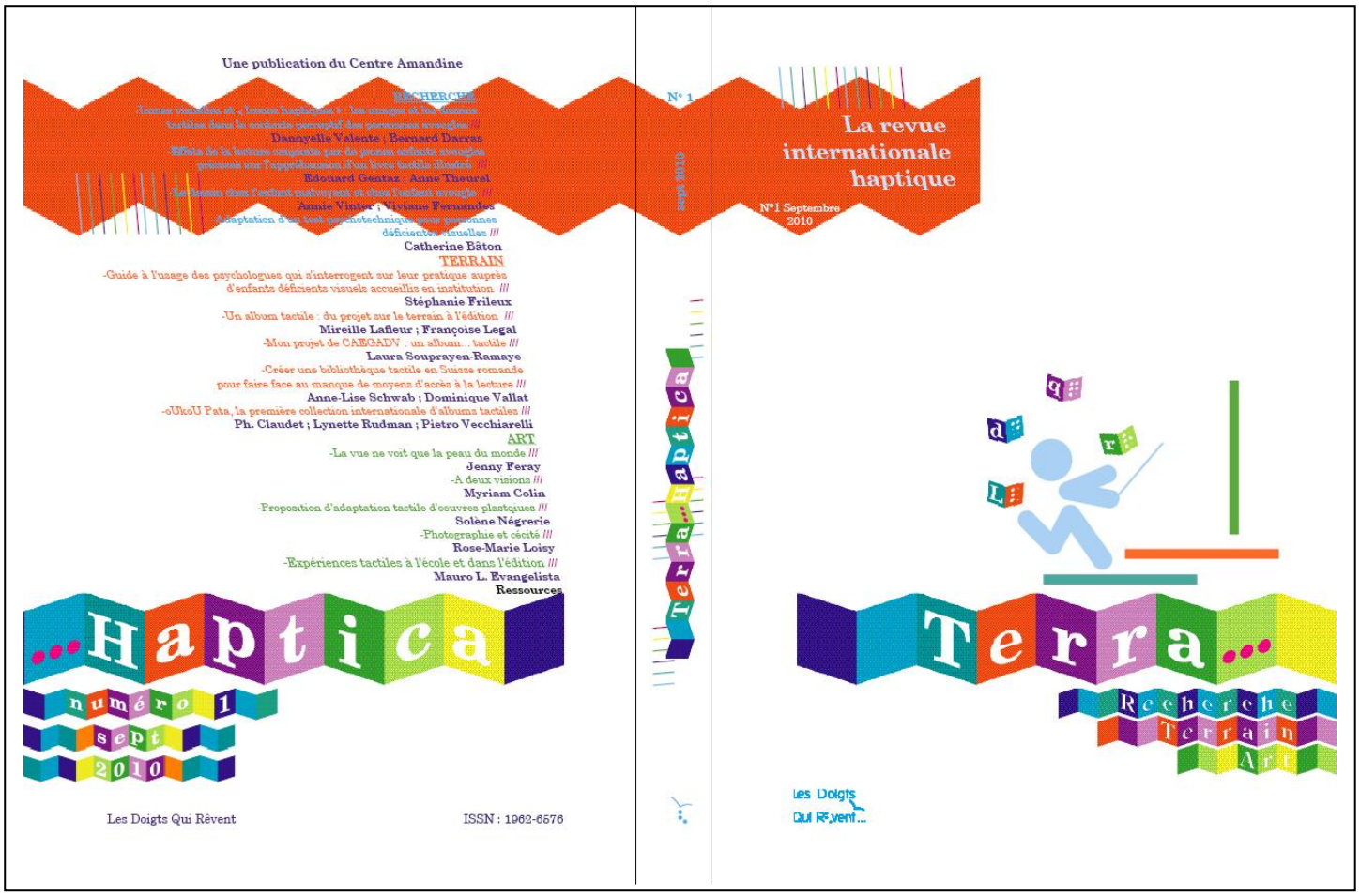

Terra Haptica is a journal published by Les Doigts Qui Rêvent (Dreaming Fingers) Here the front and back cover pages. Size A4.

Drawing in blind and visually impaired children*

Annie VINTER [a], Viviane FERNANDES [a] and Philippe CLAUDET [b]
[a] *University of Bourgogne, LEAD-CNRS 5022, Pôle 2AFE, Dijon, FRANCE*
[b] *Les Doigts Qui Rêvent (LDQR),Talant, FRANCE*

Abstract. If drawing behavior has been extensively studied in sighted children, the studies dedicated to the investigation of drawing in blind and visually impaired children are very scarce. Furthermore, most of the existing studies report on individuals, or on a few individuals. To our knowledge, the present study is the first one on drawing in early blind children conducted on a large number of participants who did not show any other associated disturbances. The results showed that drawing in blind children presented specific features, in comparison to both sighted and visually impaired

Anne Vinter editor in Terra Haptica n°1 sept 2010
Terra Haptica, the Haptic International Journal
Publisher Les Doigts Qui Rêvent www.Ldqr.org

children. We can wonder to what extent these specificities are the expressions of some kind of "haptic realism" or denote defects in the understanding of spatial relationships.

1. Introduction

Drawing behaviour has attracted the interest of developmental psychologists from the turn of the last century and ever since (e.g., Ricci, 1887; Goodenough, 1926; Luquet, 1927; Willats, 2005). Luquet (1927) has defined stages in drawing development, which have been later discussed and refined (e.g., Freeman, 1980). Numerous studies have contributed to show that drawing behaviour is permeable to various contextual factors and sensitive to different psychological or neurological disorders. By contrast, the studies dedicated to the investigation of drawing behaviour in blind or in visually impaired children are scarce, though Millar (1975) and Kennedy and his collaborators (Kennedy, 1982, 1993, 2000; et al., 1991) have opened this domain of research more than twenty years ago, revealing unexpected capacities of congenital blind people to draw. The present study aimed at investigating further the drawing capacities of typically developing early blind and visually impaired children

Kennedy showed that early blind people adhered to some general principles of pictorial representation when they drew, like the use of lines in order to represent the contours of an object or the use of T-junctions for representing overlap between surfaces. Still more impressive, Kennedy and Juricevic (2003, 2008) reported that blind persons were able to represent perspective as well as movement in their drawings. According to Kennedy (2000; Kennedy & Bai, 2002), haptics would provide access to spatial information similarly to vision, so that a large number of principles governing form depiction would be available to haptics, as they are to vision. For Kennedy, some of the rules of graphic representation would be "universal", independent of sensorial modality. D'Angiulli and Maggi (2003) confirmed that drawings made by congenital blind children aged 12 years were comparable to those made by sighted children with regard to some perceptual principles, such as the privileged point of view introduced in the drawings or the way movement was depicted.

However, most of these studies on drawing in blind people have been carried out on a few individuals. Kennedy, for instance, has made a lot of observations on Gaia, a 12-year-old congenital blind, or on Tracy, a young blind adult, both encouraged to draw throughout their childhood and having thus accumulated a great amount of experience with drawing activity. His positive conclusions on the capacities of blind persons to draw are indeed somewhat challenged by other findings. Heller (2002) reported that blind people seem to encounter more difficulties than sighted people in drawing perspective. Millar (1975) sustained that early blind persons are ignorant about the transcription rules from a 3D space to a 2D space, that is how perspective can be introduced in drawing. For Millar (1975), blind people have to learn the graphic conventions; they do not have access to them spontaneously. It is also worth pointing out that the drawings produced by blind children are not easily recognizable. D'Angiulli and Maggi (2003) have shown that only 39% of the whole set of drawings collected in 12-year-old blind children were correctly recognized when the judges did not have at their disposal the titles assigned by the children to the drawings.

These divergences point to the need for a study including a larger number of early blind or visually impaired children, from different ages, and without any other associated disturbances[1]. To the best of our knowledge, the present study is the first one on drawing in early blind children conducted on a large number of participants who had to make several drawings of objects of different categories. What are the genuine drawing capacities of these children at different ages? Do they present specificities in comparison to sighted children? Is drawing behaviour in visually impaired children closer to that in blind or in sighted children? The present paper will show preliminary results that do nevertheless reveal interesting indications on drawing in blind and visually impaired children.

Method

Participants. A total of 106 children produced drawings that were included in the study: 32 children, totally blind or with minimal light perception from birth or early infancy (under 12 months, OMS categories: 4 and 5), 41 visually impaired children, from birth or early infancy (under 24 months, OMS categories: 1, 2 and 3, 1/50° to 3/10°) and 32 age-matched control children. The early blind and visually impaired children did not present any associated psychological or neurological disorders, and they came from different occidental countries. The children were divided into 4 age groups (6-7 yrs, 8-9 yrs, 10-11 yrs and 12-14 yrs). Only 2% of the blind or visually impaired children had a very frequent practice with drawing. A little more than 50% of the children had a moderate or regular practice, while the remaining children had a rare or infrequent practice.

Data from 32 other children have not been included in the present analysis: 9 children aged 4-5 yrs (3 blind, 3 visually impaired and 3 controls), and 23 children (11 blind, 12 visually impaired) living in Africa (Burkina Faso and Niger). Ten out of these 32 children produced only scribbles.

Material. Sighted children and most of the visually impaired children used normal pencils and white sheets of paper for drawing. Most of the blind children and some of the visually impaired children (OMS category 3) employed a raised-line drawing kit. The drawings were made on plastic sheets (21.5 cm x 31.85 cm) placed on a rubberized board, using a ballpoint pen. The pressure of the ballpoint pen on the plastic sheet produced a raised line, making possible the use of haptic feedback during drawing execution. A very few blind children decided to use normal pencils and sheets of paper.

Procedure. Children were asked to produce 12 drawings of familiar objects: human figure drawing, objects that cannot be handled as a whole –a tree, a house, a bed-, objects that can be handled –a toothbrush, a glass, a banana-, objects that cannot be grasped –rain, the sun-, and familiar animals –a dog, a fish, a bird-. The order in which the drawings were required was random. A majority of the blind children needed more than one session in order to produce the 12 drawings.

Coding of the data. The drawings have been coded along a series of criteria by two judges working independently. The judges were ignorant about the identity of the drawer. They coded whether the production was a drawing or a scribble, to what extent (scale on 7

[1] We are sincerely grateful to several institutions for blind and visually impaired children in France, Switzerland, Quebec, Belgium, Italy, Lithuania, Niger and Burkina Fasso for their much appreciated collaboration in this study.

levels) it was recognizable, knowing the title of the drawing or without knowing the title, whether the drawer applied some conventions in his/her drawing, whether there were positioning errors of elements, how the spatial relationships between elements were represented, from which point of view the drawing was made, how the perspective was depicted, and some other criteria that will not be presented here.
The percentages of agreement between the two judges varied between 68% and 97% according to the criteria. The cases of disagreement were settled before the data analysis. We excluded the children who produced scribbles from the present report.

Results
The judges recognized correctly 76.7%, 70% and 36.1% of the drawings made by the sighted, the visually impaired and the blind children respectively, $F(2, 94) = 36.47$, $p < .01$. However, these differences between the 3 groups of children were lower for the human figure drawing and the drawing of the objects that cannot be grasped than for the drawing of the other objects, $F(8, 376) = 2.1$, $p < .05$. The same pattern of results emerged when the judges had the titles of the drawings at their disposal, though the percentages of correct recognition were higher for the drawings produced by the blind children. Figure 1 depicts some illustrations of drawings collected in the 3 groups of children aged 6-7 years.

Blind children *Visually impaired children* *Control children*
Figure 1: Drawings of the dog made by children aged 6-7 years

As shown in Figure 1, regardless of their visual status, almost 100% of the children respected the spatial convention according to which the top of the graphic space corresponds to the top of the drawn object. This was one of the rare criteria for which no significant differences between the groups appeared. Indeed, the drawings made by blind children presented a series of discriminative features, when compared both to the visually impaired or the sighted children. The occurrences of errors in the positioning of elements were much greater in blind children (24% of the cases) than in the visually impaired (6.7%) or sighted (4%) children, $F(2, 93) = 15.96$, $p < .01$. These differences between groups concerned mainly the human figure drawing and the drawing of familiar animals, as revealed by a significant Group by Category of drawings interaction, $F(6, 279) = 3.2$, $p < .01$. Figure 2 displays examples of errors in the positioning of head/arms/eyes made by blind children aged 8-9 years in the human figure drawing task, and shows, in comparison, drawings made by age-matched visually impaired children.

Blind children *Visually impaired children*
Figure 2: Examples of errors in elements' positioning in the human figure drawing (children aged 8-9 years)

A specific feature characterized the drawings of blind children with regard to the reproduction of spatial relationships between elements. In around half of the drawings

(43%), the elements that constituted the whole depicted object were drawn disconnected or juxtaposed one to other. This behavior was almost never observed in sighted children (0.5%), and rarely produced (5.56%) by visually impaired children, $F(2,93) = 35$, $p < .01$. Note that this criterion was not applied to the category of objects that cannot be grasped. It tended to be less often observed for the objects that can be handled (33%) than for the human figure drawing (52%) or the objects that cannot be handled as a whole (48%). Some examples of drawings illustrating this point are reproduced in Figure 3: we can see, in the three first drawings (going from the left to the right), that the legs of the dog were drawn juxtaposed to the body, and in the last drawing at right, that parts of the fish's body were drawn isolated, as open circular shapes (which correspond to the sensation of a fish hold in the hand).

Figure 3: Drawings of dog and fish from blind children

We coded the point of view adopted by the drawer in the depiction of the object, and distinguished a canonical point of view from non-canonical points of view (canonical points of view are those conventionally adopted for each object; for instance, the house, the glass, the tree, the man.. are conventionally reproduced in a front view, while the dog, the fish, the bed… are conventionally drawn in profile). The inspection of the drawings produced by the blind children led us to code whether the drawer adopted a point of view given by the hand or the arms exploring the object (body's point of view). This analysis was again not applied to the category of objects that cannot be grasped. Blind children drew objects in a canonical point of view less often (72.5%) than visually impaired (88%) and sighted children (93%), $F(2, 93) = 18.9$, $p < .01$, though this visual status effect tended to be greater in the oldest children (11 and 13 year-olds) than in the younger, $F(6,93) = 2.1$, $p = .055$. More interesting was the finding that only blind children drew objects from the exploring hand's point of view, that is, used the graphic line as a projection of the hand path or arm path when they touched the objects, $F(2, 93) = 22.9$, $p < .01$. However, such a point of view was not used by blind children for the human figure drawing, rarely in the drawing of animals, but was specific to the drawing of inanimate objects, $F(6, 279) = 11.2$, $p < .01$. Figure 4 shows some drawings of a tree (left part) and of a glass (right part) made by blind children aged from 8 years to 13 years. The trunk of the tree was represented by a circle (this corresponds to the sensation children can get when they surround a tree with their arms). The glass also was drawn as a circle, reproducing what the hand can feel when grasping this object.

Figure 4: Drawings of the tree *Drawings of the glass*

Finally, the last criterion we will report on here concerns the introduction of perspective in the drawings (coded for the two categories of inanimate objects). Only 3% of the drawings made by blind children contained perspective information, while sighted

children introduced perspective in 27.3% of their drawings and visually impaired children in 16.6% of the cases, $F(2, 93) = 11.9$, $p < .01$. As expected, drawing perspective appeared in children aged 9 (19%), and was present in 46% of the drawings of the oldest sighted children. Figure 5 reproduces the drawings of a house made by two sighted children aged 11, in which perspective appeared, as well as, in comparison, the best drawing of a house observed in a blind child of the same age, where no attempt to introduce perspective was noticed. However, blind children used more frequently than the sighted children a special drawing procedure whereby the critical features of the represented object were drawn folded out, as illustrated in Figure 6 for the drawing of a house (the door and the windows are drawn folded out) and of a bed (the legs of the bed are drawn folded out). Interestingly, while the attempt to introduce perspective in the drawings increased with age in the sighted children, the occurrence of foldout drawings increased with age in the blind children.

Sighted children
Figure 5: Drawings of the house

Blind children
Figure 6: Drawing of a house (left), of a bed (right)

Discussion

Only one blind child out of 33 (and none of the 41 visually impaired children) made scribbles when asked to produce drawings of familiar objects. This demonstrates that blind children, at least in occidental countries, do develop some capacities in drawing, as argued by Kennedy (1982, 1993). Although almost half of the blind or visually impaired children included in our study did not practice regularly drawing, they used lines to figure the objects' contours and edges, adhered to the convention that the top of the graphic space corresponded to the top of the object, and tried to depict the main elements of each object in their drawings. These results provide some support to the Kennedy claim of "universality" of some drawing rules or conventions. They also show that drawing need not require visual skills or visual experience.

However, our results also demonstrated that drawing in blind children presented specific features in comparison to both the sighted and the visually impaired children: drawings displayed positioning errors, lines were disconnected, elements were juxtaposed, drawings were fold out, and lines sometimes expressed as much the object's contours as the exploring hand or body's sensations. Do these features denote a developmental delay (drawings from blind children would be similar to those made by young sighted children because of difficulties in the construction of spatial representations) or do they indicate some kind of "haptic realism", involving that blind children draw what their hands give them to "see"? This second interpretation would mean that blind children elaborate "tactile icons" (see for instance, the examples of tree drawings, Figure 4) that make their drawing "specific".

Acknowledgments

This research is supported by a grant from the ANR (Agence Nationale pour la Recherche), project "Image Tactile (Apprentissages, Connaissances et Société)", 2006-2009.

References

-D'Angiulli, A., & Maggi, S. (2003). Development of drawing abilities in distinct population: Depiction of perceptual principles by three children with congenital total blindness. *The international society for the study of behavioural development, 27*, 193-200.
-Freeman, N. (1980). *Strategies of representation in young children.* London: Academic Press.
-Goodenough, F.L. (1926). *Measurement of intelligence by drawings.* New York: World Book Company.
-Heller, M.A. (2002). Tactile picture perception in sighted and blind people. *Behavioural Brain Research, 135*, 65-68.
-Kennedy, J.M. (1982). Haptic pictures. In *Tactual perception*, Schiff W. & Foulke E. eds, New York: Academic Press, pp. 303-333.
-Kennedy, J.M. (1993). *Drawing and the blind.* New Haven, CT: Yale University Press.
-Kennedy, J.M. (2000). Recognizing outline pictures via touch: alignment theory. In *Touch, representation and blindness*, Heller M.A. ed, Oxford: Oxford University Press, pp. 67-98.
-Kennedy, J.M. & Bai, J. (2002). Haptic pictures: fit judgments predict identification, recognition memory, and confidence. *Perception, 31*, 1013-1026.
-Kennedy, J.M. & Juricevic, I. (2003). Haptics and projection: drawings by Tracy, a blind adult. *Perception, 32,* 1056-1071.
-Kennedy, J.M. & Juricevic, I. (2008). Drawings from a blind adult: Orthogonals, parallels and convergence in two directions without T-junctions. In *The development of drawing and non-verbal intelligence*, Lange-Küttner C. & Vinter, A. eds, Cambridge: Cambridge University Press, pp. 317-335.
-Luquet, G.H. (1927). *Le dessin enfantin [Children's drawing].* Paris : Alcan.
-Millar, S. (1975). Visual experience or translation rules ? Drawing the human figure by blind and sighted children. *Perception, 4*, 363-371.
-Ricci, C. (1887). *L'arte dei bambini [The art of children].* Bologna.
-Willats, J. (2005). *Making sense of children's drawings.* Mahwah, NJ: Erlbaum.

§§§