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The Book Problem is All in the Mind

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Abstract

When we read a narrative we are often transported to the place or scene described and we may also find ourselves immersed and involved in the action or events taking place there. In all, reading a book can create a sense of presence – in a way which is similar to using virtual reality (VR) technology. This phenomenon has been described as the “book problem”.

We review the treatment of the problem in the presence literature; make a brief excursion into accounts of the power of written narrative; discuss recent cognitive, ontological and neurological treatments of representation and imagery, and conclude that the balance of neurological evidence suggests that there is no book problem.

Keywords---Book problem, cognition, representation, narrative

1. Introduction

Presence can be thought of as either the consequence of physically being-in-the-world or the product of technology which substitutes the real for the virtual. In both cases presence is dependent on sensory input. We can reasonably add to this autobiographical and episodic memory – we remember walking into the kitchen at home or the VR lab at work – which enables us to make sense of our experiences, both as who we are and what we are doing today [Riva *et al.*, 2004]. We can also add a role for the body in integrating sensory inputs [Whitehead, 1925/1997]. Yet during our coffee break we are transported (c.f. Green and Brock, 2002) to the depths of space to fight the Xeelee [Baxter, 1994] or are in the throes of a desperate romance with Heathcliff (Brontë, 18xx) – depending upon one’s taste in fiction. This is what Biocca calls the *book problem* [Biocca, 2002]. The complexity and richness of the real world and the innovation and technical wizardry of the computer scientist is matched, and occasionally trumped, by writers from Shakespeare through to Dan Brown.

Despite this hiatus in our understanding of presence there have been surprisingly few studies of the book problem, and, with due respect to these researchers, no agreed resolution of it. The central difficulty remains that it is not particularly susceptible to direct empirical investigation. In an ideal world we would like to compare a written story with a VR or movie or game version of the same narrative. Narrative theory, however, (as well as common sense) tells us that the same basic *fabula*, or story, can be realised in many different ways. Faced with this difficulty, presence researchers have looked at the comprehension of descriptions of spaces and places, and the experience of passages with varying emotional content by means of classic cognitive psychology techniques coupled with presence questionnaires., e.g. Biocca (2002; 2003); Schubert and Crusius, (2002); Gysbers *et al.*, (2004).

We begin our discussion of the book problem by considering how it has been and could be treated before arguing that it is “all in the mind”. We begin with Biocca’s definition.

1.1. The Third Axis Proposal

Biocca begins by describing the (then) current two pole model of presence which he regards as a legacy from the original telepresence research. The two pole model has (our experience of) presence shifting or oscillating between the physical and the virtual. He then tells us that this account leads to the “physical reality problem”; the “dream state problem” and the “book problem” and, of course, it is the third of these which is of primary interest here.

A consequence of the two pole model has been what Biocca calls Sheridan’s “sensorimotor immersion assumption” [Sheridan, 1992]. This involves manipulating three sets of variables, namely, the extent of sensory data, control of sensors and the ability to modify the environment. If we successfully substitute these three physical (real world) variables with virtual / computer-based elements then ‘perfect’ telepresence might result. See figure 1, redrawn from Sheridan.

Biocca also notes that this engineering, tele-robotic model became a general cognitive model and applicable to *all media* [our emphasis]. He describes the “book problem” in this context as, “*if sensorimotor immersion is the key variable that causes presence, then how do we explain the high levels of presence people report when reading books? Books are very low fidelity, non-iconic media and are extremely low on all sensorimotor variables identified as causing presence ...*”.

Figure 1: The perfect substitution leading to perfect presence

As we have already noted, related to the book problem are the “dreaming” and “real world” problems which we will briefly describe as they are important in the conclusions we draw at the end of this paper.

Biocca defines the *real world* problem as, given that sensorimotor immersion is required for presence, why do people occasional not feel present, particularly when the real world is the “gold standard” for presence. The reasons for not being present are simple – we daydream and we disengage but, of course, this leaves us with the question of “where do we go?”. This neatly brings us to the *dream problem*. We all dream and many of us experience very high levels of dreaming presence, but again, where are dreamers present? This, again, presents problems for the sensorimotor immersion account of presence as there appear to be very little or no sensory input when we are dreaming.

So how to deal with this? Biocca adopts an evolutionary perspective, from which he argues that shifts in presence are likely to have predated media. Here we can imagine our pre-literate ancestors dreaming and day-dreaming as part of their everyday lives. It therefore follows that the cognitive mechanisms which allow for these shifts in presence must necessarily predate media. Given this, a third pole of presence can be proposed, namely that of mental imagery space. Thus Biocca regards all three problems as being due to a failure of the two pole model to incorporate spatial attention and mental imagery in its account of presence.

At this point it becomes clear that the focus of the discussion is *spatial presence* rather than presence *per se*. Biocca continues that the spatial models are generated by mental imagery have similar properties of real and virtual sensorimotor spaces. He regards spatial presence as oscillating or gravitating among three sources of spatial cues – real, virtual and self-generated.

He then considers how this three-pole model can account for the *book problem*. Biocca claims the model

does so by employing the imagery space to ‘fill in’ the spatial model described by the book. He writes, “The details of the egocentric spatial model generated by the narrative are generated largely from memory. So in some ways, the presence of books contains components of the virtual space and imagery space, but unlike an immersive 3D virtual environment, there is a higher component of imagery space”.

Some empirical investigation of the model is reported by Baños and her colleagues (Baños *et al.*, 2005) who compared the sense of presence between virtual and imaginary environments. They randomly assigned participants to either an imagined or virtual space condition, with sense of presence being measured at three point (at the beginning, half way, and at the end). The results suggest that the participants in ‘imagery’ spaces indicated a progressive drop in their sense of presence, while the opposite pattern was observed in participants in ‘virtual’ spaces. They conclude that the power of imagination seemed not to persist, whereas the availability of the virtual environment did not suffer from this problem.

As interesting as this is, Biocca leaves us with a number of unresolved questions. The first is concerned with the status of those other aspects of presence – most notably, engagement (as in *engagement + spatial presence = presence*). The second is the nature of ‘gravitation’. What is it that causes us to gravitate, shift and oscillate between poles? Without a treatment of this movement, the three pole account remains a static account of spatial presence which flips from one state to another. Finally, why does imagination ‘fade’?

1.2. Five Theses

Schubert and Crusius (2002) discussion of the book problem leads them to formulate five theses which they describe in their paper of the same name. However it is worth taking a moment to understand their starting point, as it is different to Biocca’s. They claim that the sense of presence is not a direct function of immersion, but is a cognitive construct created from immersive stimuli. The structure of this mental model determines whether or not the user experiences a sense of presence.

To paraphrase the original text, the five theses are:

The psychological phenomenon is the same in all three media [VR, film and text]. In all three media, the actual environment is “suppressed in favour of an alternative, medially presented and cognitively construed environment”.

To understand the book problem, we need to acknowledge the role of cognition as a mediator between immersion and presence. The media should be regarded as the raw source of the mental model building and not directly responsible for the experience of presence. This “is mediated by mentally constructing an environment surrounding the body”. Such a model can draw on very different media and is linked to sensorimotor representations.

Presence in VR, film and text differs with regard to the amount of spatial presence and involvement.

Immersion should be understood as the offering of bodily interactions. The authors argue that immersion increases presence as it discloses the possible range of bodily interaction with the environment. In a virtual environment bodily actions lead directly to changes in the screen. In a book this is much more complex as it depends on interpreting the text.

Books can produce presence because they use the power of narration.

Thus, to understand the *book problem* is to understand the cognitive processes – specifically, the creation of the mental model - which lead to the experience of presence. However, this is not quite so, as it is one thing to understand the nature and creation of the proposed mental model, it is quite another to unpick the power of narration to which the authors give no clue. How do we become ‘lost in a book’?

2. THE POWER OF BOOKS

In this section we briefly consider what we intend by the word ‘book’, then discuss selected theoretical and empirical accounts of the phenomenology of being ‘lost on a book’. The discussion is largely confined to the reading of fiction.

In Biocca’s discussion, a book is fundamentally “black marks on paper”. We treat this as signifying a printed text, rather than necessarily an object which binds multiple pages together within covers, and would thus include short stories and other narratives. This follows usage by most narratologists and other commentators on the nature of the reading experience who employ the terms narrative, book, text and story interchangeably. Green (2005) observes that the definition of narrative in particular has been much contested in philosophy and literary criticism, her own definition being simply a text where “some change occurs between the beginning of the story and the end”. This would include *inter alia* the literary forms of narrative verse and the text of plays. Interestingly, the actor Simon Callow comments that, until

relatively recently, *reading* Shakespeare was considered by some as the only way in which the plays could be fully appreciated without distortions introduced by directors or actors: “the theatre of the mind was where they [the plays] belonged” (Times, 2011).

2.1. Being Lost In A Book

Stories are as old as humanity. Green (2005) argues that narrative is intrinsic to human thinking, citing Schank and Abelson’s (1995) assertion that “all knowledge is stories” and psycho-anthropological studies such as Mancuso (1986) who suggests that infants in most cultures acquire a basic narrative grammar by the age of three. Good narratives have an extraordinary propensity to immerse, absorb or transport their readers, invoking imagery of the storyworld and a corresponding lack of involvement in the outside, ‘real’ world. Green notes that a reader’s “thinking is focused on the narrative” and that they “may experience vivid mental imagery”. The experience may be so powerful as to have an effect on self-perception and beliefs. While many such experiences are easy and effortless, Following the work of Nell (1988), it is suggested that immersion may be even more profound when a reader has expended effort on a more demanding text.

Ryan’s work explicitly discusses presence as an emergent property of reading which closely to the phenomena of immersion and absorption (Ryan, 2001). Four degrees of absorption are distinguished. In decreasing order of awareness of the ‘real’ world, these are: concentration (*c.f.* Green’s comment on demanding texts); imaginative involvement; entrancement; and finally addiction. Alongside these levels of absorption, Ryan identifies spatial, temporal and emotional immersion: respectively transportation to the geography of the narrated world; engagement with the unfolding events of the story, often associated with a degree of suspense; and identification with the characters portrayed. In this section we confine further discussion to the spatial aspects of immersion.

Such phenomena are unsurprisingly subject to individual differences. Both Green and Ryan suggest that the power of narrative is strongest when stories, their settings and characters resonate with the reader’s own experiences and memories and where the reader’s personality pre-disposes her to sympathy for, or empathy with, the protagonists. Wolf (2008) also argues that readers will relate texts to their own experience. Nell’s empirical studies identified a variable degree of interest in mental ‘pictures’ of the narrative and in whether a

reader's focus was on character, plot or setting. Green similarly notes reliable individual variations, and Baños *et al.*, (2005) cite a lack of attention to this factor in their critique of the work of Gysbers *et al.*, (2004).

As Herman (2009) points out in his overview of narrative theory, an 'interpreter' of a narrative relocates to a storyworld. Ryan (2001) itemises techniques by which such relocation is achieved. Many texts offer a narrated, almost guided trail through salient features of the place, whether this is achieved through realistic description (Balzac is cited here) or impressionistic strokes (for example Emily Brontë, Virginia Woolf). Stories may also use real proper names for the locations, thereby evoking a reader's own first or second hand knowledge of a place, while specific, isolated, concrete features may also set the tone for an entire location. The work of Wolf (2008), emphasises similar principles for the production of 'aesthetic illusion' (Wolf's preferred term for immersion): ease of 'access' to the storyworld and vivid presentation of its contents; consistency within the world; life-like perspectivity and generating emotional interest. He adds the requirement to respect the 'potentials' of media and genres and finally the principle of *celare artem* (concealing the art).

Most authors agree that exhaustive detail inhibits spatial immersion. Indeed, spatial descriptions are at their most powerful when incomplete. Tindall (1991) (cited in Blackler, 2007) discusses how Proust evokes the house at Combray through the staircase, the narrator's bedroom, the lamp and the gate. Blackler goes on to argue that the work of W.G. Sebald, a musing on place and memory, employs "a few selected but very evocative details" to create a "textual space". Empirical support for this may be found in Gysbers *et al.*, (2004). Here participants reading descriptions of museums reported stronger spatial presence and suspension of disbelief when presented with fewer explicit spatial cues. This is attributed to "more active imagination processes".

In short, for narratologists and other literary theorists, written narratives transport their readers to storyworlds by a combination of resonances with an individual's experiences and spatial cues, which together evoke mental imagery. The sparse empirical work on being "lost in a book" suggests that both the intensity of imagery is subject to individual differences and, interestingly for our later discussion, that sparser detail tends to enhance immersion. Beyond this, however, we still have few firm data as to just *why* (as contrasted to *how*) the written word is as powerful as full-spectrum VR as a means of transportation.

At this point we wish to discuss a different approach. The argument that follows will focus on the book problem as reflecting the dichotomy between distal and proximal stimuli.

3. A MATTER OF REPRESENTATION

This is a single axis characterisation of presence but should not be seen as piecemeal or incomplete because it is foundational. Our argument is that the phenomena of experiencing texts, on the one hand, and VR, films, and games on the other are fundamentally different. They are different because of differences in the nature of the underlying cognitive and neural representations which mediate them. Clark, from a cognitive science perspective, helpfully distinguishes between 'weak' and 'strong' representations – a perspective we examine here (e.g. Clark, 1997a; 1997b and Clark and Grush 1999).

3.1. Weak Representation

A weak representation is an internal state that is capable of bearing information about an external object only when that object is in close proximity. So, the presenter of this paper at the conference will have created weak representations of the audience.

Weak representations are found in what Clark describes as "information and control systems", which provide animals with quick feedback about objects in the immediate environment and thus enable them to interact with such local objects effectively. These systems contain internal states that are "information-bearing" in the sense that they correlate, in a non-accidental fashion, with features of external objects.

If the source object of a weak representation becomes distal or absent, however, the representation falls silent. However, such representations can be stored off-line for future use or combined with other representations to form internal maps of the external world. Animals can use these maps to navigate the environment and to solve a wide range of problems.

3.2. Strong Representation

A strong representation is an information-bearing state that is serviceable even if its source object becomes distal or absent. Clark argues that "a creature uses full-blooded internal representations if and only if it is possible to identify within the system specific states ... whose functional role is to act as de-coupleable surrogates

for specifiable (usually extra-neural) states of affairs” (Clark and Grush 1999, p. 8).

According to Clark, if a system does not possess “the capacity to set-up and manipulate inner models instead of operating directly upon the world, it will fail to count as a locus of full-blooded internal representation” (Clark and Grush 1999, p. 9).

For Clark, strong representations count as genuine representations because agents actually use them as surrogates for other objects. Weak representations, in contrast, do not count as genuine representations, for while it may be convenient to describe these states as representational, agents themselves do not actually use them as representational surrogates. So, as Clark would have it, weak representations are active when the animal is engaged with its world (the world contributing to its own representation) while, correspondingly, strong representations are active when the animal is disengaged from the world (real or virtual).

Thus ... and this will seem to be a little counter-intuitive ... stories in book are held as *strong* representations while experience of VR / films/ games will tend to create *weak* representations. After all, as Brooks has noted, “The world is its own best representation” (Brooks, 1991).

As interesting as the distinction between weak and strong representations is, what really matters is how the representation is used. Well, not quite *used*, how *available* is a better ontological description

Dreyfus and Wrathall (2005, p. 4) in their introduction to a collection of essays on Heidegger write, “*we first encounter worldly things as available. Something is available when (1) it is defined in terms of its place in a context of equipment, typical activities in which it is used, and typical purposes and goals for which it is used, and (2) it lends itself to such use readily and easily without need for reflection. The core case of availability is an item of equipment that we know how to use and that transparently lends itself to use*”.

There is also substantial evidence from studies of the neural basis of perception and action. For example, positron emission tomography has shown that those parts of the brain responsible for motor representation are activated in response to the perception of the affordances of objects. Grèzes and Decety (2002, p. 212) conclude that “perception of objects automatically affords actions that can be made towards them”. It may be that availability has its origins with the ways in which we first encounter the world. Although Heidegger does not address the issue of our corporeality or embodiment, it is evident that we first encounter the limits of the scope of what is available,

proximal and handy by way of our bodies. This progresses from encountering our own hands (through, for example, sucking our thumbs) and the body of our mother to all manner of external objects (beings) to the internalisation of these actions to form what we experience as cognition – if Piaget is to be believed. So, it is likely that embodiment is at the root of what we find available, however it is represented cognitively.

However, compelling as the argument is for the cognitive ‘strength’ and therefore availability, of representations evoked by distal stimuli, this does not answer the fundamental (book) problem. However it is interesting that the nature of the representation is independent of its medium or substance - what matters is how available it is / they are. For a further discussion of what is common to these different forms of stimuli, we turn to neuroscience.

4. EXPERIENCING, IMAGINING AND DREAMING: THE EVIDENCE FROM NEUROSCIENCE

There is very strong evidence, again from various forms of brain scanning, that imagining an object implicates (“lights up”) the very same neural circuits as seeing that object for real. Thus the very same neural structures and processes are responsible for processing real and imagined stimuli

Decety *et al.* (1989) report that when people are asked to imagine walking to a specific goal placed in front of them, and to indicate when they would have arrived, their estimates of transit time are remarkably similar to the actual time they subsequently require to walk that distance. In such tasks, people report that they imagine moving.

Decety (1996) further examined the hypothesis that motor images (self-created mental images of skilled motor actions – such as skiing) share the same neural mechanisms as those that are responsible for preparation and programming of actual movements. His hypothesis was based on the following evidence-based reasoning: there is common agreement that motor acts are centrally represented and are stored, modified, and may be retrieved through specific cognitive processing (cognitive processes and overt behaviour being closely related). And, motor imagery arises is a when a person imagines (mentally simulates) a given action. Further, there is evidence that motor imagery pertains to the same category of processes as those which are involved in programming and preparing actual actions, with the difference that in the latter case execution would be blocked at some level of

the cortico-spinal flow. And there is evidence that motor imagery has significant positive effects on motor skill learning. The same reasoning that is used in visual imagery research can be extended to motor imagery, by assuming that motor images share the same neural mechanisms as those that are also responsible for preparation and programming of actual movements. Decety's methods included mental chronometry, monitoring autonomic responses and measuring cerebral blood flow in normal subjects during motor imagery tasks. All three data sources supported the hypothesis that motor imagery and actual movements involve on the same neural processes.

Similarly, mental motor images are constrained by the same physical laws as real world actions. Sirigu and her colleagues (1996) have shown that imagined actions follow the same speed-accuracy trade-offs as embodied in Fitts' Law.

These initial ideas and findings were subsequently developed by Jeannerod (2001) to create his "theory of neural simulation of action". The theory, at its simplest, states that real and imagined actions are mediated by the same cortical areas. **Error! Reference source not found.**, which has been adapted from Jeannerod (*ibid*), is a simplified summary of 14 reported studies.

Erlacher and Schredl (2008) have extended this discussion by examining the hypothesis that REM dreams also call upon these same neural substrates. Their approach has been to review the literature on REM / lucid dreams against the Jeannerod / Decety position. They found abundant anecdotal evidence from studies of the reported dreams of athletes – who have reported 'practicing' difficult or demanding procedures in lucid dreams – and clinical evidence from people suffering from REM sleep behaviour disorder and invasive animal

studies. In all, the strongest support for the shared substrate hypothesis was from the central nervous activity (recorded) during REM sleep. However, the evidence from autonomic responses and "mental chronometry" was inconclusive – which the authors attribute to methodological issues.

All-in-all, the evidence suggests that when we read about something (and construct a representation of some sort of the place, people and events) or dream, or watch a movie or experience a virtual environment we necessarily engage the same sense-making neural and cognitive processes.

5. IN CONCLUSION

Is there a problem with books? We have seen so far that Biocca's original formulation of the problem argued that it was a consequence of the pervasive engineering paradigm in presence but that the "real world problem", the "dreaming problem" and the "book problem" had a common origin. Biocca placed this common origin at the feet, so to speak, of mental imagery.

Schubert and Crusius treat the 'book problem' as a cognitive psychological issue but one which relies on the power of narration.

We have discussed a range of accounts of how narratives possess such power, in short by the presentation of carefully constructed cues which are strengthened by resonance with the reader's own knowledge and experience.

We have also reviewed the nature of weak and strong representation, arguing (after Clark) that textual narratives evoke strong, and therefore, compelling, cognitive representations, and further that the availability of such representations is grounded in embodiment.

Finally, we outlined a small sample of the neurological data on which parts of the brain are implicated in the processing of information from virtual environments and the written word. In considering the evidence from studies of imagining and directly experiencing scenes and objects, we find that the same neural structures are implicated. Biocca was both right and wrong – correct to group dreaming, the book problem and the real world problem together but wrong about imagery as being the missing component. Especially when we note that Kosslyn *et al.* (2001) notes that Pylyshyn, who championed the view that mental images are not 'images' at all, but rather rely on mental descriptions no

Brain regions & Brodman areas (Ba) engaged	Execute	Intend	Imagine	Observe actions	Observe objects
Precentral gyrus Ba	✓		✓	✓	
Precentral gyrus (dorsal) Ba	✓		✓	✓	
Precentral gyrus (ventral) Ba	✓		✓	✓	✓
SMA (rostral) Ba	✓		✓	✓	
Cingular gyrus Ba	✓	✓	✓		
Superior frontal gyrus Ba			✓	✓	
Middle frontal gyrus Ba		✓	✓	✓	✓
Inferior frontal gyrus Ba	✓		✓	✓	✓

Table 1: Adapted from Jeannerod, 2001 (table 2, p. S104)

different in kind from those that underlie language. According to Pylyshyn, the pictorial aspects of imagery that are evident to conscious experience are entirely epiphenomenal.

We may conclude that there is no book problem because in terms of neural mechanisms, the brain does not distinguish between the real and the imagined. Nor is there a dream problem or a physical reality problem because all of these diverse sources of ‘stimuli’ are processed by the same parts of the brain. And the same parts of the brain give rise to very similar kinds of experiences – QED, no book problem.

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