4. The Static and Spatial dimension of memory

Why include a spatial dimension when olfactory, kinaestehic or emotional memory are not given their own dimensions? The reason is simply philosophical: the temporal dimension is included on the merit of a long tradition of research, and due to the fact that time is a logical prerequisite for the concept of memory, it would therefore seem strange not to include space and consequently the spatial dimension. In Bertrand Russell's book on the theory of relativity he seems even to regard the space, in Einstein's view of it, as basic a physical entity as time, resulting in the spacetime concept, and therefore we may even find evidence from a more prominent scientific discipline for the inclusion of a spatial dimension in memory (Russell, 197--).

Even though Russell does not give much credit to Immanuel Kant, the author recognizes that we are unable to think of anything that does not take place or time. In the writings of the philosopher from Königsberg it is clear that both space and time are the most basic forms of perception (Prolegomena, 1783), and following the long tradition of modern epistemology modalities such as olfactory, kinaestethics or emotion are secondary properties of perception and consequently memory following Galileo, Decartes, Locke, and Hume. We will return to olfactory memory in the chapter on the Interest dimension of memory.

We may also note that the spatial dimension is important for all species, and in an evolutionary aspect human progress depends greatly on the ability to locate, and remember, places where to find food. In civilised times the knowledge where to find the best suited places to establish marketplaces and industries is paramount. The strong development of routes for trade from the Silk Road in the five hundreds B.C. to the routes over the Alps in the 13th century was dependent on advanced ideas of how to travel across the land mass (Sufford, 2002). The knowledge of how to navigate the Pacific Ocean between distant archipelago has to rely on devolpments based on spatial perception and memory (Gladwin, 1970). As long as there have been trade relationsships the ability to make judgements of distances, and remember the best paths or the best sailing routes, space knowledge will have been of paramount importance for humans.

Pattern recognition is spatial because each pattern is a spatial configuration. In both perception and memory research there is a traditional division between pattern recognition and spatial judgements/memory. What is actuallt meant by spatial in this respect is probably phenomena that demand more than one fixation point and also how to judge/remember distances between objects (recognized patterns). The spatial is thus tied to the staticity in contrast to the dynamicity of the objects, or patterns, in space. In fact, one may say that the true nature of space is that it is static, or with a twist of Kant's terminology: space is necessary in order to place objects at a given time, and is therefore in a sense subjective. Although we are not primarily interested in physical or astronomical theory here, nothing is actually really still or static in universe, what is meant is that phenomena as they appear to us, and as they are remembered is what we will discuss in this chapter. As was said in the introductory chapter, memory is phenomenological. The combination of the spatial with the staticity into one dimension is the basis for the ability both to remember the position of objects in the environment as well recalling where our last experience took place.

It must also be said that vision may be more involved in human spatial memory than other modalitities, especially in comparison with species. In comparison our pets, cats or dogs, are more dependable on scents in the their orientation of their surroundings.

One of the major perceptual and memory dimensions is permanence or static vs dynamic properties of processes or actions. This dimension relates to the perception, learning and establishment in memory of the geographic environment, that is conceived of as stable or permanent, forming a background to animate or dynamic things or processes.

Because the focussing on the latter detracts attention from the permanent there would normally be a trade-off between perception of and memory for individual objects and perception of and memory for geography or other static information.

Instead of delving deeper into the issue of discrimination of end points in the permanence dimension, i.e. discrimination of dynamic or moving objects from their static background or static objects within the background, we have to notice that motion per se is not the core of the issue. There are different kinds of motion, even more or less *permanent motion*, for instance the multiplicity of sea waves, waving trees, mltitude of rain-drops, etc. What is important in these cases is the inevitable nature of such phenomena. Although they are in one respect dynamic, they are not attended to as individual objects, but as general backgrounds or more generally as the context in which we perceive, attend and act.

In other theoretical approaches the above mentioned geographic memory part of semantic memory (Tulving, 1983;), and recent empirical research generally follows this approach (Mazzei et al, 2009). Strong criticism, however, has been presented long ago towards the memory systems theory of Tulving (McKoon, Ratcliff & Dell, 1986), and it may be noted that our current view may also be understood as an alternative view of the tulvingian theory.

In my view the spatial dimension is part of a larger dimension: the static vs. dynamic dimension, that overrules the spatial part as well as certain attributes of the semantic type of memory.

4. 1. Spatial helpers

By the invention of the cell phone with GSM built into it we get immediate information of the wherabouts of people and outselves, and one of the first questions people ask today, when talking on a smartphone is "Where are you?". By using some of these helpers we don't even have to ask that. You might question the importance of knowing the precise location of your interlocutor when it is not relevant for the conversation, but it may have something to do with a basic need of imaging that other person in a specific place during the conversation in order to separate the voice in the head set from the actual person.

However that may be we are constantly aware of the fact that people that we talk to have to be located somewhere. This knowledge of an enduring location has to be with us in order to understand the rest of the world including dynamic events including people and objects. This is often the cause of funny misunderstandings:

*- Where did you find the glasses you were looking for?*

*- Well, I think it was close to Eskilstuna.*

*- Weren't they in your car?*

*- Yes of course, under my seat. I looked there when I stopped at the gas station in Eskilstuna.*

What is static, i.e. what you perceive as as your current room or space, changes from situation to situation. But by each and every moment you will have to instantiate it in order to separate the dynamic aspects of the environment from the static ones. Note that what is static is not necessarily perceived as totally still. For instance, as was mentioned a couple of paragraphs above, we may look at the waving tree, the sparkling water surface or the shivering leaves of the aspen. We may also perceive the blossoming or bleaching face, or a pulsating vene of an excited person. These natural phenomena are examples of "still" motion that we are accustomed to focus on or let fall into the background.

It is not far fetched to believe that our perceptual capacity to see each and every leaf of the aspen, without a few seconds later being unable to recall at, is based on an innate ability that can only be explained in terms of million years of evolution. We have already discussed the so called sensory register in the chapter on the temporal dimension. What is important here is the static aspects of perception and memory.

Although we perceive motion of every single leaf of the aspen, it would be odd to regard them as events.

There are subdimensions of this dimension: (1) recalling a position along a line/road, in a plane/surface or in a 3-dimensional space, (2) recalling relative information such as the distance between points/objects, that is related to the numeric-quantity dimension (see chapter), (3) recalling directions, and (4) learning maps and other symbolic material that are used to make our view of the world at least relatively static.

4.2. MST theories of spatial memory

The idea of internal maps or cognitive maps holds that they are orienting schemata, and that they direct orientation with respect to local environments (Sholl, 1987). It is also widely accepted that distinct memory systems are responsible for maintaining transient and enduring spatial relations (Avraamides & Kelly, 2010). The orienting perspective is obviously important in learning, and thus participants can retrieve spatial locations more easily when the orienting perspective is parallell to the learning perspective (Shelton & McNamara, 2001).

4. 3. The loci method

It is mostly an easy task for joggers to recall their paths, and even if the track is long it is often easy to visualize most of it provided that the jogger has used the specific track. There is a well known mnemonic device based on that kind of overlearned knowledge in order to improve memory , namely the method of loci (Baddeley, 1997; Bower, 1970; Lindsay & Norman, 1975). It has been used by mnemonists since ancient times, among others successfully by Cicero (Spence, 1994; Yates, 1966). In this method the material to be remembered is *visualised by the learner at well-known places (loci)*, preferably numbered.

Sophisticated use of the method was widely spread among orators and mnemonists in medieval times (Spence, 1994). If these loci are not already numbered, as in the case of street addresses or holes in a golf course, the user of the method of loci has to construe this in his or her mind. The important thing is that the numbering should be definite and not changed after it has been learned in order to avoid confusion in the encoding phase, although the most critical aspect for the learner is to be able to imagine each position vividly and with little effort. The learning period may require several learning sessions for a normal person until the method is comfortably used. Another experience is that motivation to learn the loci method varies greatly between students. The first few trials of memorising according to the loci method may be critical in this respect. If they are not successful, then learners may not use it afterwards in real learning situations.

It has to be noted that the method of loci is in fact based on a combination of spatial and order cues, so the order dimension is at work here, not only the spatial-static. What works best is if the mnemonist uses the same ordered route at all encoding, and it is paramount that images the learner uses are vivid, but they do not have to be spectacular.

There have been numerous studies that show the effectiveness of the loci method. However, to my knowledge it has never been reported to be used as an encoding technique for enhancing face recognition. The author, however, carried out a study at the College for police education that showed a strong effect of the loci method in order to recognize faces, see figure 4. 1. Below. There were four days between test versions (A, B), each including 16 target photos and 16 lures. Tw classes received instruction of how to use the method, and two classes received other instructions.

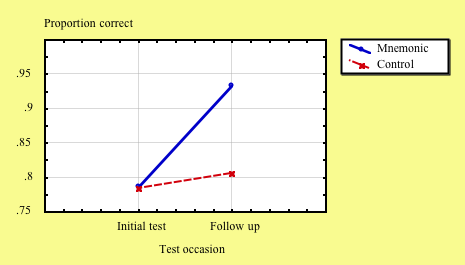


Figure 4. 1. Effect of loci method on performance in face recognition

In the study the loci method users were encouraged to use streets, roads or other *ordered and/or numbered loci* from their own personal environment. A common way was to use specific turns at their jogging route at the college as their loci.

The purpose of the present study was thus to make a first preliminary test of the effectiveness of the loci mnemotechnique in face recognition among police students

4. 4. Spatial memory in golf

The Spatial dimension comes into play very often during a game of golf, for instance when the golfer has to decide the distance between the current position and the flag on the green. In the case when no distance cues are available, the golfer has to rely on his memory for the hole. The use of modern digital equipment such as GPS abviously makes the spatial memory irrelevant, and will possibly reduce the difficulty of the game substantially in the near future. Still the spatial ability in general will be important due to the three dimensional space of even the flattest golf course, and even if you know the distance based on GPS the surroundings will probably influence your perception of it.

We may also note that the game around the green will not gain much from GPS information, and memory of slopes of the fairway will forever be part of the game. Therefore, memory of how the ball bounces at certain places of the golf course will have a great impact on the the performance.

4.4. Static vs dynamic dimensions in neuropsychology

One of the major perceptual and memory dimensions is permanence or static vs dynamic properties of processes or actions. This dimension relates to the perception, learning and establishment in memory of the geographic environment, that is conceived of as stable or permanent, forming a background to animate or dynamic things or processes.

Because the focussing on the latter detracts attention from the permanent there would normally be a trade-off between perception of and memory for individual objects and perception of and memory for geography or other static information.

Instead of delving deeper into the issue of discrimination of end points in the permanence dimension, i.e. discrimination of dynamic or moving objects from their static background or static objects within the background, we have to notice that motion per se is not the core of the issue. There are different kinds of motion, even more or less permanent motion, for instance sea waves, waving trees, rain-drops, etc. What is important in these cases is the inevitable nature of such phenomena. Although they are in one respect dynamic, they are not attended to as individual objects, but a general backgrounds or more generally as the context in which we perceive, attend and act.

In theoretical approaches the above mentioned geographic memory is sorted into semantic memory (Tulving, 1983;), and recent empirical research follows this approach (Mazzei et al, 2009). Strong criticism has been presented long ago towards the memory systems theory of Tulving (McKoon, Ratcliff & Dell, 1986), and it may noted that our current view may also be understood as an alternative view of the tulvingian theory.

The percepion and memory for faces may be focussed on form, the specific objects within it or the general picture, i.e. the emotional or social expression. This expression is a composite of several muscular or visceral dynamisms. These dynamic qualities of a face are relatively hard to detect in a photograph, because a photograph is by definition a static capture of a moment within a process, and it takes an amount of imagination in order to interpret the facial expression. This interpretation is in a way similar to the process of reading.

It may also be said that the staticity is involved in the context of a narrative (see chapter 8 on the Narrative dimension), for instance in the sentence "The players were in the 5th set of the match" or "He was in his 60s". Closed classes in languages (pronouns, prepositions, etc) are static in the sense that they make room for the current message communicated.

Read our article "Paradoxical prosopagnosia" on the net, this may be due to a dissociation between dynamic and static information, i.e. they manage to remember people when they saw them "in action", otherwise not. One of the patients did not even recognize a picture of his former school-mate, a famous swedish comedian who was on one of the famous faces photographs. Earlier the day of the examination he had seen this celebrity at the airport, but did not approach him. Another semantic dementia patient with the same atrophy said that

the flags I showed him were not really flags, due to the fact that they did not move...These phenomena are not explained by the memory systems theory.

The spatial part of this dimension is perhaps the one with the longest tradition in memory studies. Cicero wrote about it, and the author has adminestered several courses based on spatial cues from the beginning of the 80s. We all know, without delving into experimental studies the geographical position when we heard about the 9/11, the murder of Olof Palme, etc.

orienting schemata direct orientation with respect to local environments, but that orientation with respect to large geographical regions is supported by a different type of cognitive structure (Sholl, 1987).

Shelton, A. L., and McNamara, T. P. (2001). Systems of spatial reference in human memory. *Cogn. Psychol.* 43, 274–310.

Wang, R. F., and Brockmole, J. R. (2003). Human navigation in nested environments. *J. Exp. Psychol. Learn. Mem. Cogn.* 29, 398–404. m

Implications for the hierarchical theory of spatial representations and the path integration theory of navigation are discussed.

**Sholl, M. Jeanne (1987)** [**Cognitive maps as orienting schemata.**](http://psycnet.apa.org/record/1988-03346-001?doi=1)

Journal of Experimental Psychology: Learning, Memory, and Cognition, Vol 13(4), Oct 1987, 615-628

**Avraamides, Marios N.,Kelly, Jonathan W. (2010)** [Multiple systems of spatial memory: Evidence from described scenes.](http://psycnet.apa.org/record/2010-08037-006?doi=1) Journal of Experimental Psychology: Learning, Memory, and Cognition, Vol 36(3), May 2010, 635-645

distinct memory systems are responsible for maintaining transient and enduring spatial relations