The Role of Dynamic Imagery in World Interaction

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1. Introduction

This paper centres on the notion of *imagery* (the ability to visualize in the mind's eye, and the corresponding abilities for other sense modalities), and more specifically *dynamic* imagery, i.e. representations of temporally ordered events. Special emphasis will be put on the ability to produce temporal "stand in percepts" when no direct percept is present (Malmgren 1991, 2005). Studies suggests that to perceive something and then later visualizing it is a process involving a simulation (Hesslow, 2002) or re-presentation (Malmgren 2001, 2005) of the stimuli present at the time of perception.

It should be noted that historically the imagery debate has focused greatly on the existence or non-existence of what we may name "static" imagery (the "imagery as pictures" notion). But lately the tide has begun to turn in favour of a more action-oriented notion of the phenomenon, the dynamic imagery. For instance, Raab and Boschker (2002) state that: "…mental imagery, like visual perception, is intrinsically dynamic and that the very nature of mental imagery will not be uncovered by studying static pictures. Understanding mental imagery of motor actions reveals that any theory of mental imagery should start off with the temporal nature of real-life experiences".

Despite the extensive research history relating to imagery in philosophy, the cognitive sciences and the philosophy of cognition, not a large amount of research has been done regarding *dynamic* imagery. This paper outlines an empirical method to broaden our understanding of that particular phenomenon.

2. A Walk in the Woods

While engaging myself in a woodland walk recently I decided to experiment with my dynamic imagery (Ekberg 2005). I was moving along in a fairly rapid pace perceiving the somewhat winding road ahead of me. When I, with unchanged velocity, closed my eyes all the chief elements of the visual scene remained as imagery, e.g., the specific trees and curvature of the road was still "visible" in an (almost) equally comprehensive manner as when the environment was more directly perceived through vision. I managed to skillfully navigate the road with my eyes closed for approximately 5-6 seconds after which I had to open my eyes to receive new input information since my representation was becoming rapidly vague and diffuse. In doing so I almost instantly successfully "updated" my imagery of the present environment and was then able to perform the experiment over again.

Thus, there seems to be some path tracking device of the mind that enables us to engage in activities not directly connected to the current motor action (walking) but still keeping our feet on the right track. This implies that our imaging abilities uses, or are at least connected to, the same brain systems trained to provide us with perception (Kosslyn 1994).

Another interesting aspect of the path tracking brain system was discovered when I turned my head and attention to the stunning visual scenery to my left (I had now reached the ocean side) whilst still locomoting forward at a rapid pace. The path tracker adjusted to the turned head and my experience of it remained in the direction of the road (now to the left side of my head and thus not in the retinal direction which was occupied with the ocean view). In this somewhat altered experimental situation the path tracker needed updating (by directly perceiving the path) more frequently; after approximately 2-4 seconds. This temporal discrepancy between the first and second experimental situation seems to imply that if we focus attentively on the imagery it tends to last for a, slightly but significantly, extended time period thus differing from what is the case when our attention is positioned elsewhere.

3. Establishing the Duration of the Dynamic Imagery

Let us formalize the example in mathematical terms:
In the first woodland walk experiment described above; the dynamic imagery of the changing environment had duration of approximately 5 seconds. After that time period the imagery rapidly became vague and it was necessary to open my eyes and receive a location update from the environment. Let us call the time period of the active and fully functioning imagery for *T* in the following text. It is highly probable that there are a number of factors influencing *T*, and thus the temporal duration of the imagery. I will state the influencing factors below.

- Velocity. The speed of my bodily movement most certainly affects the duration of the imagery. In the example I was moving at a "fairly rapid" pace, and ended up with dynamic imagery duration of 5-6 seconds. If my bodily movement had been faster my guess is that the dynamic imagery would have had to be updated by perception at a much shorter time scale (2-4 seconds, for instance). The reverse situation is also valid. If I stand practically motionless or move at a very leisurely pace the dynamic imagery would probably have lasted for a much more extended time period. I made another small experiment lying on my back in bed with eyes closed, which supports this notion. In this situation the room was "present" to me for extremely long periods of time and I could change from side to side (bodily position shifted, including head position) and still carry the imagery of my bedroom without opening my eyes at all.

- *Unknown Environment*. In the woodland example the environment was familiar. It would be interesting to investigate whether the duration of the dynamic imagery is shortened if used in a wholly unknown environment (depending on whom you are and where you are from).

- Know*n environment, but unknown structure of that environment*. It would also be interesting to investigate how the dynamic imagery reacts to a well known environment such as typical Swedish woodland, but one such woodland where I have never been before.

- *Known Environment*. This is the situation I have described above. This situation needs further analysis.

There is probably a relation between *T* (the duration of reliable dynamic imagery until perception steps back in) and the factors stated above. A first approximation states that this relation is of the following type.

$$T(t,v) = A + V(s,t,v) \times v^a \times s^b \times E$$

where:
t = time
v= velocity
s= distance

A, a, b are unknown constants that has to be determined from experimental data
E is the experience factor that probably varies depending on how well known or (unknown) the environment is. This factor may also vary from person to person.
V(s,t,v) is the visualization function (or the “dynamic imagery duration” function) stating how well the dynamic representation functions depending on distance

traveled, bodily velocity and time. Three examples of how V might look (if v and s are constant) are presented in the graphs below.

A) The "Exponential End" Decrease of Dynamic Imagery Duration

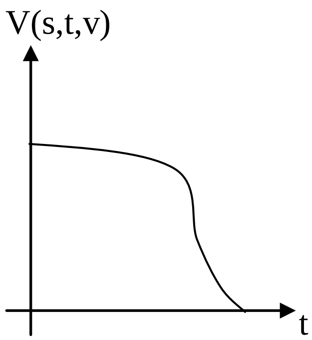

Figure A. *V* decreases in function and stability slowly at first and then at exponential rate.

B) The Linear Decrease of Dynamic Imagery Duration

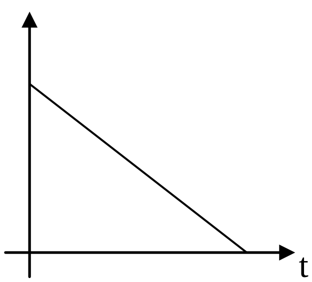

Figure B: *V* decreases in linear fashion

C) The Rapid End Decrease of Dynamic Imagery Duration

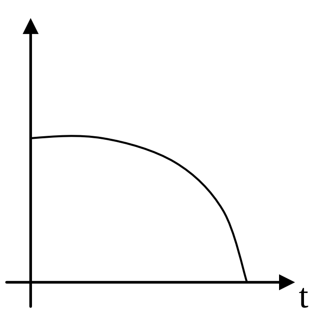

Figure C. *V* decreases slowly at first and then rapidly at the end.

This last example C) is the one I deem most fitting to my own dynamic imagery experience as stated in the example. It should be noted that this is only speculation and a platform for further work. For instance we do not know if *V* is dependent on distance traveled, it might only be dependent on velocity. The main point is that matters like these have to be settled experimentally.

4. The Experimental Method

In an experimental situation, *T* (the time period of functional dynamic imagery) is "easily" determined. All we have to do is to measure the time period until the test persons open their eyes to receive new perceptual input. But to determine the correct relation between *T* and the various other potential factors is likely a demanding task, where several experiments have to be carefully conducted and the different factors varied one at a time. The same, of course, is true for establishing *V*. For instance we may let the test persons report on the first signs of a slight "insecurity" in their reliance on the dynamic imagery and then report on the complete loss of dynamic imagery. This way we ought to be able to establish the correct graph for the imagery function. If these relations are established we have gained new knowledge concerning the function and nature of the dynamic imagery, knowledge we will be able to use in a theoretical model of the alternation between perceptual input dependent on external factors and the internally generated imagery.

4.1 Choosing Test Persons

This experimental example was construed and executed on impulse, but I still think that it shows great promise. It is to be expected that experiments carefully designed will help us gain a fuller understanding of the nature of the dynamic imagery. The experiments should mainly revolve around letting the test person's deal with world interaction situations where their dynamic imagery is tested and analyzed. Observations of the test persons during their usage of dynamic imagery in world interaction will be made as well as deep interviews with test persons to gain understanding of the phenomenology of their imagery experience. A suggestions is that the test person (control groups) are composed of people who a) has great need for this type of imagery (soccer players, for instance) and b) people who have no such need.

5. A Brain-Theoretical Model

For the theoretical part I place myself in the same "paradigm" as Hesslow (2002) and Malmgren, (2005) i.e. *simulation theory* and *representation as re-presentation theory* respectively. I will also use the *supervenience principle* as a founding principle. The principle states that for every *x* where *x* is a mental state there is one neural state *y* or several neural states (*y, w…n)*, giving rise to the mental state in question. I will not engage myself in a discussion of the relation between mind and body, i.e., how the mental is brought about by neural underpinnings. I am just working under the assumption that it is brought about in such manner.

In the woodland walk experiment described above I have illustrated how dynamic imagery functions as a substitute for perception when no direct percept is present. Hesslow (2002) has provided us with a simulation theory of such mental representation. One of his main points relevant to this thesis is the idea of *Simulation of Perception*. According to Hesslow, and the empirical evidence backing him up, perception can be simulated by internal activation of sensory cortex, as during normal perception of external stimuli. Thus, the imagery of the landscape during the woodland walk was a perceptual simulation of "external" stimuli but the perceptual activity is generated by the brain itself (internally) and not from external stimuli. Malmgren (2005) furthers the issue in the following statement: *producing similar outputs* (my underlining) *during representing as* *during perceiving will be a way for the brain to uphold stability*. In this way the adaptiveness of imagery will be a natural consequence of the brain's ability to internally produce perception-like states ("natural resonance", Malmgren 1991).

It would be productive to develop a theory of how the brain possibly produces dynamic imagery and thus represents temporal events by alternation between percepts and imagery. The model will (hopefully) be able to account for the "rise and demise" of temporal mental representations in various environments dependent on experience, velocity, distance travelled etc.

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