritalin, methylphenidate and modafinil) by certain segments of the population (notably university students; see for instance Outram 2010, 2011).

One of the authors for whom cognitive enhancement represents a major issue of concern is Francis Fukuyama (2002). In his philosophical best-seller *Our Posthuman Future* he argues that, as a result of advances in neuro-pharmacology, we may discover that human personality is much more plastic than was formerly believed. Smart drugs or mood enhancers such as Prozac and Ritalin allow us to strengthen traits like self-esteem and the ability to concentrate. In the future, personalised genomics will permit pharmaceutical companies to tailor drugs to the genetic profiles of individuals so as to improve mental functioning. This will mean that “stolid people can become vivacious;

introspective ones extravert; you can adopt one personality on Wednesday and another for the weekend. There is no longer any excuse for anyone to be depressed or unhappy. We can make ourselves happier without worries of addiction, hangovers or long-term brain damage” (p. 8). Whereas some may see this as furthering the cause of individual self-realisation, others may argue that, in the context of the 24 h non-stop economy and intensified cognitive competitiveness in a globalised environment, such a development rather amounts to intense exploitation of human resources, in the context of which the exploitation of bodies increasingly gives way to the exploitation of brains (“cognitive capitalism”, Boutang 2007).

A unique position in this debate has been taken by Peter Sloterdijk, who places cognitive enhancement in a broader temporal perspective, seeing it as a new chapter in a long history self-labour and self-improvement, a key dimension of the human condition. In his recent book *Du musst dein Leben ändern* [You must change your life] (2009) he argues that human beings have always been unsatisfied with themselves. This chronic discontent, not only with culture, but also with ourselves as individuals, has unleashed a plethora of experiments, the compilation of which we call human ‘history’. Although neuro-enhancement may be new, enhancement as such has been a key motif in human activity since time immemorial. So far, however, we notably relied on training and exercise, in combination with the use of various tranquilizing or stimulating drugs, but in the current era, more targeted techniques are being developed to influence cognitive performance in a more direct and effective manner.

For Sloterdijk, the will to improve ourselves represents the ‘vertical’ dimension of human existence. Whereas other animals basically focus on survival and pro-creation (that is: on the continuation or propagation of their specific life-form along a ‘horizontal’ axis), the drive to surpass and transcend ourselves (both individually and collectively) can be seen as typically human. Our focus on self-improvement, however, must not be regarded as a kind of ontological ‘privilege’ of human beings as ‘rational’ animals who ‘have’ something which other species lack, namely a ‘rational soul’, or something like that. Rather, our desire to improve ourselves must be regarded as a symptom, a compensation for our basic deficiencies as *Mängelwesen*. We are born prematurely into this world, and are bound to remain ‘unfinished’ animals, so that we have to rely on self-labour and self-improvement for survival. One could say that, in the course of history, this strive towards self-improvement became increasingly successful, even to the point of becoming excessive. Our deficiencies have been overcompensated as it were. In other words, for Sloterdijk, self-enhancement as such is part of human nature. Human beings are to a considerable

extent man-made, and our neurological networks are sculpted by our socio-technical environments (consisting of books, computers, mass media and the like),⁴ although certain novel features of cognitive enhancement will pose new questions that must be addressed.

For my analysis of *Limitless*, two aspects of Sloterdijk's views are particularly helpful. First of all, the connection between self-enhancement and experimentation. The dependence on self-improvement evokes in us an experimental attitude towards life.⁵ Building on Nietzsche,⁶ Foucault and others, Sloterdijk argues that, in the course of millennia, we have always been our own research subjects, our own test animals, and human history must be seen as the aggregate of countless instances of self-experimentation. By exposing ourselves to rigorous training schemes, for instance, we may develop unprecedented skills, so that remarkable feats of virtuosity (in art, science, mathematics, athletics, and the like) may suddenly come within reach. Along similar lines, we have subjected ourselves since time immemorial to experiments with all kinds of substances that affect mood, libido and level of arousal. It is against this backdrop of consistent auto-experimentation that new options for cognitive enhancement must be assessed.

A second important aspect is his emphasis on the vertical dimension of human existence, the dimension of height, which calls for what he refers to as a 'height psychology' (*Höhenpsychologie*), in contrast to depth psychology (*Tiefenpsychologie*; 2009, p. 176). His focus is on peak experiences of individuals. At a certain point, Sloterdijk refers to Ludwig Binswanger's phenomenological analysis of *Master-builder Solness*, a play by the Norwegian playwright Henrik Ibsen, published in 1892, about a frantic and ambitious architect who, apparently as a compensation for his acrophobia (his fear of heights), increasingly falls victim to a kind of acrophilia, an incessant drive to design and build excessively high buildings and towers (2009, p. 253 ff.). In the final act, he is challenged to climb a church tower which he had recently erected. While doing so, he is suddenly overwhelmed by a fit of vertigo, loses his balance and crashes. For Sloterdijk, building on Binswanger, Ibsen's ruthless, but at the same time vulnerable

architect exemplifies the vertical dimension of human existence as such: the (disconcerting, at times even lethal) desire to transcend ourselves, to move far beyond our natural restrictions, even if this means that we are likely to fall victim to our hubris, to our thirst for heights. In the next two sections, I will use both aspects (the idea of self-experimentation as well as the idea of verticality as a basic dimension of the human condition) to structure my reading of *Limitless*.

Being on MDT: *Limitless* as an informal neuro-pharmaceutical experiment

'So, Eddie,' Van Loon said, 'What's your secret?'
'Medication,' I said at once. 'I'm on special medication' (p. 129)

In his essay *The experimental novel* the French novelist Zola (1880/1923) discerns a basic similarity between writing novels and conducting experiments. Inspired by Claude Bernard's highly influential manual *Introduction to the study of experimental medicine* (Bernard 1865/1966), Zola explains that novels exhibit an experimental design, consisting in the systematic and rigorous exposure of literary characters (with their personality traits, cultural backgrounds, professions, age, gender, etc.) to various conditions, in order to study their responses as meticulously as possible. The novelist does not merely *describe* the world as it presents itself to us, but actively *intervenes*, confronting literary characters with a number of challenges of the author's own design. Thus, novels (or other literary genres, such as drama) may contribute to our body of physiological and psychological knowledge. Indeed, the experimental method will put novel-writing on a scientific footing, so that novels may function as literary laboratories, where social phenomena may be systematically analysed. To achieve this, the experimental novel must convey the same sense of detachment and precision as scientific research reports.

Zola's ideas have been criticised from the very outset. Apparently, his critics argue, the author fell victim to the prestige of science in the 1880s, siding with the scientific rather than with the romantic world-view. This struggle between scientific experiments on the one hand and romance on the other had already been depicted in a rather lively manner by the Russian novelist Ivan Turgenev in his classic *Fathers and Sons* (1861/1965), where the aesthetic romanticism of the 'fathers' is played out against the pallid scientific realism of the younger generation, notably represented by Yevgeny Bazarov, a student of physiology who, according to Frolov (1938/1970), was actually modelled on the Russian physiologist I. M. Sechenov, author of

⁴ For Sloterdijk, the omnipresence of words, symbols and numbers in our life-world (our highly symbolical environment, that is), not only stimulates and facilitates intelligent behaviour, but has had a noticeable impact on the shape, density and flexibility of our neurological networks: the bio-electrical landscape of our brain.

⁵ This idea is notably developed in an ego-document (a dialogue about his work) with the telling title *Selbstversuch* (1996), see for instance: "[Mit seinem eigenen Leben] experimentieren, das ist die Art und Weise, wie Individuen von heute ihre Modernität ausreagieren ... Die Welt ist alles, womit wir experimentieren" (p. 14).

⁶ Notably his understanding of life as an intellectual experiment: "Jener Gedanke, daß das Leben ein Experiment des Erkennenden sein dürfe" (Nietzsche 1882/1954, II 324, pp. 187–188).

a book entitled *Reflexes of the Brain* (published in 1863). Moreover, in a review, Brunetière (1880) accuses Zola of a profound misunderstanding of what an experiment is. For although Bernard indeed puts much emphasis on the (active) role of the researchers, using their hands as much as their eyes, he also makes it clear that an experiment can only genuinely be considered as such if it is conducted under rigorously controlled circumstances: preferably inside a professional laboratory or a university lecturing hall, with real live animals (In Bernard's case usually rabbits or dogs) rather than, as in Zola's case, with imaginary human subjects.

To my mind, however, these criticisms do not really kill Zola's core idea. Notwithstanding some obvious differences between novels and experiments, the similarities are at least as intriguing, notably in view of the fact that the two culture theorem (regarding novels and laboratories as representing two completely separate worlds) is still highly influential. Although literary authors indeed use their imagination to probe and explore the possible responses of their characters to the interventions they have in stall for them, the basic affinity in terms of design is nonetheless still there. Novels as well as experiments set out to answer the basic question *What would happen if?* And whereas in the case of an experiment the plot or outcome is supposed to be beyond the experimenter's control, this to a certain extent applies to novels as well, as authors often do not know beforehand how their novel will end. A plausible answer to the question *What would happen if?* can only be provided by the narrative as such, which to a certain extent 'tells itself', so that narrative coherence and plausibility become indicators of truth—or at least of credibility. Finally, last but not least, countless novels (and other literary documents, such as plays and film scripts) have been written that explicitly purport to be the account of an experiment, from Daniel Hawthorne's classic story *Dr. Heidegger's experiment* (1837/1993) via (for instance) Georg Büchner's timeless play *Woyzeck* (on biomedical research into the relationship between food, cognition and behaviour) up to a whole series of contemporary literary documents, including *Limitless*. In many of these documents, Zola's idea is brought to life and its validity seems to be proven, often in a very convincing way. What happens if *Limitless* is analysed in this manner, as an experiment? To what extent does Zola's idea allow us to bring some of the novel's core aspects to the fore?

Already in *Limitless-the-movie*, the experimental set-up is clearly discernible. The question basically is, what designer drugs such as NZT/MDT will do to people, in terms of alertness, attention span and ability to process large amounts of information, but also in terms of their careers, their sense of identity, their relationships. Thus, the movie unfolds as a carefully designed and monitored

experiment, with Eddie playing both the role of the research subject and the role of the observer. Initially, the outcomes seem quite beneficial, with Eddie suddenly producing many pages of fluent prose on a daily basis. Gradually, however, certain side-effects become increasingly noticeable, such as withdrawal symptoms and a disintegrated sense of time. These side-effects are meticulously described as well.

In *Limitless-the-novel*, the experimental set-up is even more outspoken (although NZT is now called MDT-48). From the very beginning, this nootropic drug is introduced as the product of an experimental procedure, although Vernon initially claims (as was already pointed out) that the trials had already been performed ("They've done all the clinical trials, and its FDA approved", p. 14). Eddie then decides to try the new drug on himself, and it seems to work miracles. MDT-48 is described as steroid for the intellect (p. 278) and (in the movie) as Viagra for the brain. Indeed, Eddie becomes a high performer, no longer disappointing everybody. Indeed: "with MDT-48, the future was no longer an accusation or a threat" (p. 145). And in the description of these changes, a neuro-centric perspective is dominant. The brain emerges as kind of a super-computer whose biochemistry can be boosted by nootropic pharmaceuticals ("I was processing a huge amount of information", p. 122, p. 131; "My mind was a living fractal", p. 123; etc.). Gradually, however, the negative consequences announce themselves as well: nausea, an increasingly blurred continuum of waking time, withdrawal effects such as malaise, migraines, panic attacks and black-outs and, in the longer run, serious irreversible brain damage.

As the novel progresses, it becomes increasingly clear that the idea of an experimental design is more than simply a metaphor. In fact, Eddie discovers that he really *is* a research subject in a trial: albeit in an 'informal' (and therefore illegal) one, conducted by a big pharmaceutical company called Eiben-Chemcorp, outside laboratory settings, using self-reports by early users to improve the drug and make it ready for the more formal clinical trials (based on informed-consent procedures) that are to be conducted at a later stage. Eddie is informed that earlier waves of informal testing had already taken place in the United States,⁷ but MDT is different and more effective. The effects of MDT on consumers are fairly predictable: there is a sudden leap forward in the career of the persons concerned until, suffering from withdrawal problems, they

⁷ "Series of trials had been done on an anti-depressant drug in the early Seventies, similar to LSD—trials that had gone disastrously wrong. There were rumours floating around in the mid-Eighties that research had been taken up again. These trials were unofficial" (p. 310).

become seriously ill and die. When Eddie becomes too inquisitive, and even decides to contact a famous lawyer, the company suddenly decides to drop him.⁸ They take the pills away from him, so that his neurological and physiological system quickly deteriorates.

This means that, in the course of the novel, a disconcerting switch takes place. Initially, it is Eddie himself who is watching his own experiment, describing and assessing his own decisions as well as his subsequent responses. The novel thus portrays a situation of self-experimentation: a subject taking an experimental attitude to life. At a certain point, however, Eddie notices that he is *being* monitored, *being* watched. He now finds himself in the visual field of a panoptic other, of Eiben-Chemcorp as a neuro-pharmaceutical Big Brother. Instead of being a self-conscious subject, and the author of his own life story, he is suddenly transformed into an ‘object’, someone who is exposed to the gaze of a powerful, intervening other.⁹

In this new situation, Eddie describes himself as a test animal (“I felt like a cornered rat”, p. 225) and towards the end, when death is approaching and the auto-biographical report is almost finished, this is how he sees his life-story, namely as “the story of a human lab rat ... who was tagged and followed and photographed, and then discarded” (p. 340). In other words, although the novel purports to be an ego-document (an autobiographical retrospect), the experimental set-up basically reflects a third-person perspective: the panoptic gaze of a powerful company, monitoring their research subjects like laboratory organisms, focussing on the enhancement and, subsequently, on the deterioration of their brain systems. If we read the movie and the novel in a phenomenological manner, however, namely as the account of a *Daseinsanalyse*, the focus is likely to shift from a third- to a first-person perspective, and from brain to world (that is: from a neuro-centric to an eco-centric perspective).

⁸ “We’ve taken the stuff back. So, as of now, you can consider the experiment terminated. We’ve been monitoring you. We decided to see what would happen next, to conduct a little clinical trial as it were. We haven’t had that many human subject you know. No one has ever done as much MDT as you have, no one has ever taken it as far as you have. You’ve been ... a very useful subject” (p. 318).

⁹ Therefore, from a phenomenological perspective, an experimental rapport (between researcher and research subject) is basically a power relationship. Cf. Jean-Paul Sartre: when all of a sudden I realise that I am being watched by someone else, my world becomes empty, more or less, because it floats into the world of the other (“Car le regard d’autrui embrasse mon être [et toutes les choses] au milieu desquelles je suis ... au milieu d’une monde qui s’écoule vers l’autre ... nous avions pu appeler hémorragie interne l’écoulement de *mon* monde vers autrui-objet” (1943, p. 307). Thus, the research subject’s world is emptied out by the monitoring gaze of science.

Limitless as seen from a phenomenological perspective

The brain has been an intriguing target of scientific inquiry for many centuries already. On one of the two famous anatomy lessons painted by Rembrandt van Rijn, namely the anatomy lesson of Joan Deyman (1656), the anatomist, after successfully lifting the skull of a convicted criminal, sheds a proud glance at the neo-cortex thus exposed. Yet, it is clear that the brain as a functioning organ¹⁰ is still a complete mystery to him. Joan Deyman (1619–1666) was a contemporary of René Descartes (1596–1650) who tried to connect the human subject as a *thinking thing* (a *res cogitans*) with the brain as a *res extensa* (an extended thing), seeing the pineal gland as a possible bridge between the two. Yet, his neuro-anatomical efforts were still highly speculative.

In the nineteenth century, significant progress in brain anatomy was made, notably in Germany. And yet, as Hegel already argued in his analysis of phrenology (in one of the sections of his *Phenomenology of the spirit*), when it comes to really understanding and encountering the human mind, we must turn our attention to the human *world*, rather than to the human *brain*. For although human beings ‘are’ to a certain extent their bodies, most notably their brains, we must nonetheless acknowledge that in the end we only really *are* what we *do* (p. 233). Therefore, rather than in our brains or skulls, we encounter the human mind in how we actively realise ourselves, producing a world both with our sense organs and with our hands, through practical activities.

This line of reasoning was taken up by phenomenology, one of the major philosophical schools of thought of the twentieth century. And one of its key representatives was the Swiss psychiatrist Ludwig Binswanger (1881–1966), a follower of Husserl and Heidegger, but also heavily influenced by psychoanalysis. He became widely known as the initiator of a phenomenological form of psychotherapy called *Daseinsanalyse*. As a phenomenologist, Binswanger (1942/1962) argues that, in order to understand human existence in general, and psychiatric phenomena in particular, we should predominantly focus our attention not on the patients’ brains, but on their worlds. In this context, special attention is granted to the dimension of spatiality. Human perception is characterised by what Husserl and his followers refer to as intentionality. Rather than perceiving the world in a passive, receptive manner, perception must be seen as an active process: we pose questions and literally browse and *look for* possible answers—a viewpoint

¹⁰ It is an organ, moreover, that can only be exposed if the individual in question—the convicted criminal—is no longer a subject of a life, a subject of a world. In other words, to the extent that the brain is made visible, the subject no longer inhabits it.

that is increasingly adopted and acknowledged in contemporary neuroscience. The visual world is actively produced and brought into existence (brought to the fore, allowed to emerge) in the context of this process.

This has major implications for our understanding of spatial phenomena as well. For Descartes, only one mode of spatiality existed, namely extension. It is what Heidegger (1927/2006) called *Vorhandenheit*: the way of being exemplified by objectified physical entities in three-dimensional space. Yet, the primary mode of experience is *Zuhandenheit*, which entails a much more active stance towards the spatial world. Things are basically tools that allow us to open up and disclose the spatiality we inhabit. Human life is basically a *vita activa*, an active and practical dialogue with our surroundings. The world we inhabit is thoroughly human. This mode of being-in-space concords with a spatiality of engagement and action, or, in Heidegger's terms, "die Räumlichkeit des Handelns, des Besorgens". Heidegger's concept of *Dasein* literally means that, from the very outset, we are *in* the world, in a rather engaged and interactive way. We realise ourselves *in* our world, as we allow it to emerge.

Binswanger builds on these general considerations also in his case studies. In addition, he makes ample use of literary documents to further articulate his views (1942/1962, p. 14). His opus magnum *Grundformen und Erkenntnis menschlichen Daseins* for instance, contains an intriguing analysis of the autobiography written by science fiction writer H. G. Wells entitled *Experiment in Autobiography. Discoveries and conclusions of a very ordinary Brain* (1934). Interestingly, although the title seems to suggest a neurocentric stance on the part of the author, the prelude of the book very much reads like a phenomenological account of a certain way of being-in-the world, which Wells refers to as the 'experience of entanglement'. The opening lines of this prelude read as follows:

I am distressed by immediate circumstances. My thoughts and work are encumbered by claims and vexations and I cannot see any hope of release from them... I am in a phase of fatigue and of that discouragement which is a concomitant of fatigue, the petty things of to-morrow skirmish in my wakeful brain, and I find it difficult to assemble my forces to confront this problem which paralyses the proper use of myself. I am putting even the pretence of other work aside in an attempt to deal with this situation. I am writing a report about it—to myself. I want to get these discontents clear because I have a feeling that as they become clear they will either cease from troubling me or become manageable and controllable. There is nothing I think very exceptional in my situation as a mental worker. Entanglement is our

common lot. I believe this craving for a release from—bothers, from daily demands and urgencies, from responsibilities and tempting distractions, is shared by an increasing number of people who, with specialized and distinctive work to do, find themselves eaten up by first-hand affairs. This is the outcome of a specialization and a sublimation of interests that has become frequent only in the last century or so. Spaciousness and leisure, and even the desire for spaciousness and leisure, have so far been exceptional...

The lines are remarkably similar (in terms of the basic mood conveyed by them) to the first pages of *Limitless*, capturing Eddie Morra's sense of imprisonment in a jungle-like entangling *Umwelt* that frustrates his desire for spaciousness and progress (although Wells is eager to point out that both experiences, the feeling of entanglement as well as the desire for spaciousness, are recent phenomena, closely tied up to the modern way of life, the present state of things).

This idea of entanglement and liberation, as *spatial* experiences, is fleshed out in more detail in an essay which Binswanger devoted to a literary character who actively sets out to liberate himself from mundane entanglements by opting for excessive heights, thus giving free reign to his desire for spaciousness, namely Ibsen's Master-builder Solness (Binswanger 1949). According to Ibsen, Binswanger argues, our basic motif in life is to *realise* ourselves. And our conscience more or less continuously assesses our progress (or lack thereof) on this path towards self-realisation. In fact, self-realisation takes place in two directions. First of all through self-expansion, by broadening our field of action, our scope—for instance in the form of travelling. Yet, genuine self-realisation can only be brought about by focussing on the dimension of height,¹¹ the dimension of earnestness, of self-transcendence and, in practical terms, of architecture: the realisation of heights in a very concrete and tangible manner, creating forms of space (such as: religious spaces) where very specific experiences (such as: religious experiences) become possible. In human beings, there is a longing for altitude, for upward mobility, which has an obvious downside as well, namely the risk of decline and fall, of relapse and recidivism, the incessant possibility of a sudden crash into the looming depths below. The higher we climb, the more *Fallhöhe* we are likely to experience.

¹¹ "Die eigentliche Kategorie der Selbstrealisierung Ibsens [kann] nicht die der Entfernung in die Weite sein, sondern nur die des *Steigens* in die *Höhe*. Nur im *Aufwärtssteigen* vermag der Mensch, das Höchste zu erreichen, wie er nur im Herabfallen, im Sturz, es verfehlt" (10).

It is within this dimension that the drama *Master-builder Solness* is played out. The male protagonist had been a ruthless climber in his younger days, but suddenly he seems all but paralysed by the awareness that a new generation is now climbing the societal ladder, literally coming after him, so that his own moment of decline and fall seems at hand. He seems to be heading for the frightful slope beyond the peak, steeply facing downward. And as he realises that his most basic desires have remained castles in the air, he is suddenly overwhelmed by a strong sense of vertigo, of which his fatal attack of acrophobia (while climbing the church tower which he himself erected) is clearly a symptom.

If we apply this approach to *Limitless*, we may first of all notice that a sense of spatiality and altitude is already discernible in the title. Initially, during Eddie's honeymoon-weeks as a drug-user so to speak, the sky seems the limit. In fact, *Limitless*-the-movie features quite a few elevator-scenes to symbolise his new free-moving upward and downward mobility. Thus, if movie and novel are approached from a phenomenological point of view, the focus is bound to shift from brain chemistry (and its behavioural and psychic consequences) to the way in which NZT/MDT induces the subject's world to emerge in a different manner. The focus shifts from Eddie's remarkable aptitude for information processing to his constructive inter-action with his experienced environment. In other words, the question becomes: what kind of world does the NZT/MDT user inhabit?¹²

First of all, MDT allows Eddie access to a completely new type of environment that used to be far beyond his reach, namely the dazzling world of the digitalised stock market, which suddenly reveals itself to him as a sky-scape in its full immensity and complexity: "As I sat there at my table, staring vacantly at the screen, the ruminations slowly coalesced into an overwhelming vision of the vastness and beauty of the stock market itself ... it was an ocean, a celestial firmament" (p. 123). This world emerges as "a collective nervous system, a global brain" (idem). Moreover, not only the world as seen through the window of his laptop screen has fundamentally changed, this also goes for his daily environment, the streets of Manhattan. The sense of entanglement has given way to a completely different manner of being-in-this-world. Indeed, the world *as such* has become unreal, has assumed the shape and colours of a computer game: "I floated through the streets, with a vague

sensation of moving through a kind of virtual-reality environment, a screen-scape where colours contrasted sharply and perception of depth was slightly muted ... It was as though I was entering a new phase of play on some computer game" (p. 151). And when he, as an individual suddenly moving forward and upwards, returns to his room, he suddenly feels "outsized – like Alice" (p. 98). His humble dwelling has become much too small for him.

Yet, the most noticeable modification concerns what has already been referred as the dimension of spatiality or more precisely: of verticality. Tall buildings are an important item in the novel. Some of the key scenes take place in one of Manhattan's most famous skyscrapers, namely the Seagram Building, described as "the holy of architectural holies" (p. 163). Manhattan had always been famous for its skyscrapers and in 1989, eight of the ten tallest buildings were still located in the United States. Yet, today, all of the world's tallest buildings have been built elsewhere. The skyscraper had once been the supreme symbol of corporate capitalism, of America itself: the Finger of God, the reader of the novel is told. Skyscrapers were buildings that made certain forms of interaction possible, but increasingly they are now turned into oversized commercial billboards. Van Loon, however, is intent upon regaining the title of World's Tallest for New York, and is proposing the establishment of an enormous glass box on Forty-Eight Street.

Literally on the height of his career, Eddie buys a luxurious penthouse on the top floor of a newly established skyscraper called the Celestial Building, a huge bronze-tinted glass monolith. As he gazes out at the city from the sixty-eight floor, the view is simply spectacular (p. 285/6). The whole of Manhattan rises dizzily up into view. Indeed, all of the city's landmark buildings can be seen. They appear to be looking in his direction. Standing before his huge window, he also gazes down "along these vast, vertical plates of steel and glass, all the way down to the streets below, the tiny rivulets of people and traffic" (p. 298).

The Penthouse is what Bakhtin (1988) has called a 'chronotope': a kind of space (emerging within a particular historical time-frame) where certain experiences become possible and plausible. A penthouse is typically inhabited by single, attractive, highly successful young male, who uses it as a safe haven, an oasis of calm and luxury, but also as a place where unique erotic adventures or drug orgies can be staged. There is a rather outspoken contrast between the elevated penthouse (where Eddie lives, albeit rather briefly, during the height of his career) and the street below: where the multi-lingual anonymous masses move and dwell, the jungle-like entangling environment from which Eddie once came. As we have seen, in the opening scene of the movie, Eddie is standing on the roof of his penthouse, looking at the streets below, ready to jump

¹² In fact, in the phenomenology-based psychiatric and psychological literature, the type of self-experimentation Eddie indulges in is not uncommon. The self-report published by the Swiss psychiatrist Kurt Behringer on a self-induced mescaline trip, for instance, may stand as an example here (Behringer 1927). A literary classic in this genre (a self-report on the effects of prolonged opium use) is of course De Quincey (1822/1960).

down. He has reached the highest altitude, which also signifies his approaching downfall.

A completely different sense of space dominates the final scenes of the novel. In order to withstand the physical malaise he experiences (as a consequence of his withdrawal symptoms), there is only one thing left from him to do. As the sense of dread and horror over his relentless mental and physical degradation intensifies, he finally comes “to some accommodation with the pain. So long as I remained absolutely still, didn’t flinch, it obligingly receded into a dull, thumping, mindless rhythm” (p. 323). In short, his final stance is a state of complete immobility, occupying a minimum of space. The contrast with his experience of overlooking Manhattan from his penthouse couldn’t be more outspoken. And a final, sudden, Tolstoy-like fugitive impulse takes him out of Manhattan and into a dreary Motor Lodge, somewhere in upstate New York, where he somehow manages to finish his memoirs. Here, in this desolate spot, the dimension of spatiality has shrunk dramatically. It seems emptied out, almost frozen, reduced to a bare minimum, a point zero. Thus, the phenomenological perspective allows us to assess the *topological* dimension of the novel: the importance of heights (frightening as well as alluring) and upward mobility, but also the contrast between various types of spaces (such as street vs. penthouse, or down-town skyscraper vs. up-state motel).

Concluding remarks: the role of genres of the imagination in preparatory debates

If we frame the prospects of pharmaceutical brain enhancement in standard bio-ethical grammar, the issue may quickly be reduced to the question whether and to what extent individuals will be allowed to make autonomous and informed choices, or whether and to what extent undesirable risks and harmful consequences can be minimized or at least contained. And it goes without saying that it is possible to look at *Limitless* from such a perspective, for instance by comparing the research practices as described in the novel (in an allegedly realistic fashion) with ethical rules and regulations for conducting experiments with human subjects in a responsible and deontologically correct way. And from a consequentialistic perspective, the focus will then no doubt be on the extent to which short term benefits are likely to be overshadowed by detrimental side-effect that will become increasingly noticeable in the longer run (as is usually the case with many forms of physical doping as well). Yet, such an analysis runs the risk of short-circuiting the debate long before cognitive enhancement has even become a socially relevant phenomenon at all (Ferrari et al. 2012).

It is precisely in the preparatory interlude between the current state of affairs on the one hand and the possible advent of effective brain enhancers in the future, that genres of the imagination, such as plays, novels and movies, can play a highly significant role. As Zola argued, the novel as a genre can be regarded as a kind of laboratory where certain scenarios may be acted out, in the form of moral exercises, not in order to address past traumas (as is the case in depth psychology),¹³ but rather to prepare the field for future developments in an imaginative fashion. Between the scientific and technological developments on the one hand and the values and principles of bioethics on the other, there emerges a broad conceptual landscape where plausible scripts can be developed and assessed, focussing on experiences of time, space and identity rather than autonomy and risk. Such exercises represent an experimental rather than a ‘bio-conservative’ attitude towards human existence. At the same time, rather than voicing unequivocal euphoria over emerging prospects for boosting human intelligence and self-realisation, the focus will shift to the ways in which (the temporal and spatial dimensions of) our world may be affected. Indeed, before we drastically change our world, a moment of interpretation may be called for. Thus, artistic and controlled imagination can provide valuable input when it comes to assessing the ‘wider’ implications of neuroscience in a ‘timely’ fashion.

¹³ *Limitless* offers various opportunities for a psychoanalytical *depth* analysis. Ambivalence is everywhere. Carl van Loon is the typical (archetypal) father figure with whom Eddie develops an oedipal relationship, astonishing him, challenging him, annoying him, disappointing him, etc. Chemicorp is the archetypal powerful mother, feeding her subjects, but also making them dependent, even poisoning them as they start to become too dependent. We may also link neuro-enhancement with Freud’s neurological research (before 1900) and his famous cocaine episode on the one hand, and the subsequent shift of attention towards more interactive phenomena such as transference later on. Also from a Lacanian perspective, Van Loon emerges as the powerful father-figure, the Big Other (Φ). Eddie’s own life, however,—before his MDT episode, that is —, is dominated by a sense of impotence, a fiasco, due to a basic deficit—in Lacanian notation: ($-\phi$). The missing link ($-\phi$) between desire (the desire to write, to produce) on the one hand and joy or bliss on the other (prolific authorship, but also erotic pleasure and upward mobility) is blocked or absent (Lacan 2004). Therefore, Eddie seeks solace in MDT (‘Viagra for the brain’ as it is called), a small, milky-white object (a), a kind of oral nurture that in the end proves to be a poison,—a ‘*pharmakon*’ (ϕ) in short, that functions as a chemical link or transmitter, opening up the passage from desire to bliss, but at a cost: anxiety, vertigo, Angst, and, eventually, collapse, downfall, paralysis and impotence again.

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