The spatial consciousness of the blind: a contribution to the research

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The precocious and total blindness brings remarkable effects on the cognitive elaboration of the space.
In case of absence of the sight, the two perceptive systems, hearing and touch, substitutive of the sight in the acquisition of the spatial conducts, use different strategies.
Whether it is a question of elementary motor sense acquisition, or it is a question of complex symbolic representations, these alternative perceptive systems result less efficacious for elaborating the spatial data.
Hearing is a telereceptive system which gives information about the features of the objects, useful to the localization of the sonorous sources in the space.
As regards the sense of touch, it lets the knowledge of the traits of the objects, such as shape, size, breadth, width, height, spatial localization, distance, weight, temperature.
Nevertheless, touch is a contact-receptor which has a field of perception.
So, hands have to accomplish several exploratory movements, wide and accurate, in order to increase the expanse of the field of perception and the perception of the objects.
Besides, the tactile perception develops in sequence, hearing and touch depend on succession, whereas sight has the control of simultaneity.
However, the world of the blind is not different to that one of people who are able to see, and this is also true for the field of the spatial knowledge.
But the elaboration and the control of the spatial conducts is more difficult and slower for the blind in comparison with people who can see, because sight is more effective in the field of spatial knowledge.
On the contrary, hearing is specialized for everything which is in sequence; touch is suitable for the knowledge of the substantial characteristics of the objects.
In spite of what people who don't have familiarity with blindness think, there are not remarkable differences under the sensorial and imaginative viewpoint.
It is obvious, that the blind achieve different strategies compared with people who use sight to receive information about spatial localization.
These differences are connected with the typical particularity of the tactile-kinetic system, which is the system of reference used by the blind.
In fact, blindness causes a functional reorganization, by which some substitutive processes carry out the consciousness of the reality and the elaboration of the external world in a particular way.
People who can see use simultaneous, general cognitive maps, which base themselves on visual images, whereas the blind use cognitive maps made up of tactile and auditory images.
The aptical space would be built as an independent space from a specific visual codification.
Un important factor is the faculty of taking advantage of the mobility of hands; this condition is a specific character of the system of reference of the blind. But, it is not right to consider it as an advantage on the other formality of exploring the space.
In fact, every formality has its own points of strength and its own lack.
The aptical space has a specific originality in comparison with the optical space.
It derives from the tactile exploration of the environment.
Tactile images follow a dynamism which is based on principles and strategies different to those ones which give origin to visual images.
Our work has the aim of singling out these principles, conceived as alternative strategies adopted by people who cannot see in order to elaborate the spatial data.
We had investigated a sample composed by 25 blind men - a few of them having lost their sight at a precocious age, whereas the others at an adult age - and we asked them of singling out the main strategies used for the mental representation of new unknown places.
The results of our experiences demonstrate as the sample of the blind taken in examination built the spatial consciousness and the knowledge of the objects in the world by information derived from the environment and perceived by receptors such as hearing, touch, smell, which substitute sight for the exploration of space and the elaboration of reference - points and cognitive maps of the environment.
The results point out that the blind use tactile maps in orientation tasks in wide rooms.
Spaces are represented mentally by perceptive and cognitive information, that is on the ground of data previously acquired and retained in memory.
In particular, those ones who had lost their sight at a grown-up age availed themselves of used information reported by their companions with the support of the visual images still held in their memory, in order to achieve a spatial consciousness.

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On the contrary, those ones who had lost their sight at an early age preferred using the aptical perception, because they were trained to use their body as receptive means of information.
So, they succeeded in obtaining a mental representation of space much more abounding in particulars, more detailed and complete than that one achieved by means of descriptions or information related to them by their guides.

The experimental context We started from the supposition that the world of the blind is not different in comparison with that one of people who can see, and this is also true for the spatial consciousness.
What is different is the formality, the time and the strategies used for elaborating and checking spatial conducts.
In spite of the fact that the perceptive processes are not the same, the blind have a good knowledge of surroundings, thanks to the construction of cognitive maps and tactile images. In this perspective, it seemed right to support the theoretical references with the work carried by means of the joint-effort of some blind friends, who wished to take part in this experience, giving their personal contribute. We asked them: "what strategies do you avail yourselves in order to have a mental consciousness of a new room?"
In particular, the sample was made of 25 people who were absolutely blind, with an age included from 20 to 45 years, a few of them had lost their sight at an early age (20 people), whereas the others at an adult-age (5 people). The distinction of the age of the coming up of the disease revealed itself a significant variable, because people who became blind at an adult age, showed to rely on the report of guides and they managed to reconstruct the visual images, not being able to use correctly the information derived from the space and perceived by hearing, touch and smell.
The reason is to be sought in the fact that they were not trained to use hearing, smell and touch in order to construct points of reference and cognitive maps of space. On the contrary, the blind who had lost sight at an early age, had just trained their organs of sense to the knowledge of space, so they achieved the representation and the elaboration of spatial data by their aptical faculty and their perception of the obstacles, in spite of the difficulties and the slowness typical of this formality of exploring the space.
Finally, those ones who had lost their sight at an adult age availed themselves of their experience of people who were able to see, since they still held visual images of environments and objects in their memory, formed when they could see with their eyes. The task to which our sample was subjected was just that of describing meticulously the principal strategies carried out when they needed to know a new room.
In particular, as to this task, a part of the sample, used formalities characteristic of a mentality trained to search for points of reference and to place them exactly in the space.
In order to seek points of reference in the room, our sample seemed to avail itself of the topological concepts, which are also basic pre-requisites for the knowledge of the method of writing and reading "Braille", which helps the development of the ability of spatial reasoning, since the six points of this method have a precise position in the space. So, the blind of the sample who knew this method very well, seemed to be favoured to carry out the task, being trained to reasoning and living in spaces organized mentally through topological points of reference. Our sample singled out several and varying strategies in order to achieve the task about the mental representation of a room by:
A1: seeking points of reference after having verified the dimensions of the room, by means of the echo of the voice, of the windows, of the doors, etc...;
A2: individuating and memorizing every possible obstacle (and impressing it on one's memory);
A3: asking a guide about a detailed report of the room in order to reconstruct mentally soon afterwards;
A4: the relation of the guide represents a factor of confusion and inattention;
A5: looking for references in the odours, or in the noises and vibrations;
A6: stamping the ground in order to measure a space;
A7: clapping one's hands to grasp the dimensions and the volume of a room;
A8: the rhythmical movement of the white stick points out a change in the perception of the space;
A9: the air pressure on the face enables the perception of the obstacles;
A10: the exploration of the room by means of pacing and in armfuls enables to measure the room and to construct a mental map through tactile images.
From the analysis of the results we obtained firstly, we observed the answers of the first five blind subjects who had lost their sight at an adult age – and soon afterwards the answers of those ones who had lost their sight at an early age (see table 1).
The first ones apply strategies such as clapping their hands or stamping their feet or using the echo of their voice to locate the obstacles.
All five asserted to avail themselves of the reports of a guide to know a new room.
On the contrary, those who did not lose their sight at an adult age asserted they were bothered by the report of any guides (see graphic 1).
Moreover, it is possible to point out as the blind we have examined used their own body as a measuring instrument; in other words, they used their arms and legs to measure a room.
So, this is the more occurring strategy to construct a mental map with tactile images (see graphic 2).
Those who had lost their sight at a precocious age had developed the ability of perceive the obstacles thanks to

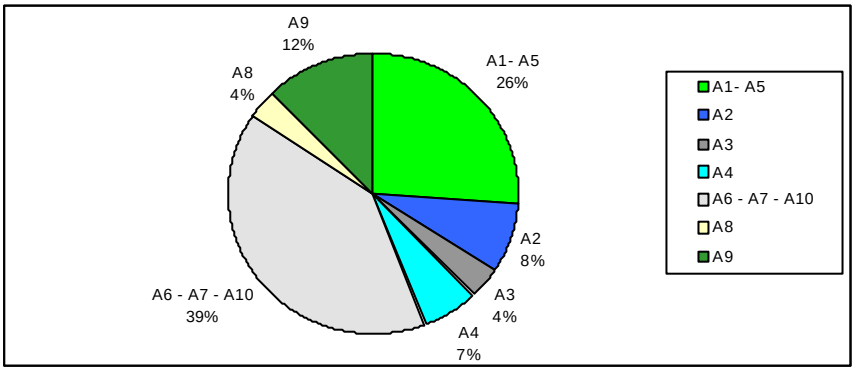
the air pressure exercised on the face; those who had lost their sight at an adult age did not manage to strengthen this potentiality.
On the contrary, the possibility of clapping their hands or stamping their feet as strategies to know the space seemed to be very used also by the blind who had lost theit sight at an adult age (A6= 14% - A7 = 12%).
In fact, they seemed to be trained to the construction of maps through visual images, not being able to pay attention to the vibrations, to the sounds, to the odours which bombard their receptors creating only a state of confusion. An important data is the use of the white stick. Although only 4% of the blind we have examined seemed to use it (A8), it can offer some very useful information about the space. In fact, our sample showed that it was possible to grasp the dimensions of a room thanks to its rhythmical movement.
It also lets them perceive the presence of obstacles, of doors and windows.
Moreover, the blind seem to have a more trained mind to organize the space through points of reference, elaborating the information coming from the environment to construct mental maps with tactile images.
Those ones who had lost their sight at a precocious age had received a sensorial education; from their childhood, that education was based on the possibility to get information, sensations, vibrations, learning to pay attention to every external stimulus thanks to the employ of perceptive systems, which in the absence of the sight are concerned with the knowledge of the space.
Besides, they had a better capacity of autonomy and a better sense of direction, employing appropriately the tactile perception of the obstacles, feeling the air pressure on the face (A9= 12%).
Therefore, with reference to our sample, we can end by saying that how the visual damage arises and the way it evolves during the life is an important factor to understand the psychological and functional consequences of the disease.

Final thoughts As regards the mental representation of space, the world of blind is not different in comparison with that one of people who can see.
In fact, on the basis of the experimental data, we can assert that sight is neither necessary, nor sufficient with reference to spatial tasks, but it is also true that if you pay your attention on external clues and on links the codification is made easier. The basic difference between vision and touch lies in the spatial organization, which is achieved with more difficulty by touch, because it lacks of the right reference schemes (spatial co-ordinates based on external clues), since you must base on characteristics more difficult to codify. In fact, the input is to be organized spatially, through inner organized references or through the use or further sources of external information, such as those olfactory ones.
In the light of this theoretical perspective, we have observed as our sample carried out some alternative strategies to those employed by people who are able to see, and they had a good knowledge of the room, thanks to a precocious sensorial training. In fact, the age of coming up of disease is a significant variable, since it is responsible of the functional consequences of the disease.
The blind (who had lost their sight at a precocious age and had a good knowledge of Braille were trained to represent mentally rooms with points of reference, because it is just the structure of Braille which has favoured the mental organization through points of reference with an exact placing in the space.
Besides, they said they were very used to pay attention to all sounds, to the odours, to the vibrations and to the echo of the voice, more than the information related by a guide, which could result less intelligible and precise.
The blind, who had lost their sight at an adult age, were not able to carry out a process of rebalancing of the exisisting potential, availing themselves with their other senses.
The process of mental representation modifies itself when sight lacks.
It is necessary to make the most of the extant potential and to put the main altenative strategies into effect, in order to construct mental maps with tactile images, to be exploited in the orientation and the moving in a place.
Clapping one's hands, stamping one's feet and paying attention to the odours, to the sounds, to the vibrations, to the air pressure on the face, represent the main alternative strategies carried out by our sample, who - with formalities and in different times in comparison with those of people who can see - has succeeded to achieve a good knowledge of the space examined. Moreover, we have noticed how there was not a precise agreement with the visual, the tactile, the auditory and the olfactory images, but there was a processus of re–balancing which put each extant perceptive formalities into effect.
In order to construct a mental representation of the environment, our sample reported of availing itself of olfactory and aptical information; these last ones coming from the active tactile exploration, carried out through the use of some parts of the body as guiding and perceptive systems. In particular, we can explain the more difficult and slower formalities thanks to features of the aptical perception, which firstly grasps the particulars, analysing in sequence the sevaral parts, and finally gets to an overall representation of the environment.
Through the sense of sight, you can obtain an overall knowledge of the environment, whereas you can achieve it through an analytic way, if you employ the aptical perception. You will get to the knowledge of the environment through a final synthesis, which is the result of a set of perceptions, as to graze, to touch, to weigh up.

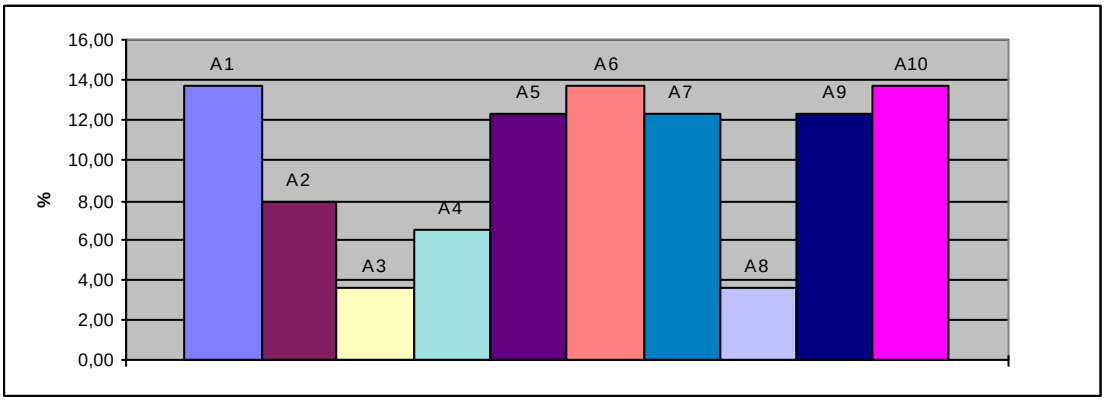
STRATEGIES CARRIED OUT BY THE BLIND IN THE MENTAL REPRESENTATION OF SPACE

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Soggetto 1	X	X	X			X				
Soggetto 2	X	X	X			X				
Soggetto 3	X	X	X				X			
Soggetto 4	X	X	X				X			
Soggetto 5	X	X	X			X	X			
Soggetto 6				X	X	X		X	X	X
Soggetto 7	X			X	X		X	X		X
Soggetto 8				X	X		X		X	X
Soggetto 9					X	X	X		X	X
Soggetto 10	X			X	X	X	X			X
Soggetto 11				X	X	X			X	X
Soggetto 12	X				X	X	X		X	X
Soggetto 13	X				X	X	X		X	X
Soggetto 14	X				X	X	X	X	X	
Soggetto 15	X					X	X		X	X
Soggetto 16	X				X	X			X	X
Soggetto 17		X			X	X			X	X
Soggetto 18	X				X	X		X	X	X
Soggetto 19	X	X				X	X		X	X
Soggetto 20	X			X	X	X			X	X
Soggetto 21		X		X		X	X		X	X
Soggetto 22	X	X			X	X	X		X	X
Soggetto 23	X	X		X	X		X	X	X	X
Soggetto 24	X			X	X		X		X	X
Soggetto 25	X	X			X	X	X			X

TABLE 1



GRAPHIC 1



GRAPHIC 2

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Annexes

The tree of the similarity points out the following relations:

1) (A2-A3) "Identifying and memorizing all the possible obstacles" is tight bound to "The request for information to the guide" and this, in his turn, is bound to (A1-A7) "Looks for reference points" and "Beats the hands to know the dimensions of the room".
2) (A4-A8) when "The guide's description confuses", this is in relation to "The use of the stick for the orientation". While "The reference with the smells, noises and vibrations" is tight bound to "The exploration of the sense-motor environment" (A5-A10).
3) (A6-A9) binds the variables on the exploration of the sense-motor environment.

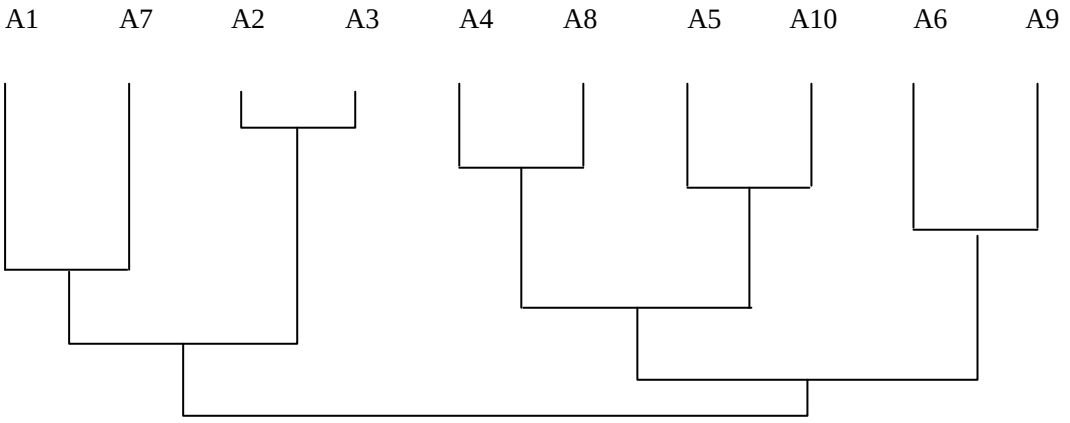

FIG. 1

The A3 → A2 implication points out that "If it asks the guide the detailed description of the environment" then "It is able to memorize all the possible obstacles".

While the A5 →A10 and A9 → A10 implications "Looking for the references in the smells, noises and the vibrations" and "Looking for the perception of the obstacles through the air pressure on the face" involves "The exploration of the environment through psico - motor sensations".

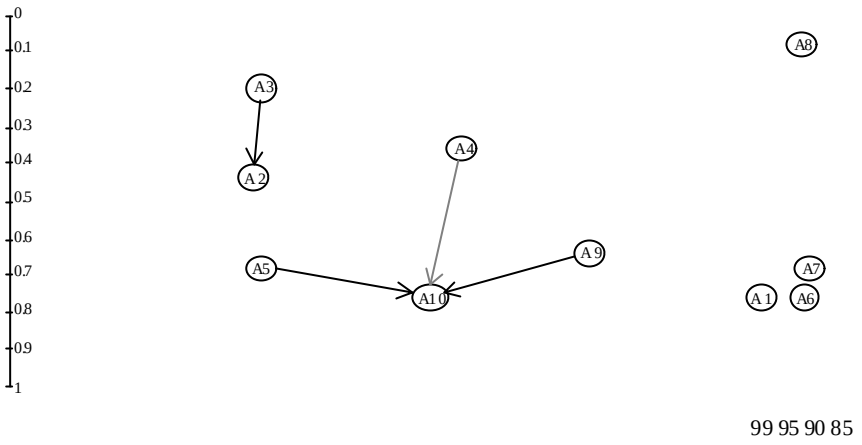

FIG. 2