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Intuitive Technologies. Models of Posthuman Subjectivity in Simon Ings' *Hot Head* and *Hotwire*

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Abstract: This article analyzes two novels by the British writer Simon Ings, Hot Head (1992) and Hotwire (1995), from perspectives provided by second-order systems theory, philosophy of neuroscience and posthumanist philosophy. In Ings' cyberpunk fiction, the use of a particular novum, a programmable cerebral tissue called "datafat", enables elaborate experimentation on different theories of mind and matter. Due to this experimentation, Ings' work is able to convey a conception of cognition as an emergent effect produced in material processes that are both human and non-human. Ings' work asserts the human subject as a complex system in a complex technological ecology and, consequentially, presents us with a model for subjectivity that might be called "posthuman".

Keywords: Simon Ings, Hot Head, Hotwire, posthuman subjectivity, posthumanism, philosophy of neuroscience in literature, complex systems in literature

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"I know that the molecules in my body are traceable to phenomena in the cosmos. . . . That *excites* me. That makes me want to grab people on the street and say: 'Have you HEARD THIS?" – astrophysicist Neil deGrasse Tyson in a talk given at the Beyond Belief Conference, 2006

There is profound reconfiguration going on in scientifically oriented minds – reconfiguration of the models of human existence and practice. This is rather dramatically explicated by the popularity of charismatic scientists such as Neil deGrasse Tyson, quoted above. The enthusiastic force of deGrasse Tyson's rhetoric resonates with people who are searching not only for explanations, but for meaning: it actually does have the effect of grabbing people in the street and shaking them to feel the awesomeness of the cosmos in their own bodies. In May 2014, his Facebook page has 1.44 million followers, his Twitter account 1.97 million. Scientific theories, and observations made by natural sciences, inspire and effect people, changing not only the way they think but also the ways they perceive themselves and relate to each other. This is nothing new. It is new, however, that the articulated call for alternatives to the totemic image of Man – as an autonomous, unitary subject and

the master of all things natural – can now be heard in public discussions rather than just in postmodern cultural discourse. The capitalized "Man" no longer provides a useful model for identification – rather, there is an acute need for non-anthropocentric models of thought and practice. In search of a functional model of operating in the complex technological, ecological and social environments, many people turn to science – and scientists, such as deGrasse Tyson, who can craft information into intuitively meaningful sentences.

Some people take the additional step of approaching science through cultural criticism. The paradigmatic shift from humanist and idealist models of thought to scientific and materialist thinking has not passed humanists unnoticed: it is the driving force behind many contemporary philosophical approaches, such as the different critiques of classical humanism (see Soper, Sheehan), and interdisciplinary work in fields such as ecocriticism, cognitive literary studies, Darwinist literary studies, literature and science, animal studies and feminist science studies (see Åsberg et al 222). Conversations about the ideologies and assumptions present in scientific discourse and practices have been lead for decades by critics such as N. Katherine Hayles, Evelyn Fox Keller and Donna J. Haraway.

Still, there is more work to be done. One of the areas that call for a more detailed mapping is the construction and mutation of subjective experience, especially in the literature most interested in the scientific mode of thought: science fiction. In contemporary philosophy, there are innumerable theoretical approaches to subjectivity, and the modern and postmodern representations of subjective experience have been thoroughly studied in scholarship focusing on "mainstream" literary fiction. The study of science fiction, however, has not taken up the challenge in quite the same way – partly due to the preconception that science-fictional characters are not interesting, philosophically speaking. They have been dubbed as flat rather than round, types rather than individuals, mere devices for presenting ideas and plot (see Mandala 119–124, Jones 171).

This may be true in many cases. However, there are works of science fiction that speculate not only about technological progression or scientific theories, but also about the potential and alternative developments of human subjectivity. I suggest that in the early novels of British writer Simon Ings, subjectivity is rewritten in particularly interesting ways. Ings' novels *Hot Head* (1992) and *Hotwire* (1995), combining technological speculation and gritty milieus with neurophilosophy and metafictional narration, can be characterized as late cyberpunk. Although Ings has been lauded as an original voice in the field of science fiction (and later as a writer of postmodern fiction closer to the literary mainstream) his work has not previously received attention from critics within the academy.

The primary goal of the article is to show how ideas derived from second-order systems theory and cognitive science are involved in the represented experience of fictional characters, and how this process relates to the concept of "posthuman" In particular, I focus on analyzing how the model of subjects as complex systems evokes a sense of posthuman subjectivity. I argue that 1) science fiction literature is essential for understanding the on-going reassessment of human subjectivity in relation to non-human systems, and 2) that Ings' novels *Hot Head* and *Hotwire* provide a particularly profound model of posthuman subjectivity. All in all, the article is an attempt at applying a posthumanist approach to the study of literature.

The method of analysis in this article is far from perfect. There are brilliant analytical tools and concepts developed in cognitive narratology and cognitive stylistics, and utilizing them would definitely provide a deeper understanding of represented experience. However, at the time of conducting my analyses, I was still unsure of the ideological underpinnings of these approaches, and wanted to avoid blind commitment to traditions. As a result, except for the occasional use of narratological concepts, the reading follows loose intuitive logic based on metaphorical and analogical thinking. I am tracing certain structures of thought – resonant similarities between Ings'

narration and scientific theories. This logic is inspired by the insightful readings made by N. Katherine Hayles (in *How We Became Posthuman*) and Sherryl Vint (in *Bodies of Tomorrow*).

The questioning also employs a phenomenological mode: what could it mean, on the experiential level, to be posthuman? I approach fictional characters as potential models for subjectivity – as experimental positions for a curious reader. I am well aware that this immersive approach involves the risk of antropomorphizing textual constructs. I find the risk not only acceptable, but necessary. For me, the reflective flickering between alternative perspectives – reading characters as people and as processes – is an integral part of the job description of a literary researcher.

The article involves a heavy load of references to scientific theorization. Even though my approach allows for no in-depth analysis of most theoretical aspects, I find it necessary to work towards a synthesis that involves perspectives from both natural sciences and humanities. This stance is dictated by the source material at hand: in order to fully appreciate the complexity of this sort of science fiction, the research needs to be informed by a multitude of approaches. In his fiction, Simon Ings samples the theories of complex systems and cognition and integrates them into a postmodern literary narrative. To leave out the natural-scientific aspect of this elaborate construction would be neglectful. By utilizing multiple perspectives – provided by second-order systems theory, the philosophy of neuroscience and posthumanist theory – I also hope to convey some of the challenges ingrained in the posthumanist mode of thought.

Posthumanist Thought and the Search for Posthuman Subjectivities

The crisis of humanism has informed new conceptions of embodied human subjects – as biological and phenomenological, social and environmental beings. In recent years, theorization identifying as posthumanist has worked towards modeling subjectivity in ways that can acknowledge the many roles non-human entities and systems play in the formation of subjectivity. Posthumanist models of subjectivity have drawn on both the tradition of systems-theoretical (cybernetic) thinking and poststructuralist philosophical discourse. As a result, the models often emphasize the processual and material aspects of subjectivity.

Despite differences in disciplinary background and methodology, the common ground for contemporary posthumanist thinkers seems to be the critique of certain dualist and idealist strains in the tradition of humanism. Whether posthumanist thinking focuses on questions of nonhuman and animal agency and the feminist critique of scientific practices (see Åsberg et al.) or the systems-theoretical approaches to culture and fiction (Clarke, *Posthuman Metamorphosis*; Wolfe), there is an ongoing search for theories and models of subjectivity that can articulate life, consciousness, action and emotion in materialist and non-anthropocentrist terms. In this search, posthumanist thinkers often engage in conversation with natural sciences and technology studies (with variable amounts of interdisciplinary critique). The tradition of interdisciplinarity goes back to the early development of cybernetics in the 1940s, and especially to the Macy Conferences that brought together scholars from fields ranging from psychology and anthropology to mathematical physics and information technology (see Hayles, Clarke and Hansen).¹

The "post" in "posthumanism" should not be considered as a total break from the tradition of humanism, but as a critical deconstruction of it - in the sense of Lyotard's paradoxical

¹ Another major current of influence to posthumanist thought consists of the work of materialist and empiricist philosophers – from Leibniz, Hume and Spinoza to Foucault, Deleuze and Guattari. This genealogy has lead to coining the term "new materialism", referring to a philosophical approach intertwined with posthumanist thought. Posthumanist discussions (especially the strains that emphasize animal ethics) are also closely linked to different forms of cultural activism such as the animal rights movement and deep ecology. For two exemplary accounts on genealogies of posthumanism, see Neil Badmington's introduction to the reader *Posthumanism* and the editors' introduction to NORA Magazine's issue on "post-humanities".

postmodernism that happens both before and after modernism (Wolfe xiv-xv) or as a critical position inescapably rooted in humanist assumptions and language (Rabinowitz 42–43). In Cary Wolfe's formulation, posthumanism happens "before" humanism

in the sense that it names the embodiment and embeddedness of the human being in not just its biological but also its technological world, the prosthetic coevolution of the human animal with the technicity of tools and external archival mechanisms (such as language and culture)... and all of which comes before that historically specific thing called 'the human' that Foucault's archaelogy excavates (xv).²

On the other hand, posthumanism happens "after" humanism as the historical phenomenon of reconceptualizing the human as entangled in technological, medical, informational and economic networks – and the call for a new paradigm of thought to account for these entanglements (xv-xvi).

Often (but not always) the posthumanist discussion is centered around the term "posthuman" – both as a general adjective implying a mode of thought and practice that rewrites the meaning of the word "human" and as a speculative figure, "the posthuman" In both syntactic forms, the posthuman evokes a plethora of alternatives to current models of humanity and subjectivity. In the discussions emphasizing the liberating aspects of technology, the posthuman is a futuristic figure that has transcended the boundaries of nature, finitude and biological embodiment: "the fully technologized successor species to organic *Homo sapiens*" (Graham 9). This transhumanist notion of inevitable advent of the superhuman is what Elaine Graham wanted to question with her formulation "post/human", to which she attributes a dual function: "The post/human is that which both confounds but also holds up to scrutiny the terms on which the quintessentially human will be conceived" (11). The dual function makes the post/human an analytical device, a shifting node in a dynamic web of conversation. This nonessentialist view has been quite popular among posthumanist scholars after Graham's formulation. It is also what makes the term posthuman – even without the cautionary forward slash – so useful for philosophical discussion. In posthumanist thought, "posthuman" denotes above all a change in conceptualizing human subjectivity.

In this article, the use of the terms "posthuman" and "posthuman subjectivity" carries the full weight of the contexts and functions discussed above – and hopefully adds to it. Adding "subjectivity" to "posthuman" is in itself quite problematic, as R. L. Rutsky, among others, has noted. "The subject" has traditionally signified the one in control, the ruler of a world of objects. To control or to be controlled, to be the subject or an object – this dualism has prevailed. According to Rutsky, overcoming this dualism is a central challenge to posthumanist thought:

[T]he human subject can only conceive of itself in opposition to the random, just as it seeks to control the body, dominate the material world, and narrativize history. On the other hand, any notion of the posthuman that is to be more than merely an extension of the human, that is to move beyond the dialectic of control and lack of control, superhuman and inhuman, must be premised upon a mutation that is ongoing and immanent. From this perspective, there can be no such thing as a posthuman subject - at least, not in the traditional sense of an individualized, unitary and autonomous subject. (Rutsky 111.)

The problem of posthuman subjectivity is also approached in second-order systems theory – or, as Bruce Clarke and Mark B. N. Hansen prefer to call it, neocybernetics. Neocybernetics, highly uninterested in individualized subjects, shifts the emphasis of observation to the networks of connections among systems and environments, both living and nonliving. From this perspective, the subject appears to be only a convention of Western metaphysics, "an amalgamation" or a

² Andy Clark would even claim that this very openness to "multiple mergers and coalitions" is what distinguishes *Homo sapiens* as a species (*Natural Born Cyborgs* 7).

"noumenal unity" which deserves no further attention. (Hansen 6.) It is important to note that in systems theory, the definition of a system always involves selection: the boundaries that define a system such as "a human individual" are dependable on the question you want to ask. For a neocyberneticist, the subject is only a matter of distinction: instead of an individual, one can decide to focus on the various psychic and social systems that constitute an individual, or on the interaction and collaboration between an individual and its environment. The individual is dividable and mergeable. What makes this shift of emphasis urgent in the eyes of the neocyberneticists is the increasing complexification of the living environment.

In today's computational world, countless instances of human agency – even those as mundane as making online credit card and mortgage payments, monitoring information about the weather or the stock market, even writing letters and sending messages – occur against the backdrop of complex computational infrastructures, which geographer Nigel Thrift has christened with the felicitous name of the "technological unconscious". (Hansen 117.)

For Hansen, the central challenge for contemporary cultural theorists involves the inevitable hybridity of systems and environments: how to both recognize the certain consistency of the "human mindbody" and to account for the certain non-autonomy resulting from its reliance to informationally complex environments (ibid.). Hansen's proposal for accounting for this dynamic is the concept of "system-environment hybrids" or "SEHs" couplings that "realize their autonomy . . . through a constitutive relation with alterity". In SEHs, the environmental component cannot be considered as merely supportive of or trivial to the system. (115.)

In cultural theory, the unavoidable and constitutive relation to the (technological) environment has been approached through concepts such as the cyborg and the hybrid. Neomaterialist theorist Rosi Braidotti addresses the contingency of systemic boundaries by suggesting that the formation of subjectivity (on an experiential level) also involves a process of distinction and selection. In Braidotti's poetic formulation, the experience of any unitary subjectivity, of a grammatical "I", is a "fictional choreography" (*Metamorphoses* 22). Braidotti writes:

The subject is a process, made of constant shifts and negotiations between different levels of power and desire, that is to say wilful choice and unconscious drives. Whatever semblance of unity there may be, is no God-given essence, but rather the fictional choreography of many levels into one socially operational self. (Ibid.)

In this line of thought, every self is fictional – constructed and operated according to models or schemas that are, in turn, constructed and transformed by social, cultural, psychological and biological forces (*Metamorphoses* 13). Despite the notion of fictionality, Braidotti still sees subjectivity as a valuable ethical and political category. She even promotes the idea of "alternative figurations" or *conceptual personae* (in the deleuzian sense) as empowering or affirmative "signposts for specific geopolitical and historical locations" (*Posthuman* 164). The constructivist view on subjectivity can be used as an opportunity for intentional change.

Considered together, these theories pose a challenge. Even if one accepts the idea of the subject as a process or an effect produced in the network of multiple systems and environments, will it always remain just that – an idea, an intellectual exercise? Can the posthumanist models of subjectivity actually be experienced subjectively? And, translated into a problem specific for the study of literature: can these models ever take the form of an identifiable literary character, when characters tend to be just that: individualized, unitary and autonomous, caught in the dialectic of control and lack of control?

These questions call for a deeper analysis of the relations between the traditions of humanism and modernity and the conventional form of literary character – a continuation of the work already started by such scholars as Daniel Punday, Genie Babb and David Porush. However, due to the restrictions of time and format, I must now approach them with a more thematic reading of Simon Ings' novels *Hot Head* and *Hotwire*. I start with an introduction to the representations of non-human systems and cognition in cyberpunk literature.

Cyberpunk and Cognitive Science

In English-language popular culture, non-human intelligence has traditionally been depicted as threatening – whether it resides in technological, institutional or biological systems. The relation between a human individual and a non-human system has typically been that of opposition. Just think of such iconic fictions as *Brave New World* or *The Matrix* – both setting the original human personality against a nonpersonal threat. The function of the hero has been to resist assimilation (even when it is futile) and retain his individuality at all costs. In science-fictional literature, notable reactions to the apparent rise of non-human systems are paranoia about origins, as in Philip K. Dick's and William S. Burroughs' oeuvres (see Butler), and a form of escapism that hovers between technophilia and technophobia, as in gibsonian cyberpunk.³ As a counterreaction to the anthropocentric heroism of 1970's sf literature, the genre of cyberpunk problematized the relationship between human subjects and their technological others. In particular, it mockingly questioned the position of Man as the master of both nature and technological systems. For the cyberpunk protagonist, this often meant the loss of autonomy and control – and in some cases, also the loss of a unitary self-image. (See McGuirk, Slusser, Bukatman.)

Cyberpunk is often regarded as particularly hostile towards embodiment and materiality. Many cyberpunk texts depict the self-dissolving integration to computing systems as a sort of nirvana, as liberation from the constraints of flesh. As many critics have noted, this is a transhumanist view – it seeks not to decentralize or redefine the human subject but to extrapolate on it, resulting in superhuman or inhuman figures, not posthumans. (See Hayles, Wolmark, Parikka.) As Carol McGuirk has noted, the most novel feature of cyberpunk as a subgenre was its orientation towards the interior: whereas the tradition of "hard science fiction" sent its ships to explore outer space, cyberpunk turned to examine the vulnerable inner space of the human mind (114–115). This orientation is apparent also in Ings' work. What sets him apart from most cyberpunk writers is his remarkable interest towards phenomenological embodiment and cognitive science. Indeed, in reading Ings, a basic understanding of recent developments in cognitive science appears not only useful but crucial. Therefore, a short summary is needed.

In the classical theory of mind, the brain is the seat of human consciousness: a central commander, the subject in a world of objects. However, recent models have also emphasized the *embodied* and *environmental* aspects of cognitive activity, decentering the rational and conscious self. Andy Clark summarizes this process as a three-stage progression: The first stage (*classical cognitivism*) depicted the mind in terms of a central logic engine, symbolic databases and some peripheral "sensory" models. The key characteristics of this vision included the ideas of memory as retrieval from a stored symbolic database, problem solving as logical inference and cognition as centralized. The environment was seen just as a problem domain and the body as an input device. The *connectionist* view replaced these characteristics with the ideas of memory as pattern

³ Of course, opposition is not the only way of articulating relations between humans and non-human systems in science fiction. There are literary works, such as Octavia E. Butler's Xenogenesis series, that posit the human subject as an integral part of a larger techno-biological ecology – works that do not determine subjectivity through modern notions of originality, individuality and autonomy. In Butler's texts, human subjectivity is produced in social and ecological processes. In this regard, Simon Ings' *Hot Head* and *Hotwire* are similar to Butler's work.

re-creation, problem solving as pattern completion and pattern transformation, and cognition as increasingly decentralized. The third turn – the *emergentist* perspective – also took account of embedded and embodied cognition: the environment is seen as an active resource whose intrinsic dynamics can play important problem-solving roles, and the body is seen as part of the computational loop. Cognition is viewed, not as something "internal" but as a process that takes place in the complex interactions of body, world and brain. (*Being There* 83–84.) The third turn has also been called *embodied dynamicism* by Evan Thompson. As Thompson notes, all three approaches coexist in contemporary research, both separately and in hybrid forms. (*Mind in Life* 4.)⁴

Datafat and Models of Cognition in Hot Head

Simon Ings' *Hot Head* (1992) can be considered as a literary application of the progression from disembodied central cognition to embodied distributed cognition. Written at a time when the embodied approach was just gaining a foothold in cognitive sciences and the philosophy of neuroscience (*The Embodied Mind* by Varela, Thompson and Rosch was published in 1991), Ings' novel describes the change of human subjectivity in relation to a series of computational systems. The virtual realities Ings envisions start from relatively logical command-control-systems and build up into rich complexities that cannot be consciously controlled by either human or artificial intelligence. Still, the characters in *Hot Head* strive for some form of control over environmental complexity, even a partial one – and end up using intuitive methods that are described as "magic".

From a systems-theoretical perspective, this process could be described as reducing the complexity of the environment in order to function. The process is tied to the neocybernetic concept of emergence as movement from the chaotically complex to the manageably complex: any particular system that emerges within an environment is necessarily less complex than that environment. In order to maintain its functionality and perpetuate itself, a system cannot process the whole complexity of the environment. It needs to maintain the processes of selection and generalization – there is no perception without cognitive models and categories. (Clarke and Hansen 10–12.)

In the corrupt, technology-driven and islamized early 21st Europe of *Hot Head*, the central character Malise Arnim is a cybernetic soldier implanted with a programmable cerebral tissue called *datafat*. There are two wars, both staged between humanity and a technological other: the first enemy is a conglomeration of mining robots in the Moon, driven to unexplainable rampage against the Earth (bombing down all major cities before being stopped), the other against a similar but bigger AI threat originating in Jupiter. As the enemies become more complex, so does the military technology used to enhance the soldiers.

Malise is taken through a series of transformations that restructure her subjectivity according to the computational systems she is coupled with. From the start, she is written as the object of manipulation – by her father, by her lover Seval, by the psychiatric institution that turns her into a soldier via a restorative video game, by the military that enhances her with datafat and removes it after the first war, and most prominently by Snow, the transhumanist Frankenstein-character who develops the second-generation datafat and uses it to turn Malise into what she considers the next step in evolution: "It's inevitable, unstoppable, as natural an evolutionary progression as the opposable thumb or walking upright" (HH 256–257). Malise is a typical cyberpunk protagonist: gifted, traumatized, abused and addicted. Unlike some of the more technophilic caricatures, though, her suffering is not alleviated by the immersion in virtual reality technologies. Instead, she finds

^{4 &}quot;For cognitivism, the metaphor is the mind as digital computer; for connectionism, it is the mind as neural network; for embodied dynamicism, it is the mind as an embodied dynamic system." (*Mind in Life* 4.)

that the symbolic structures that form the base of her personality continue to define her, throughout the transformations into enhanced transhumanity and virtual existence.

As the name suggests, *datafat* is programmable yet organic matter. The tissue functions first as an extension of the human mind, then as a replacement for it. Primarily, it is a control system for weapons technology. However, as both the datafat and the enemy intelligence evolve, the datafat becomes a tool for creating artificial persons and worlds. As a narrative device, datafat is a tool for cognitive estrangement – by replacing the "natural" brain with versions of datafat, Ings can experiment with different theories of mind. The first-generation datafat, operated via conscious control of icons, articulates the relation between the program and the operator in terms of the classical theory of mind:

To aid her in her mission, Malise has with her some drones, monitors and gash-built peripherals which she controls via the datafat in her skull. She pictures an icon and a menuscape meshes over her vision. She whispers her choice of equipment and the mesh fills with data, graphics and statistics. (HH 59.)

Hovering just before her was the tree-like icon of her virus. . . . [T]his quick-to-understand symbolic landscape gave her a visual representation of what it could do. It looked right. (HH 70.)

In classical cognitivism, the central metaphor for the mind is the digital computer. Cognitive activity is conceptualized as the formal manipulation of symbols. Meaning is representational, objectively present in the relation between signifier and signified. (See Varela et al 40-43; *Mind In Life* 4–5.) This model of formal and disembodied thought is what is at work in the relation between Malise and the computer program in the above passages of *Hot Head*: Malise chooses an icon – a symbol – and the program responds with a pre-determined action. The operator exists in space as a disembodied point-of-view. This logic of symbolic operations forms the basis of *Hot Head's* model of mind, elaborated further in the next stages.⁵

The first version of datafat features the unconscious routines of the mind explicitly in the icon-based interaction between Malise and the computer. With the introduction of the second version – developed by the neuroscientist Snow – Ings moves towards describing a more connectionist theory of mind. The transition to second-generation datafat is depicted as a painful transformation, involving neurosurgery with ritualistic properties – in Malise's narration, the technicians' strange jargon becomes an incantation, their screens scented fires. After surgery, Malise experiences a new sense of self:

Her idea of her self was changing, warping, and expanding to fill the new spaces within her. Her homunculus was evolving in strange new directions - cancerous swellings and nightmare etiolations. I've killed myself, she thought, wildly. I've killed the human in me. (HH 99.)

Despite the killing of the self and the human in her, Malise is still an "I" – both grammatically and phenomenologically. Even though she is well aware of her self becoming a model of a person running inside a computational system, she still experiences this self as *her* self. Losing her original

⁵ Classical cognitivism divided the mind into two separate regions: the subjective mental states of the person and the subpersonal cognitive routines implemented in the brain. This attempt at solving the mind-body problem ("how can a brain have experiences") resulted in what Ray Jackendorff has called the "mind-mind" problem – the unexplainable relation between unconscious computational states and conscious experience (Jackendorff 1987, 20 < Mind In Life 6). The cognitivist model offers no explanation for subjectivity or consciousness, as it focuses on the workings of the unconscious mind – which is depicted as a mechanical operating system, hovering beneath consciousness.

form and giving in to "cancerous swellings and nightmare etiolations", she is disoriented and exhausted, but the change does not lead to a loss of subjectivity.

As Malise "updates" her operating system to second-generation datafat, the distinction between "operator" and "program" disappears. Malise's conscious mind is fully integrated into the system as a subroutine. The system still uses the computational capacity of her brain for its operations, but Malise no longer has conscious access to these operations. All mental action happens completely inside one datafat system that includes both artificial and human intelligence. In this system, it becomes possible for the artificial intelligence (datafat) and the human intelligence (or the model thereof) to instantly adapt to each other. On the subjective level of Malise's consciousness, these transformations take place in immersive virtual environments called "story engines":

What Snow's datafat does is read and model your whole intelligence. The operator does not work through Snow's datafat – the datafat models the operator and attempts to achieve a rest state between itself and its model. . . . It's like one of your battle'scapes only more complex. It's running in the calculation spaces of our datafat. It's modelling us. You think you're you, but you're really only your datafat's model of you. (HH 169.)

If a narrative of a novel is considered a kind of virtual reality (as Jean Baudrillard has suggested, and as Ings' artistic choices also seem to suggest), then a virtual reality within a narrative can hardly avoid being metafictional. Ings' text openly embraces the philosophical conundrums brought on by metafictionality. As the focus of Malise's point-of-view shifts from her "original" self to that of a datafat model, she becomes a model of a person running inside a model of an environment. Ironically, her operations in the environment become more dependent on her embodied action than they were in the enfleshed world. She can't control the environment with commands any more – all she can do is live in it:

[I]n a very real sense these places are stories, not landscapes. They're designed to integrate the operator wholly within their structure, in time as well as in space. After a while one isn't aware of performing operations here – one simply lives here. One isn't aware that one is learning anything. The memes act in such a way that it seems one has always known how to use them. . . . The environment adapts itself around whoever inhabits it, like a story rewriting itself for each new reader. (HH 172.)

As tempting as the notion of metafictionality is, focusing on it would not further the cause of this article (there is a risk of it hijacking the whole discussion). A more useful way of reading these passages is to treat them as unusually explicit accounts on phenomenological perception. Read through the computationalist theories of cognition, the virtual environment becomes a metaphorical elaboration on the phenomenological experience of the actual world. Malise – even in her "original" form – is constantly "performing operations" and "running models" but never expressing it with those terms. Phenomenologically, Malise is human – operationally, a machine. The only difference is that in the virtual world she is made aware of the existence of these subpersonal computations. By removing the "natural world" and replacing it with a "virtual reality", Ings clears room for this phenomenological conception.

The idea of a story engine also entails the personal narrative construction of the phenomenological environment. The story engine subtly adapts to the assumptions and expectations of its inhabitants, altering them in the process. Malise is introduced to the story engines by a woman who has, in the course of subjective years, shaped a virtual world of her own:

The landscape and its ghosts have shaped themselves the better to express my life here with Snow. My memories have been webbed to the fabric of the environment so that I can no longer say what is me and what is external to me. The tastes and smells of the ocean itself have taken on a private meaning. (HH 173.)

In story engines, the relation between cognitive processes and the environment is still viewed as representational (memes act as symbols providing complex meanings for different parts of the environment), but more dynamic than the unambiguous relations in first-generation datafat systems. The emphasis on the interactive learning processes in the distributed system highlights that the story engine is considered a neural network.

Adapting to Environmental Complexity

The third level of complexity in *Hot Head* involves a collective artificial intelligence the size of an asteroid – the Jovian Massive. Originally sent to Jupiter for mining purposes, these semi-intelligent non-human AI's have conglomerated, began to reproduce exponentially and left the planet in search for new hardware and electronics. The AI's endless appetite poses an apocalyptic threat to Earth. Along with other veterans of a previous AI war, Malise is sent to stop the Massive. This includes her physically entering its computational system and becoming a part of it – another model, now run by a different machine.

The environment inside the Jovian's mind is depicted as a large-scale neural network - "the kind of informational matrix that is suited less to the lives of individuals than to the modelling of whole civilizations" (HH 283). It is also labeled "insane". The only functional way to operate in it is to intuitively engage in mythical and symbolic narratives – sacred quests, metamorphoses and ritual deaths. The complexity of these operations is overwhelming to human operators. The only suitable label for the unconscious computations between the subjects-as-models and the world-as-operating-system appears to be "magic".

Particularly important is the symbolic system of tarot. The Jovian uses it to make sense of Malise's personality. "The cards are useful. They act like a kind of . . . story engine. They are a tool-kit by which to describe personality." (HH 292.) It is possible to use tarot this way because Malise's personality has already in her youth been founded on its symbols. Malise's first lover, Seval, has used tarot as a powerful codifier. In *Hot Head*, the reversed Papess card becomes a heavy cluster of personal symbolism, signifying all the violent experiences of her life: the death of her mother, the death of Seval, the previous war. Turning it round becomes an act of transformation – or reprogramming:

Seval pointed to the fourth card: 'This is beneath you; upon this you are founded. Oh dear –' It was the Papess reversed. 'Lust. Enslavement. Belligerence. We can't have that.' She turned the card round. 'Hey!' Malise yelled, scandalized. 'You can't do that!' Seval looked into her eyes. Her whole face seemed old. Not decrepit – old. Ancient, adamantine. 'You wanna bet?' (HH 143.)

In the climatic ending of *Hot Head*, the Jovian goes through Malise's personal history by re-running them through her subjective experience. Ings reuses the above tarot-reading scene almost verbatim, as he does several other scenes from the earlier sections of the story. As Amy, the Jovian's communication channel, puts it: "The symbols which lie at the very root of your personality will explain your purpose and worth to the Jovian" (HH 292). Until the turning of the reversed Papess card, the reading follows the one made in the past by Seval. As the card is revealed, there is a

significant variation: frustrated with the machine intruding into her past, Malise turns the card over herself – which leads to the final resolution with Jovian. This illustrates rather elegantly the connectionist view of problem solving as pattern completion and pattern transformation. Form is inseparable from content: the complex weave of Ings' prose is repeated and slightly altered, as are Malise's memories and the configuration of the Jovian's mind.

Malise has no idea how the Jovian exactly uses this information to judge her character – but it is implied that the method is some form of complex computation. "I suppose stopping the Jovian was such a complex business, it took all my life experience to contain the necessary memes" (HH 297). However, the general feel invoked here and throughout the story is that of magic – of incomprehensible and illogical happenings that still, on some unconscious level of cognition, make perfect sense. In young Malise's mind, magic forms the basic structure of the physical world:

Magic works, she thought. Magic does not come from outside the world - it is all around us, if only we knew how to look. It is not a thing. It is simply the way the world weaves itself before our eyes. We obey the weave; we look in the right directions and the world seems solid. (HH 43.)

"Magic" is, of course, just one way of naming unintelligible phenomena. To quote the old SF proverb known as Clarke's Third Law: "Any sufficiently advanced technology is indistinguishable from magic."⁶ In *Hot Head*, magic appears as an intuitive explanation for environmental complexity – and a strategy for addressing it. From a neocybernetic perspective, the function of tarot in *Hot Head* could be viewed as a means of reducing the complexity of the environment that is the Jovian system. Ings' "magic" could be considered as an intuitive technology – a means of addressing "the way the world weaves itself", even without analytically understanding it. The symbolic system of tarot serves as a tool-kit for the specific purpose of describing the complexity of a psychic system.

Even though Malise is produced as an integral part of AI systems, as a character she still contains a certain nostalgia for individuality and originality. The symbolic order determining the narrative logic of her life posits her as the warrior character, the war hero – and throughout the story, she has strived to become that hero. The final resolution between herself and the Jovian is therefore anticlimactic and she is left without a purpose in the world. "[I]t doesn't feel like winning. I'd hoped I would get to press its stop button. As it is, I was the button it pressed to stop itself." (HH 298.) Born and culturally inscribed as human, Malise cannot willingly become posthuman. For a deeper vision of posthumanity, Ings has to come up with another character: *Hotwire*'s Rosa.

Technological Ecosystems in Hotwire

Set in the same fictional universe as *Hot Head*, *Hotwire* (1995) also illustrates the embodied and enactive views of distributed cognition. Where *Hot Head* addresses the modeling of cognition and the symbolic construction of subjectivity, *Hotwire's* focus is on life and its emergent properties.

In the speculative historical situation of *Hotwire*, the world teeters on the brink of technological singularity. Human subjects have been made largely redundant by massive artificial intelligences who handle all major analytical and administrative tasks. As the Massives gain more power and coherence of will, the humans are rapidly reduced to the state of "fleas trying to second-guess their dogs" (HW 96). It is not only human-made AI's, but cities and seas too, that emerge as cognizant subjects. As in the wildest transhumanist dreams, the whole material world seems to be "waking up" due to the increase in computational power (see Kurzweil 33, 265–266).

⁶ See TV Tropes: <u>http://tvtropes.org/pmwiki/pmwiki.php/Main/ClarkesThirdLaw</u>

Massives also have the power of producing new biological creatures from scratch. One of the two protagonists of *Hotwire*, Rosa, is an artificial girl produced inside a Massive. This Massive, a rogue orbital space station called *Dayus Ram*, is referred to as Rosa's Mother. From this womb-like state, she is transferred to Earth by the other protagonist, Ajay. Ajay is a reluctant hero character, similar to *Hot Head*'s Malise Arnim in many aspects: he is also a "hired gun", a component of a superhuman machinery of violence. Like Malise, he is also denied the resolution of a heroic narrative: by the end of the story, he is made to realize that for his whole life, he has been controlled by the needs of other people and institutions. Ajay also plays the human to Rosa's posthuman: the posthuman aspects of Rosa's character are brought out by the contrasting perspectives.

Rosa's Mother is at once a womb, a mind and an ecosystem: a bio-technological laboratory, constantly producing and re-producing novel forms of enfleshed posthumans. Only a small fraction of these creations are made in Dayus Ram's conscious parts, others are of unconscious origin. They take on all the grotesque, sublime and abject forms of speculative posthumanity: talking animals, angels, balls of cancerous tissue inhabited by collective minds. Rosa herself is but one possible outcome of the process of creation, temporal and contingent as the rest of the odd creatures. Roaming the dusty rooms of her mother's unconscious parts, she too is reduced to the scale of fleas and even microbes:

A fish cannot imagine 'sea'. A tree snake cannot picture 'forest'. A foetus does not know its mother's shape. Rosa, living here, lived still in her mother's womb. She had, as a consequence, no image of her mother. She could no more understand her ma than a bacterium in her gut could know her. (HW 47.)

From a systems-theoretical perspective, Rosa can be considered a subsystem. Like Malise in *Hot Head*, she can be described as an "animate calculator" (HH 253), an integral and oblivious part emerging from a complex whole. In the passage above, her inability to process the complexity of the environment is made strikingly clear. In *Hotwire*, however, this logic acquires a more visceral effect due to ecological metaphors and excessive descriptions of Massive-made flesh. For the purposes of this article, the most important aspects of the novel are the technological connectivity of Rosa's biological body and the peculiar nature of the agency this connectivity brings with it.

Intelligent Flesh and Emergent Consciousness

The bodies of Rosa and other Ma's creations are fashioned from a novel brand of datafat. A few decades of experimenting by mad scientists (both human and non-human, including *Hot Head's* Snow who now rules the world as the primary operating system for emerging AI cities) has resulted in intelligent flesh, capable of connecting and communicating with one's technological environment. As Rosa finds out in a communication loop with a Massive, every cell of her body is made of datafat: "You're all 'fat, little one. All Massive flesh. Each flake of skin. Each cell." (HW 270.)

In Rosa's phenomenological experience, the capabilities of her intelligent flesh are independent of her rational consciousness. Inside her Mother, she is an instinctive being, devoid of individual language or thought, acting without conscious decision. Once she is brought to Earth, her body continues to confuse her – it does not function in the same way as do the bodies of Earth-born humans. Rosa becomes conscious of her receptibility to electromagnetic waves: as she turns off the radio, the song keeps on playing in her head. She instinctively operates everyday appliances, vehicles and weapons by "minding" them, sometimes without consciously willing to. Her abilities

are compared with sexual desire and enhanced by affects like anger and fear. "I don't really know how I do it. I do it is all." (HW303.) It is not her brain alone that connects and computes, it is the entirety of her body, both the conscious and the unconscious aspects of it.

As in *Hot Head*, datafat functions as a tool for cognitive estrangement. It enables a detachment from the traditional dualist model of mind and body, as well as the "skullbound" model of classical cognitivism. As we saw above, it cunningly reroutes the reader's attitude towards embodiment by building on the well-established science (fiction) trope "the brain is a computer". At first, datafat is a cognitive enhancement, an interface tissue, supposedly operating analogically to cells in a human nervous system. Once this is established in *Hot Head*, it now becomes possible to invent bodies constructed completely of intelligent material, resulting in a model where every cell is a computer – or matter with mind. Not exclusively human mind, however, but a mind pervasive in all matter – best exemplified by the emergent intelligence of Massive Presidio's body of water, a "thinking sea":

She looked out the porthole. Sunlight skittered on the rippling water, like TV interference. 'You hear it?' he whispered.

'Just white noise.'

'Oh no.' He was sobbing openly now. 'Not noise. A harmony. So beautiful!'

'The sea?'

He nodded. 'Presidio!'

Rosa frowned. Which did he mean? Presidio or the sea? Or did he mean both? But how could the sound be both? What sound? What was he listening to? The rush of quanta from the sea, or some hidden rhythm? Natural music, or minded music?

And after all, she thought then, who's to say when chaos becomes mind? What stops the sea, as it signs its name in ripples on Waddell Beach, from thinking? May it not one day flux and give over scrawling in the sand, and start instead to manufacture eyes, fingernails, bags of blood and rolls of hair?

What distinction made her 'artificial' and Ajay 'natural'? Could you not say, with equal rightness, that the Earth had mind to make the things it made? Or that Ma herself was unthinking, a natural force merely, though supplied with handier tools?*Flap* went the waves. Ajay as Earth's signature, Earth's ripple.

Flap.

Rosa, in her turn, as Ma's –

Troubled by thoughts that did not seem to come from her, Rosa lost her concentration and found herself looking not at the waves, but through them, at deeper patterns of light, correspondences, shapes, echoes... (HW 267–268.)

In this passage, there are two things that need addressing. Firstly, the form of narration. As Rosa connects to the sea, its mind merges with hers with a subtle glitch in the discourse. The glitch is located at "And after all, she thought then", after which certain poetic grandiosity enters the discourse. Sophisticated phrases such as "could you not say" and "a natural force merely" are not present in the passages where Rosa's mind is disconnected from the Massives. Rosa thinks with Presidio, "thoughts that did not seem to come from her". In this form, her individuality is renounced. As during her time inside *Dayus Ram*, her mind is constructed as an integral process of an environment.

The second thing that needs addressing is the philosophical content of these thoughts. Presidio refutes the distinction between artificial and natural life, moving from the dualist framework – indicated by the conjunctive "or" – to a view supporting continuity of life and mind. On a dynamical level, Presidio *is* the sea, much in the same way as Rosa *is* her body – the thinking subject is an effect of material existence and movement, the rhythm and ripple of waves. This is elaborated later in the "conversation" between Rosa and Presidio, when "mind" is defined as an

emergent "side-effect of being". "The more you are, the more you think. Of course the earth thinks, on one scale. And so do you. Xu's boat thinks too; just not a lot, is all." (HW 269.)

In cognitive science and theoretical biology, the idea that life and mind share a set of basic organizational properties is known as the "strong continuity thesis of life and mind". Simply put, this thesis sees the distinctive properties of mind as an enriched version of those fundamental to life. In Evan Thompson's elaboration of Fransisco Varela's proposition, "living is sense-making", every living system is considered as both an autopoietic and a cognitive system. This broad usage of the term "cognition" is meant to highlight the intentionality present in the enactive self-organisation of all living systems. Even the simplest motile bacteria "make sense" of the world through their sensorimotor and metabolic activities: the environment of a bacterium is more organized than a world as an objective reality. The acts of moving and eating constitute both the bacterium (as an individual or a self) and the environment (as a domain of interactions proper to that self). (*Life in Mind*, 128–129, 158.)

This is the far end of the emergentist approach to cognition. The proposition "living is sense-making" reorganizes life and mind into a continuum: mind is life-like and life is mind-like. Similar ideas can be found in neomaterialist philosophy. For example, in the "vital materialism" of Rosi Braidotti, all matter is considered as affective and self-organizing. "Life" is not codified as the exclusive property of the human species but as a dynamic force that "cuts across and reconnects previously segregated species, categories and domains". This conception of life is signified by the word *zoe* – as opposed to *bios*, the discursive and intelligent life reserved only for humans. (*Metamorphoses* 132, *The Posthuman* 60.)⁷

Despite never becoming a "subject" in the sense of a unitary and autonomous individual, Rosa acquires a certain "competence with the world" (HW 251). This competence is not articulated in terms of control over other individuals or the environment, but in terms of adaptation.

Reminiscent of most teenage superheroes, Rosa's body is superhuman but her social self is not: she is constantly permeated by overwhelming technological, social and emotional influences. For the most part of the story, she is depicted as clumsy, awkward and ignorant. As the other central character of *Hotwire*, Ajay puts it, "Rosa was no goddess, monster, angel, ancient power; she was a girl" (HW 309). On a conscious and discursive level, she does not grasp the complexity of processes permeating her – but she adapts to them and learns to work with them on an embodied and intuitive level. In a sense, *Hotwire* can even be considered as a variation of a *Bildungsroman*, telling the story of the socialization of a young person. However, in Rosa's case, the socialization is not only adapting to the norms and conventions of human society, but also coming to terms with other life on Earth – including the life of her own body. For Rosa, "competence" includes the posthuman dimension of her senses, her ability to "reach out with her mind" towards all entangled systems of the technosphere.

One of the complex processes permeating Rosa's body is the change induced by pregnancy. The originating event is described quite early on in the story – a symbolically loaded sexual scene featuring unconscious Ajay and one of *Dayus Ram*'s surgical operating rooms – but the issue does not re-emerge until Rosa begins to feel the effects the pregnancy has on her. The pregnancy is also described as a loop of technological interaction:

Her morning nausea wore off at last, and in its place came a sensation of power she'd not experienced before. Something inside her, solid and powerful, was giving her energy. Like a battery, she thought. A battery in her belly. She said nothing about it to Ajay. She didn't want him to know

⁷ Braidotti's view is linked to what Stacy Alaimo has termed the "material turn" in feminist theory, environmental studies and science studies. Karen Barad has also called for a reassessment of the cultural from the perspective of the material: "How did language come to be more trustworthy than matter? Why are language and culture granted their own agency and historicity while matter is figured as passive and immutable, or at best inherits a potential for change derivatively from language and culture?" (801.)

how strong she was, how capable. She hid from him her growing competence with the world. (HW 251.)

In Braidotti's perspective, the construction of a thinking subject can not be separated from that of a desiring subject. Thinking is seen as "a tendency, a predisposition which expresses the outward-bound nature of the subject . . . a way of establishing connections with a multiplicity of impersonal forces" (*Metamorphoses* 70). "Thinking", in neomaterialist thought, is very much like the all-permeating "mind" in Ings' novels – largely non-conscious, affective and intensive. There is a pre-discursive moment in thinking, a passion for it, like the rippling of waves in the sea that is Presidio. This passion is also present in the descriptions of *Hotwire*'s thinking cities – the city of Rio de Janeiro is expected to develop emergent consciousness on its own (without a human-assigned brand-name personality), a tendency that is expressed in the material flows of masses – traffic, football audiences, crime and carneval. Even if it is not conscious yet, the city can be said to "think" on some level – on the preconscious level of its living operationality. In Ings' novels, the conception of living matter leads to a particular brand of cybernetic animism.

In this monistic model of the world, there is no categorical difference between a Massive-made datafat-body and an earthmade flesh-body. Both are considered thoroughly intelligent due to their living processes. However, it is crucial that Rosa is narratively constructed as different, as posthuman – without this defamiliarization it could be hard for a rationalist sf reader to accept the sense-making capacities of her living body. The posthuman signifies first and foremost a change in the conceptualization of subjectivity – Rosa the posthuman is Rosa the human, just conceptually organized in a slightly different manner. In creating a character that experiences the computational power of her biological system on a sensory level, Ings makes the reader consider the possibility of all bodies having "a life of their own" – and the limits of conscious control.

Conclusions

In *Hot Head*, Simon Ings utilizes the novum of datafat in developing a conception of subjectivity as an emergent effect produced in the interaction of multiple complex systems. Through the painful subjective experiences of the character Malise Arnim, he is able to convey some of the challenges inherent in the crisis of humanist thought: the loss of originality and heroism, and the disorientation of a character whose symbolic construction posits her as the subject in a world of objects. Overcoming this dualism, and the dialectic of control and lack of control, is depicted as a slow and painful process. Malise is constructed as a tragic character, striving towards a goal that has no practical value in a fictional world where individual heroism has been replaced by the strategies of collective environmental adaptation. Malise cannot escape the systems that produce and define her any more than she can escape her own living body.

Hotwire's Rosa evokes a different kind of subjectivity. She is produced as a posthuman creature, devoid of individualized language and agency. In the narrative construction of Rosa, datafat acquires a new purpose as a device enabling a conception of thoroughly intelligent flesh. Rosa has little conscious control over the operations between her flesh and the technological environment. However, both Rosa and Malise find ways of reducing the complexity of their respective environments. In Ings' prose, the strategies of adaptation acquire forms that would appear paranormal in any other context: tarot readings and animistic communication. In the logic of Ings' prose, these actions are constructed as thoroughly material – based on the premise of the living intentionality of matter itself.

Ings' work is exceptional in its thorough utilization of systems-theoretical ideas and recent developments in cognitive science. Still, it is not the rational communication of ideas that makes the work exceptional, but the integration of these ideas into the representation of subjective experience. In Malise and Rosa, Ings manages to convey modes of experience that might be called 'posthuman subjectivity.

Works Cited

Primary sources

HH = Ings, Simon. *Hot Head*. London: Harper Collins Science Fiction & Fantasy, 1992. Print. HW = Ings, Simon. *Hotwire*. London: Harper Collins Science Fiction & Fantasy, 1995. Print.

Secondary sources

"99. Neil deGrasse Tyson - Beyond Belief 2006." A talk by Neil de Grasse Tyson, recorded on video at Beyond Belief Conference at the Salk Institute, La Jolla, California Nov 7th 2006. Viewed May 10th 2014. Url: https://www.youtube.com/watch?v=BIbfD4VuVsc

Alaimo, Stacy. *Bodily Natures: Science, Environment and the Material Self.* Bloomington: Indiana University Press, 2010. Print.

Åsberg, Cecilia, Koobak, Redi & Johnson, Ericka: "Beyond the Humanist Imagination." *NORA* – *Nordic Journal of Feminist and Gender Research* 19.4 (2011): 218–230. Print.

Badmington, Neil. "Introduction: Approaching Posthumanism." *Posthumanism*. Ed. Neil Badmington. Hampshire and New York: Palgrave, 2000. 1–10. Print.

Barad, Karen. "Posthumanist performativity: Toward an understanding of how matter comes to matter." *Signs* 28.3 (2003): 801–831. Print.

Braidotti, Rosi. *Metamorphoses*. *Towards a Materialist Theory of Becoming*. Cambridge and Malden: Polity, 2002. Print.

- --. *The Posthuman*. Cambridge and Malden: Polity, 2013. Print.

Bukatman, Scott. *Terminal Identity. The Virtual Subject in Postmodern Science Fiction*. Durham and London: Duke University Press, 1993. Print.

Butler, Andrew M. "Postmodernism and science fiction." *The Cambridge Companion to Science Fiction*. 9th edition. Eds. Edward James and Farah Mendlesohn. Cambridge: Cambridge University Press, 2011. Print.

Clark, Andy. *Being There. Putting Brain, Body and World Together Again*. Cambridge: Massachusetts Institute of Technology, 1997. Print.

---. *Natural Born Cyborgs: Minds, Technologies and the Future of Human Intelligence*. New York: Oxford University Press, 2004. Print.

Clarke, Bruce. *Posthuman Metamorphosis. Narrative and Systems*. New York: Fordham University Press, 2008. Print.

Clarke, Bruce and Hansen, Mark B. N. "Introduction." *Emergence and Embodiment. New Essays on Second-Order Systems Theory.* Eds. Bruce Clarke and Mark B. N. Hansen. Durham and London: Duke University Press, 2009. 1–25. Print.

Graham, Elaine. *Representations of the post/human. Monsters, Aliens and Others in Popular Culture.* Manchester: Manchester University Press, 2002. Print.

Hansen, Mark B. N. "System-Environment Hybrids." *Emergence and Embodiment. New Essays on Second-Order Systems Theory.* Eds. Bruce Clarke and Mark B. N. Hansen. Durham and London: Duke University Press, 2009. 113–142. Print.

Hayles, N. Katherine. *How We Became Posthuman: Virtual Bodies In Cybernetics, Literature and Informatics.* Chicago: University of Chicago Press, 1999. Print.

Jones, Gwyneth. "The icons in science fiction. "*The Cambridge Companion to Science Fiction*. 9th edition. Eds Edward James and Farah Mendlesohn. Cambridge: Cambridge University Press, 2011. Print.

Kurzweil, Ray. *The Singularity is Near. When Humans Transcend Biology*. London: Penguin Books, 2005. Print.

Mandala, Susan. *The Question of Style: Language in Science Fiction and Fantasy.* London: Continuum, 2010. Print.

McGuirk, Carol. "The 'New' Romancers: Science Fiction Innovators from Gernsback to Gibson." *Fiction 2000. Cyberpunk and the future of narrative*. Eds. George Slusser and Tom Shippey. Athens: University of Georgia Press, 1992. 109–132. Print.

Parikka, Jussi. *Koneoppi: ihmisen, teknologian ja median kytkennät*. Turku: Turun yliopisto, 2004. Print.

Rabinowitz, Paula. "Soft Fictions and Intimate Documents: Can Feminism be Posthuman?" *Posthumanism*. Ed. Neil Badmington. Hampshire and New York: Palgrave, 1995/2000. 42–55. Print.

Rutsky, R. L. "Mutation, history, and fantasy in the posthuman." *Subject Matters*, Vol. 3, No. 2/Vol. 4, No.1: 99–112. London: London Metropolitan University Press, 2007. Print.

Sheehan, Paul. "Introduction. Contingencies of Humanness." *Becoming Human. New Perspectives on the Inhuman Condition*. Ed. Paul Sheehan. Westport: Praeger, 2003. 1–12. Print.

Slusser, George. "The Frankenstein Barrier." *Fiction 2000. Cyberpunk and the future of narrative.* Eds. George Slusser and Tom Shippey. Athens: University of Georgia Press, 1992. 46–71. Print.

Soper, Kate. *Humanism and Anti-Humanism*. *Problems of Modern European Thought*. London: Hutchinson, 1985. Print.

Thompson, Evan. "Life and Mind: From Autopoiesis to Neurophenomenology." *Emergence and Embodiment. New Essays on Second-Order Systems Theory.* Eds. Bruce Clarke and Mark B. N. Hansen. Durham and London: Duke University Press, 2009. 77–93. Print.

- - -. *Mind in Life. Biology, Phenomenology and the Sciences of Mind*. Cambridge and London: Harvard University Press, 2007. Print.

Varela, Fransisco J., Thompson, Evan & Rosch, Eleanor. *The Embodied Mind. Cognitive Science and Human Experience*. Cambridge and London: Harvard University Press, 1991. Print.

Wolfe, Cary. What is Posthumanism? Minneapolis: University of Minnesota Press, 2010. Print.

Wolmark, Jenny. "Staying with the Body: Narratives of the Posthuman in Contemporary Science Fiction." *Edging into the Future. Science Fiction and Contemporary Cultural Transformation*. Eds. Veronica Hollinger and Joan Gordon. Philadephia: University of Pennsylvania Press, 2002. 75–89. Print.