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Cover design: Laimute Varkalaite

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Virtual worlds and reality: knowing through imitation

Jan H.G. Klabbers

Abstract
In the context of gaming, this paper addresses the question: What is real? Related question is: What knowledge does a person employ to interpret and act on the world? To understand the meaning of these questions, I elaborate more specifically tacit knowing as the key to understanding what is going on in the minds of the players. Advances in neuroscience enlighten the roles of some key ingredients of tacit knowing: peripersonal space, mirror neurons and empathy, and the notion of Self. Their interplay shapes the basis for action learning and tacit knowing. As imitation is ingrained in the workings of our brains, I will draw attention to the potentials of learning-through-imitation. I will argue that if the notion of Self is an illusion, then what we consider real is an illusion too.

Keywords: action; action learning; agent; brain; empathy; explicit knowing; illusion; imitation; macro-cycle; micro-cycle; mirror neurons; peripersonal space; real; schema; Self; tacit knowing; theory of mind; virtual image.

Scoping
Virtual worlds are spin-offs of advances in computer science, information and communication technology, new media technology, and digital game design. They also represent illustrated worlds such as in movies and ordinary unrealism as in advertisements. They are both different from and similar to our daily experiential and empirical world. As we look into our mirrors every morning, we are very familiar with virtual images.

“By definition a virtual image is generated by a planar mirror behind the mirror surface. Although rays of light seem to come from behind the mirror, light spreads and exists only in front of the mirror. Therefore the virtual object does not exist as a physical object, but it exists with full rights as a visual object. The match between real and virtual objects preserves metric information but the two are not identical, they are related by a mirror reflection (they are enantiomorphs) like, for instance, the left and right hands” (Jones & Bertamini, 2007, p.1574).

In other words, virtual objects are ontologically subjective, and epistemologically objective. In virtual worlds such as “Second Life”, there are no similar physical objects in front of the computer screen surface, which acts like a mirror. Nevertheless, the objects and their surroundings landscapes and architecture being virtual, exist with full rights as visual, or more general, as sensory objects. The emergence of digital games technologies and the convergence between new technologies such as, augmented reality, mobile technologies, GPS technologies, sensor technologies and entertainment computing, offer a wide variety of tools for shaping virtual worlds. Through this business-driven technology push, little time is being devoted for developing the necessary theoretical and methodological framework for the user-centered design, use, and assessment of digital games. Moreover, those involved in the so-called design of interactive user experiences through games, in general tend to be unaware of, or prefer to neglect the vast literature on games and gaming research since the 1950s. This ignorance is most obvious through their use of the term “serious games”. For example, the scope of the articles in the 39 issues of the journal Simulation & Gaming and the proceedings of the ISAGA conferences since 1970 reflect the overwhelming attention of gaming methods being applied in the design, research and professional practice.

Scholars in regular gaming & simulation take the time to design and extensively test their artifacts, often for years, before they put them into educational and professional practice, and use them for further research. Those who use the term “serious games” for marketing reasons seem to trying to steal the existing body of knowledge in gaming, pretending that they are the ones that are inventing the wheel.

The modern use of virtual worlds is very closely related to advances in the information and computer sciences and technologies. Virtual worlds are the worlds of artifacts: deliberate human
constructions. Are virtual worlds real? This question can only be answered if in the first place we are able to answer the question: What is real? Answers to the question what is real are related to the ontological question: How do we know the essence of things? The related epistemological question is: As knowing is a mental state, how do we justify knowledge claims?

I will make a distinction between two sorts of knowledge: representational and action-based knowledge. Representational knowledge claims take the perspective of the observer (spectator), while action-based knowledge claims emerge from the inside participant’s perspective. In Table 1, I have compared basic features of both sorts of knowledge (Klabbers, 2008).

Table 1: Two theories of knowledge

<table>
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<tr>
<th>Representational view on knowledge</th>
<th>Action-based view on knowledge</th>
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<tr>
<td>Knowledge-as-object (state);</td>
<td>Knowing-in-action (process);</td>
</tr>
<tr>
<td>Context independent;</td>
<td>Rich context for generating meaning among learners;</td>
</tr>
<tr>
<td>Disembodied knowledge;</td>
<td>Embodied knowledge;</td>
</tr>
<tr>
<td>Knowledge through acquisition,</td>
<td>Knowing through interaction, learners are agents;</td>
</tr>
<tr>
<td>learners are mental containers;</td>
<td>Context as a unique temporary configuration to assign meaning;</td>
</tr>
<tr>
<td>Treating learners as if they can</td>
<td>Learners as co-producers of meaning in a learning community through engagement &amp; alignment;</td>
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<tr>
<td>be understood in isolation from</td>
<td></td>
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<tr>
<td>their contexts, and the contexts</td>
<td></td>
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<tr>
<td>as if they exist in isolation from</td>
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<td>learners;</td>
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The action-based view on knowledge is more closely connected to gaming than the representational view, mainly due to the fact that the playing of games drives the players' experience. Games provide rich contexts for generating meaning.

Addressing what is real in the context of gaming, I will not pay attention to physical objects as such. I am primarily interested in the sensory objects that our minds may consider real.

When we play games - any games - we enter magic circles: temporarily hedged spaces in which certain rules, regulations, and procedures apply (Klabbers, 2008). An interesting question is: What happens in the magic circle; is it real?

The magic circle

When we choose to professionally arrange a game-session, the players enter the magic circle, which globally consists of four stages: briefing, actual game play, debriefing-1, and debriefing-2, see Figure 1. These four stages represent the macro-cycle of a game session. During the briefing, the players read the game manual, receive instructions, and assume their roles. When they start playing, they become involved in meaning processing, actions, and mutual interactions. While enacting their roles, they try to make sense of what is happening, and use and adjust their schemas: perception-and-action-repertoires to achieve their goals. They reflect while acting. All these processes are embedded in the micro-cycle of playing games (see Figure 2).

The micro-cycle illustrates the processes of situated and action learning with emphasis on the self-reproduction of schemas. Once the game is over, the players engage in the first debriefing, sharing their experiences of what happened during the game. The scope of the first debriefing is story telling: interactively framing narratives. Once the players have agreed that their common narrative covers satisfactorily what happened during the game, they switch to the second debriefing, which focuses on key concepts that have emerged through playing the game, and the way they relate to each other. During this second debriefing the players reflect on their prevailing schemas, and consider whether they need adjustment.
While making sense of the simultaneous and consecutive actions and interactions, the players use three coordinates to continuously position themselves in the game space: the activity dimension, awareness dimension, and the articulation dimension. Combined, these coordinates form a three-dimensional perception-action space (see Figure 3). The players continuously position and reposition themselves in that space. Through these three coordinates, the players enact explicit and tacit knowing. (For a more elaborate discussion on this subject, see Klabbers, 2008, Ch. 3).

As playing games is always related to situated learning and knowing, for the players - in their capacity of individuals and team members - as well as for the designers and facilitators, a key question of what is happening inside the magic circle concerns: Is it real? Related to this question are the following questions (Barth, 2002):

1. What is the nature of the relationship between the one who knows and what is known?
2. How do those-who-know engage themselves in discovering or constructing knowledge?
3. What knowledge does a person employ to interpret and act on the world?

Answering these questions is not simple and straightforward. I will illustrate this by focusing on tacit knowing. In general, we can say that knowledge encompasses ways to understand major
aspects of the world, ways think and feel about the world, and ways to act on it. This idea of knowledge connects to schemas, which are multi-sensory perception and action plans, including our perception of and beliefs about our own body’s appearance.

*Figure 3: Representation of explicit & tacit knowing*

![Figure 3: Representation of explicit & tacit knowing](image)

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Designers and facilitators pay most attention to conceptual aspects that are well articulated, and under control. If I read advances in neuroscience and cognition well, then - to make a conservative estimate - more than eighty percent of what is happening in games is beyond our awareness. Applying that notion to figure 3, then the space, covering tacit knowing, is at least four times as large as the space producing explicit knowing. Therefore, there are good reasons to elaborate the domain of tacit knowing.

**Tacit knowing: creating a mental world**

Frith (2007) has pointed out that our brain creates the illusion of an effortless interaction with the world through our perceptions and actions. It actively creates pictures of the world, and continuously learns things about the world. We have no direct contact with the world or even with our own bodies. Our brain creates this illusion by hiding from us all the complex processes that are involved in discovering about the world. We are not aware of all the inferences and choices our brain constantly has to make. Behavioral and neurophysiological studies suggest that the brain constructs different representations of space. How these two representations are bound to give a unified sense of space in which humans act is not clear (Vaishnavi et al, 2001). In the context of playing games, I will elaborate three key qualities of tacit knowing that will give us some clues about what is real:

- Peripersonal space;
- Empathy;
- The experience of Agency.

**Peripersonal and extrapersonal space**

The brain constructs multiple representations of space (Vaishnavi et al, 2001). These representations include:

- *Personal space* - the space (volume) occupied by the body;
- *Peripersonal space* - the bubble of space around our body - within the reach of our limbs;
- *Extrapersonal space* - the volume of space beyond the reach of our limbs.

The peripersonal space around our body, in reach by our arms and legs, is mapped inside our brain, which contains cells that keep track of everything and anything that happens within the invisible space at arm’s length around our body. When we sense objects entering that space, these cells start
Virtual worlds and reality: knowing through imitation

firing. Each part of our body has its own spatial map attached to it (Blakeslee & Blakeslee, 2007). In the context of playing games with groups of participants, it is worthwhile to understand that in various cultures, different hidden codes apply about entering that peripersonal space. From personal observations, I have noticed that Italians like to stand close to each, touching each other while speaking with one another. They don’t show signs that they invade each other’s personal space comfort zone. The Dutch and Americans like to keep more spatial distance, implicitly being keen on not invading each other’s comfort zones. This silent body language gives clues about the way players arrange themselves - or are arranged - in the physical game space, and about their feelings of easiness and uneasiness in multi-cultural game settings. The idea of peripersonal space enlightens that there is no clear-cut distinction between our body and the rest of the physical world. Moreover, the boundary between peripersonal and the space beyond it, the extrapersonal space, is fluid. Frith (2007) discussed several experiments that show that as far as the parietal cortex of the brain is concerned, tools become extensions of our arms and hands. This applies to using pencils, rakes, rackets, cars, etc. When we drive a car, the wheels, and the way they keep in contact with bumps in the road, extend our body image into extrapersonal space. So, the car becomes embedded in our peripersonal space. If, by direct remote control, we are able to move a vehicle on the surface of the Moon, or Mars, through the joystick and the related ICT-infrastructure, our body becomes extended to the surface of the moon, or Mars. This notion also applies to those tools that are being used while playing games. While playing games, we are unaware of that tacit knowing-in-action. Blakeslee & Blakeslee pointed out:

It turns out the sensory maps of your parietal lobe are also de facto motor centers, with massive direct interlinkage to the frontal motor system. They don’t simply pass information to the motor system, they participate directly in action. They actively transform vision, sound, touch, balance, and other sensory information into motor intentions and actual movements (Blakeslee & Blakeslee, 2007, p. 115).

This interlinkage is the essence of our schemas. The physical and virtual settings of the game space are important design parameters. They directly impact on our experiences (knowing, feeling, and action) in peripersonal space. A key question is how our brain connects peripersonal and extrapersonal space to virtual images and worlds, to augmented reality.

Empathy

How do brains connect? Frith (2007) is very explicit about answering this question. He said that we know a lot about what is in the minds of others by simply observing the way they act upon the worlds, by the way they move. A leaf blowing in the wind, a rock tumbling down the hill are moving objects. Those movements are different though from seeing human beings what they are doing. He referred to Gunnar Johansson’s studies in the 1970s, attaching small lights to the major joints of one of his students and filming her moving in the dark (Johansson, 1973). The interrelated 14 light spots represent a dynamic physical space. As soon as the spots start to move a figure immediately emerges. You can distinguish whether it is a man or woman, running, dancing, being happy or sad. For an enjoyable demonstration, see for example http://www.biomotionlab.ca/projects.php from Nikolaus Troje’s Biomotion laboratory. Apparently, our brains are well established to reveal intentions through our movements. A leaf blowing in the wind does not show intentions. We recognize a cat or dog from their shapes and the sounds they make. We see a woman dancing. Recognizing a woman, a man, a cat, or dog - as objects in space - does not give us access to their mental world of beliefs and intentions. We recognize them from the way they move, revealing their intentions and feelings. A leopard, stalking its prey, or a woman feeling happy, through their movements they open for us their mental worlds. Frith (op cit.) said that even simple movements could reveal something about goals and intentions. We pay particular attention to other people’s eyes. We are able to detect very small eye movements of less than 2 millimeters when standing up to 1 meter away from the face. Ross and colleagues (2008) noted that emotional contagion enables individuals to experience emotions of others. It is closely linked to facial mimicry, where facial displays evoke the same facial expressions in social partners. In
humans, facial mimicry can be voluntary or involuntary. Involuntary mimicry can be processed as rapid as within or at 1 second. They assessed whether rapid involuntary facial mimicry is present in orangutans for their open-mouth faces during everyday dyadic play. Results clearly indicated that orangutans rapidly mimicked open-mouth faces of their playmates within or at 1 second. Their study revealed the first evidence on rapid involuntary facial mimicry in non-human mammals. This finding suggests that fundamental building blocks of positive emotional contagion and empathy that link to rapid involuntary facial mimicry in humans have homologues in non-human primates.

Rizzolatti et al. (2004) demonstrated that different neurons were active with different kinds of grasping movements. Most interestingly, they noticed that these neurons did not become active only when the monkeys in their experiments grasped something. They also became active when the monkey saw one of the experimenters grasping something. These so-called mirror neurons - neuronal assemblies - represent action sequences to produce actions as well as to observe those actions. The human brain is similar. Frith (2007) pointed out that our own brain becomes active in the same regions in the premotor and parietal cortex that would be active if we made the same movement ourselves. The major difference however, is that we don’t actually move. Blakeslee et al. (2007) characterized mirror neurons as follows.

A special set of cells within certain high-level body maps that represent actions performed both by oneself and by others; hence, they are key to many higher mental functions, including imitation, empathy, and the ability to read one another’s intentions (Blakeslee et al., 2007, p. 213)

Blakeslee et al. mentioned that mirror neurons allow us to grasp the minds of others, not through conceptual reasoning, but by imagining their actions, intentions, and emotions in our own schemas. Seeing is doing. Many athletes rehearse their skills by imagining that they perform them, or as Blakeslee et al. pointed out, by watching or playing video games. The better our own skills in gymnastics, or football, the more deeply we understand the skilled performances we witness, because we are mentally capable of imitating them. The actions we mirror most strongly are the ones we know best.

Blakeslee et al. referred to Ramachandran, who stated that in human evolution our brains did not become unique because they evolved highly specialized modules, through mirror neurons they absorb culture the way a sponge sucks up water. Mirror neurons provide an alternative explanation for the emergence of unique human abilities such as, empathy, theory of mind, and the ability to adopt another’s person’s viewpoint, in other words for the horizontal transmission of culture, for decoding and internalizing meaning of other people’s actions and intentions by processing them directly within our own schemas.

Lewis (2003) distinguished four interconnected levels in the development of a theory of mind, which attributes thoughts and motives to other people:

1. I know - Basic level also common to animals;
2. I know I know - the capacity to reflect on one’s self and to reflect on what one knows;
3. I know you know - In addition to levels 1 & 2, I believe and expect others know it as well.
4. I know you know I know - Two persons can check their knowledge of what they know about each other, against what each individually knows.

Playful gaming only starts at level three.

Frith (op cit.) said that to imitate someone, we watch their movements closely, but we don’t copy these movements. We use the movements to discover something in the mind of the person we are watching: the goal of their movement. Then we imitate them by making a movement that achieves the same goal. Thus, learning-by-imitating is a powerful capacity in transferring knowledge and skills.

If I see a smiling face, I start smiling a little too, and I feel happier. The same applies with seeing a face filled with disgust and anger. Those private feelings are automatically shared through the ability of our brain to translate between schemas: perceptions-and-actions. When we see someone else in pain, the same brain areas become active as when we experience pain ourselves, thus experiencing empathy. We share the mental experience of the pain, not its physical aspect.
Learning through imitation while playing games, through our mimetic ability and based upon a powerful human neuronal capacity, is a little explored area of research and practice. As argued above, it builds upon experimental and empirical evidence in neuroscience. It should receive much more attention in relation to action learning. However, this potential of feeling empathy has also a dark edge that needs to be understood as well. It relates to Girard’s notion of mimetic desire, a powerful and sometimes destructive force in human relations. Although mimetic desire is a basic feature of life, I have elaborated this idea more specifically in relation to the dynamics of play (Klabbers, 2008, p. 303-304). Through the neuronal basis for empathizing with people, and our potential for imitating their actions and incentives, we engage in games (of life) that trigger sequences of actions and incentives that rapidly might become beyond our control.

Girard (1976) has illustrated the potential force of mimetic desire by two examples. When giving plenty of toys of strictly the same kind to a group of children, the kids start to dispute and fight each other for the same object, while ignoring plenty of other toys left. In another example, he described a common experience of the neglected wife, who once again becomes attractive to her husband when another man courts her through his actions and incentives. Girard stressed that mimetic desire has neither subject nor object. It is always the imitation of the desire of another person. That person becomes a model to be imitated or copied. The simultaneous convergence of desires of people defines the object of desire. It starts rivalries and models become obstacles in fulfilling desires. We desire what others desire because we imitate their desires.

Desire is triangular: an object, a subject, and a third person toward whom the desire (envy) is directed (Girard, 1965). He argued that envy might be reduced to mere irritation when our desires are accidentally thwarted. However, true envy is infinitely more profound and complex. It always contains an element of fascination with the ‘insolent’ rival. This mimetic desire is the immediate interference of the desire of the imitator with the imitated desire. In other words, the desire of the one imitates (copies) the desire of the other, and shows what is desirable when desiring. It is a dynamic pattern that makes rivalry out of imitation in a continuously reinforcing imitation. Mimetic desire is coded and mediated (unknowingly) by the model. An external observer may notice the incompatible, conflicting process of, on the one hand the merging of imitation, and on the other hand the differentiation - distinction - in desire. The protagonists, - the rivals - being soaked up in their mimetic dance, do not perceive the characteristics of their actions and motives by virtually stepping out of their magic circle, which leads to such circular memitism. They cannot stop their mirror neurons, which operate largely outside consciousness, from firing. However, the protagonists still have the choice to disconnect themselves from this mimetic dance via the intervention of a neutral outsider. Through the force of mimetic desire, many good working relationships run the risk of being destroyed.

In competitive games, mimetic desire can set in motion a destructive flow of events as occasionally shown during FUNO sessions (Klabbers, 2008). FUNO, by design, is a cooperative game. Providing the mimetic desire of key players, it easily becomes a competitive game.

Our ingrained capacity for empathy may cause sympathy and antipathy, triggering a whole variety of perceptions and actions, and impinging on ethical questions related to facilitating games. Our potential for empathy does not rule out deceit.

**Agency: the sense of Self**

In the former section, I have made the distinction between movements such as, tumbling rocks, and movements that reveal something about goals and intentions. Mirror neurons represent actions performed both by me and by others. They are key to many higher mental functions, including imitation, empathy, and the ability to read one another’s intentions. Frith remarked that the brain does not automatically imitate a robot’s arm. We see them mechanical rather than biological: “…only certain creatures move on their own accord in order to attain goals” (Frith op cit. p. 148). He called these goal-directed movements actions, and creatures with goals agents. Our brains will only imitate actions of agents. Experimental evidence has shown that a robot arm is not perceived as an agent with goals and intentions. Therefore, Frith concluded that when a robot arm moves, my brain
sees only movements, not actions. For various reasons, this observation is quite revealing. The
engineers who design robots have built in algorithms for goal-directed movements. They call their
artifacts, goal-directed and adaptive. Yet our brains seem to see only movements and no actions. If
a similar distinction applies to avatars in digital games, then our brains do not automatically imitate
their movements. They do not become part of our body image, and part of our peripersonal space.
Moreover, we would not see them as agents to which we may connect. We will not be able to
automatically imitate - via our mirror neurons - their goal-directed actions and intentions. If
empirical evidence eventually will support this thesis then the potential of learning through digital
games will be greatly diminished. In addition, this thesis may shed new light on the question about
ethics of violent digital games.

We experience privately that we are in control of our intentions and actions. We are agents that
make choices, decide which goals to pursue, select tools to perform those actions, and decide when
to perform them. We consider ourselves as free agents. My thought can make things happen in the
physical world. Agents link cause and effect in simple causal chains. Our brain is very good at
linking cause and effect through prediction. Through trial and error it learns to link them together.
However, we should keep in mind that there is no control center, or in other terms, no
“homunculus” in our brains that represents our Self.

To check who is in control, Libet and his colleagues performed an experiment, in which they asked
the subjects to lift a finger whenever she or he felt the urge to do so. Their key observation was that
the change in brain activity occurred about 500 milliseconds before the finger was lifted (Libet et
al., 1983) Brain activity, indicating that the volunteer was about to lift a finger occurred about 300
milliseconds before that volunteer reported having the urge to lift his or her finger. From this and
related experiments, Frith (op cit.) concluded that we think that we are making a choice when, in
fact, our brain has already made the choice.

One of the characteristics of our explicit selves is the subjective sense of unity and continuity over
time. Gazzaniga (1998) pointed out that the capacity for self-awareness seems to be limited to the
left-brain. Extensive split-brain studies have shown that the right brain will iteratively process what
it receives and that the left brain routinely invents stories to explain what the right brain
experienced, even though it had not experienced it itself. If shown what the right brain chose to
match a picture that the left-brain didn’t see, the left-brain invented a plausible, and totally fictitious
story to make it coherent with what it had seen or experienced (Gazzaniga, 1998).

It is out of the scope to review advances in cognitive and neuroscience literature, dealing with the
illusions of agency and the Self. In the context of this paper, I will summarize some conclusions
Frith has drawn that I consider relevant for game research and practice.

We don’t have direct contact with the physical world. It is an illusion created by our brain. Our
brain creates schemas by combining signals from our senses and prior experience and expectations.
We are aware of these schemas. In similar way, our brain creates schemas of the minds of others -
of their mental world. By making schemas of the minds of others, our brain enables us to enter a
shared mental world.

   By sharing my mental world with others, I can also learn from their experiences and adopt the
   models of others that are better than my own. From this process, truth and progress can emerge,
   but so can deception and mass delusions (Frith op cit., p. 183).

Blakeslee and colleague (op cit.) noted that the illusion of the Self is that Self is a kernel, rather than
a distributed emergent system.

**Summing up**

In regular games with direct face-to-face interactions, the interplay of peripersonal space, mirror
neurons, and goal-directed movements - *actions and interactions* - shape a silent understanding, a
tacit knowing that is beyond the control of the players. It emerges while playing. It is the basic
ingredient for sense making during the game process, and important input to the debriefing. To my
view, explicit knowing, the main focus of attention during the design of games, plays a much less
central role, while playing games, than commonly assumed. Understanding the neurological basis
of peripersonal space, empathy, and agency in shaping our tacit knowing seems to me a prerequisite for adequately studying learning through gaming. It will shed light on what is real in the magic circle, on our ways of understanding major aspects of the world, ways to think and feel about the world, and ways to act on it. As we do not have direct contact with the physical world, let alone the mental world of others, the idea of having direct contact with our environment is an illusion. So, an answer to the question, what is real, depends on how we handle illusions. Frith (op cit.) stated that for us to act upon the world, it does not matter whether or not our brain’s schemas are true. All that matters is that the schemas work. Perception is according to Frith a fantasy that coincides with reality. We should be aware that if perception does not coincide with reality, then we enter the realm of hallucinations. Addressing that world, is however beyond the scope of this paper.

**Summarizing remarks: What is real while playing games?**

Through their minds, players construct reality in games. All worlds, virtual and gamed worlds included, are illusions.

1. The illusion of agency, of Self, arises when experiencing the thought of making a movement just before the movement occurs - even if we don’t actually perform the movement - is sufficient to make us think that we have caused the movement (Frith op cit.).
2. If my sense of Self is an illusion, then what I consider real is an illusion too.
3. Virtual reality is an illusion.
4. Our brains connect through mirror neurons, which enable empathy between the players (agents), which are creatures with goal-directed movements.
5. Mirror neurons trigger learning through mimesis (imitation) - processing directly the meaning of other people’s actions and intentions within one’s own schemas.
6. Since imitation and empathy are qualities of our brains, compassion, mimetic desire and envy are their counterparts as states of mind.
7. These capacities condition the players’ mutual tacit knowing & knowing from experience.
8. Providing the different memories and related schemas, it will not come as a surprise that when people have played a game together and tell about it, they have experienced different things.
9. The overwhelming number of brain processes that make up our mind, makes that the role of tacit knowing should receive much more attention in game research and practice. The volume of that tacit knowing space - see Figure 3 - is at least four times larger than the volume of the explicit knowing space.
10. Knowledge is what a person employs to interpret and act on the world. This includes feelings (attitudes), information, embodied skills as well as verbal taxonomies and concepts, all the ways of understanding that we use to make up our experienced reality.
11. It may very well be that when playing a game, we clearly grasp what is going on, and because of that, we chose to refrain from acting out. The facilitator and the game researcher will not be able to observe that concealed outward behavior and its inner connotation. Yet, it is vital for the way games evolve, to be aware that this will happen. Therefore, outward behavior is an unreliable and invalid index of the internal mental events that happen in the brains and minds of the players.
12. Virtual worlds are ways of perceiving and thinking. They are not ways of being, just habits of mind. Therefore, we can only interact with them, and construct illusions. We cannot enter them.

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