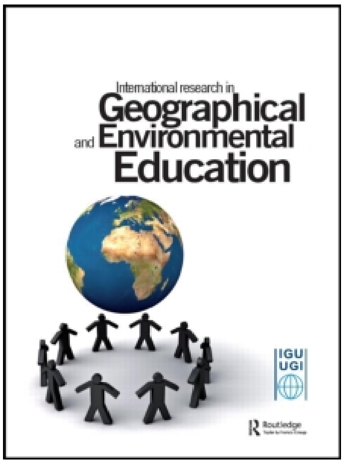

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Mapping the journey from home to school: a study on children's representation of space

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Mapping the journey from home to school: a study on children's representation of space

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This paper describes a study conducted with 235 children from Brazil and Switzerland. The children, from 5 to 13 years of age, were asked to draw the journey they undertake every day from home to school. The purpose of the study is to understand the relationship between the cognitive development and map-drawing abilities of children in both countries. The maps were analyzed qualitatively by focusing on elements of space representation such as paths and landmarks. The analysis shows that younger children can draw simple topological maps and then move on to egocentric landmarks. Older children can identify and draw more streets and buildings and move on to decentered maps. Country differences are mostly related to local geographic and social particularities. No gender differences were found. Results are discussed in relation to the underlying process in developmental abilities of children.

Keywords: map drawing; space representation; children; journey to school; navigation

Introduction

Drawing a map for geographical navigation is a common activity of spatial representation. Cognitive psychology has shown that people use some kind of mental map when they deal with space in tasks such as navigation, scene description and spatial reasoning (Denis, 1994; Tversky, 2003). Few people's mental maps will correspond precisely with cartographic maps, but it is the mapped world, not the map, that they are trying to understand.

Representing a path for someone else to understand is a well-documented subject for adults (Denis, 1997a; Tversky, 2003). Spatial perceptions have been explained in environmental psychology primarily through socioeconomic and demographic factors (Alibrandi, 2003). Studies on map drawings by children have focused on free-hand drawings of their cities (Tsoukala, 2001) and their school or home surroundings (Rissotto & Tonucci, 2002; Y Al-Zoabi, 2002). The ability to gradually encode spatial information in their description is well documented by Spencer, Blades and Morsley (1989). Drawing a navigation map is a less-studied task. For example, Matthews (1984) and Rissotto and Tonucci (2002) present quantitative results on accuracy of elements presented on a map.

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From another point of view, geography teachers center their reflection on mapping abilities (Catling, 2005; Downs & Stea, 1977). For example, Wiegand (2006) presents extensive analysis on map understanding. The abilities to understand and produce maps develop with age, and even if only children after 10 years of age are considered to be able to master maps (Cornell & Heth, 2006; Wiegand, 2006), abilities at earlier ages have been put forward by Blades and Spencer (1994).

This paper focuses on children's familiarity with their physical environment, more specifically with their trajectory from home to school. The purpose of this study is to analyze how children draw a map from the journey they undertake every day from home to school. We will examine the landmarks taken into account in the drawings, the spatial representation and cognition and the ability of the children to represent a non-egocentric map. The drawings are analyzed for clues involved in developing spatial competencies. All the aspects will be discussed in relation to age, gender and country for our data collection in Brazil and Switzerland. We will first review the literature on cognitive maps and space representation. Then we will focus on the development of space representation.

Cognitive maps and space representation

In cognitive psychology, studies on mental maps of adults have been done since many years. For example, Lynch (1960) has pioneered the use of sketch maps in urban studies by asking residents of a city to both sketch and verbally describe their cities. With drawings from several cities, Lynch derived the main mental constructs used by adults in their daily operations around the city, which are "paths", "landmarks", "nodes", "edges" and "districts". In *Maps in Minds*, Downs and Stea (1977) used the terms "cognitive maps" for the sketches representing a spatial phenomena and "cognitive mapping" for the internal representation. Denis and Briffault (1997) analyzed the cognitive operations underlying a route description and how people code spatial information in language. Three means are used to facilitate the navigation of a person to a particular place: verbal, graphic and gesture means. The relation among these means and the cognitive operations needed to describe routes are as follows:

- Activation of a representation of the environment in which the movement has to be made – this operation is performed for each space representation.
- Definition of a route – a route description is not simply the execution of a graph but rather a planning task that has to coordinate many segments related one to the other and other elements.
- Formulation of the procedure to execute the route.

The first and second operations are activated before describing the route itself. The third operation is activated to transcribe the mental representation in a verbal and/or graphic description.

Research on communicating route directions by graphical means is more recent. The work by Tversky and Lee (1998, 1999) and Tversky, Zacks, Lee and Heiser (2000) built a conceptualization of spatial primitives for route directions, both graphical and verbal. In Tversky and Lee (1998) data were collected by asking persons on the Stanford University campus to give either a graphical or a verbal description as route directions to an off-campus place. Their main claim was that the structure of verbal and graphical route direction is based on the same cognitive elements.

Concerning developmental aspects of representing space on a map, without going into the vast literature on teaching geography at school, we mention here research directly related to our study – children's ability to give a non-egocentric view of space as it appears on maps. Harwood and Usher (1999) analyzed the effect of teaching basic skills to draw a map. Children at 8 and 9 years of age were asked to draw a route from school to church at the beginning and the end of a teaching process, which contained a bird's-eye view, pictures and plans, symbols and reading a street map. Their results showed an improvement with each map drawn by the experimental group (with teaching) and no improvement for the control group (without teaching). The improvement concerned more specifically their representation of perspective, the use of symbols and contents. Nevertheless the authors mention, "For most children the improvements after teaching were relatively modest, suggesting . . . that this is still a difficult task for primary school children" (Harwood & Usher, 1999, p. 237).

On the other hand, Davis and Hyun (2005) show that kindergarten children can improve their ability to draw through being introduced to a vast range of various media for drawing. Moreover, they improve their representation of space through construction activities such as block constructions.

When speaking about representation of space, one also has to consider gender differences in spatial abilities. Common theories consider that females are superior at static object-location tasks and that males perform better when the task contains a component of mental rotation (Montello, Lovelace, Golledge, & Self, 1999). However, women rapidly became able to acquire men's abilities through training (Vidal, 2006). Regarding gender differences in children, Harwood and Usher (1999), as well as Umek (2003), did not find any differences through a teaching procedure.

The development of space representation

Making a map to guide someone is a challenging task. A "good" map contains pertinent landmarks, indication of crossroad choices and visible labels. For example, it is often useful to know where *not* to go to understand where to go, and moving or changing landmarks are not useful to find a route.

It is a long way from a child's first drawings of a house, sun and flowers to perspective representation, passing through the representation of simple geometrical shapes. Piaget and Inhelder (1957), in their famous work on space representation, distinguished three aspects of space comprehension: Euclidian space, projective space and topological space.

Drawing a map to represent a route from one place to another for someone else to understand contains almost all these aspects of space comprehension. Maps are simultaneously Euclidian (the length represented is proportional to the real length, when drawn to scale), projective (a point of view is taken) and topological (buildings in proximity in real space are in proximity on the map too). The fact of walking on a familiar route adds a subjective dimension to the presentation for others. To be efficient, the space drawing on the map to inform others on a route must be "decentered", i.e. not centered on the child's own view of the route.

Children's development of space representation is argued over by geographers and teachers. Debate puts forward the role of underlying cognitive operations for acquisition of space representation. Blaut (1997a) addresses critics to Downs, Liben and Daggs (1988) who are said to underestimate children's abilities to be educated early in geography. Liben and Downs (1997) emphasize the underlying cognition operations to suggest a slower development than Blaut (1997b). Our aim is to give a contribution to the knowledge about children's development of space representation. Understanding space for children can be described as a *progressive coordination of perspectives.*

Experiments with projective space

Children's ability to coordinate points of view is a long development (Thommen, 2001; Thommen & Rimbert, 2005). The first acquisition is demonstrated at the age of 3, when children are not implicated in the analysis of point of view. They are able to hide a doll in such a way that it cannot be seen by another person (Hobson, 1980). However, as soon as their own point of view is implicated, they confuse their point of view with others'. Nevertheless, the study by Masangkay et al. (1974) shows that 5-year-old children are able to coordinate two points of view. When children had to represent the relation between objects from another point of view (which is needed to represent a route), they encountered difficulties. In the well-known task of Piaget and Inhelder (1957) involving three mountains, children were asked to choose the photograph of a three-dimensional environment as it would be viewed from another point of view. They made errors until they became 12 years old.

Experiments with Euclidean space

In the classical task of Piaget and Inhelder (1957), children were asked to copy geometrical shapes such as a square, triangle, cross, circle, in and out. The *Euclidian space* of the shapes was understood at 7 years of age, when all the shapes were correctly reproduced. At the same age, children can also understand the conservation of length (Piaget, Inhelder, & Szeminska, 1960). Mastering the conservation of surface comes later at the age of 8 to 9 years and of volume at age of 12 years.

Summary and hypotheses

People who communicate a route to go somewhere use many cognitive operations (Denis, 1997b). Children develop slowly their abilities to coordinate perspective and represent space. They were taught at school about the plan-view perspective, symbols and keys symbols (Harwood & Usher, 1999). Nevertheless, how they become able to give a representation of a familiar trajectory to others has not yet been precisely described. The aim of our study is to describe the developmental process of children when drawing a map on the journey they undertake every day from home to school. We analyzed route drawings from children of different ages and compared them in a transversal approach.

We start with 5-year-old children, the age just before going to regular school, and stop at age 13, when they achieve primary scholarship. The hypothesis here was that a developmental course of map drawing goes from an egocentric viewpoint to a non-egocentric one. Moreover, it was expected that we could find some particularities in the drawings to differentiate boys from girls and among countries. We focus our analysis on decentration clues in the maps rather than on geometry. Through qualitative analysis, we will describe the children's maps without qualifying the accuracy of the map or counting its elements. This allows us to elaborate a typology on map drawing, typology that could be useful for other researchers to analyze the qualitative aspect of such drawings. It is important to precisely describe their developmental course to improve geographical teaching.

Method

We adopted a qualitative methodology. The main purpose is to describe general trends and not to compare drawings in details. We had the opportunity to collect drawings from an extensive range of age of children living in different geographic context in order to be able to carry out an elaborate qualitative analysis with a maximum of variability. Our aim to build a typology of children's drawing could only be achieved through an extensive collection of drawings.

As we take data from four different towns in Brazil and Switzerland, a lot of variables are not under control, such as the length of the journey to school, mode of transport, the available material to make the drawings, previous geographical teaching, the spatial visual abilities of the children and the socioeconomic status of the children. Our approach is observational rather than experimental because we want to catch the general process, the "what" develops in mapping a familiar route. Our qualitative analysis is careful to not take into account what the result of uncontrolled variables was. For example, we do not count the number of elements represented in the map as in Matthews (1984), since this is related to the length of the journey. We often used the criterion "at least one" to describe the elements of drawings. This heuristic has the advantage of studying the representation of a familiar route from different places. The results will be analyzed with statistics for qualitative data (chi-square).

Procedure

We asked children to draw the route they take daily from home to school in a free-hand map. The instruction for the map was that it should be useful to a friend when going to school from their home. The drawings were made individually in the school classes. The children had the time they needed to complete their drawings, which was less than 2 hours.

Participants

The map drawings were made by 235 children aged between 5 and 13 years from different towns in Brazil and Switzerland. In Brazil, data were collected from a school in Conselheiro Lafaiete (or simply Lafaiete), which has 102,836 inhabitants (2001 census). In Switzerland, we collected data from schools in La Chaux-de-Fonds, Lausanne and Solothurn, which have, respectively, 36,809, 117,388 and 15,079 inhabitants (2005 census). The physical reality in the neighborhood of the school in Lafaiete has many trees, and the houses are spread out in the area. The school offers space to run and to play games, such as football and ball play, in the break. The physical reality in the part of La Chaux-de-Fonds where the school is located has large orthogonal roads, houses with a small garden in front and a park with trees, where children can take part in outdoor physical activities. In Lausanne and Solothurn, the surrounding is also similar.

Table 1. Description of the samples from Switzerland (CH) and Brazil (BR).

Age group	Origin	Female	Male	Total
5- to 7-year-old	Chx-de-Fds (CH)	11	8	19
	Lafaiete (BR)	7	10	17
	Lausanne (CH)	16	15	31
Subtotal		34	33	67
8- to 9-year-old	Chx-de-Fds (CH)	24	24	48
	Lafaiete (BR)	9	3	12
	Soleure (CH)	13	8	21
Subtotal		46	35	81
10- to 11-year-old	Chx-de-Fds (CH)	21	19	40
	Lafaiete (BR)	18	7	25
Subtotal		39	26	65
12- to 13-year-old	Lafaiete (BR)	12	10	22
Subtotal		12	10	22
Total		131	104	235

Table 1 lists the age groups of the children and their origin and gender from each school in which the map drawings were made. The scholars in Brazil prepared their maps in 2003 and those in Switzerland in 2004.

Our sample is unbalanced because we considered all drawings of scholars that were collected by their teachers. This required a qualitative analysis that works independent of the unbalanced sample. So comparison of drawings from Switzerland and Brazil will be performed only for subgroups of subjects.

Assessing the children's maps

As Harwood and Uscher (1999) argue, classical analysis of map-drawing skills is often not specific enough to assess improvement. For this reason, they developed their own system to assess maps. For this same reason, we created our own map assessment system with three motivations:

(1) Creating a map for representing a route is not the same as creating a map of a city.
(2) Scoring the map in a quantitative scale does not give information on what are qualitative changes through development.
(3) Comparing maps of routes from home to school in different towns have to capture general indicators of the space representation not specific to the place. We will take into account the type of feature (see the following) instead of the feature itself.

Thus, our aim when we analyzed the maps was not to quantify or to score the accuracy but to describe what the changes depending on age were. The children drew their routes for a specific goal, which was that a friend could use them to find their houses. In order to evaluate if this goal was reached, we did not compare the maps with reality, but we analyzed the relevance of the features present in the drawings. We described in detail the maps produced by the children, in order to answer the following research questions:

(1) What are the particularities of the children's drawings?
(2) How do children present useful landmarks to point out their route from home to school?
(3) Are there specific characteristics in the representations related to the age, origin and gender of children?

Elements of spatial representation

The drawing of a route from home to school for another person to understand should contain information on the environment such as crossroads, names of the streets and special buildings and show the path itself. We describe here the elements of the environment shown by the children in their map drawings. We proceeded in two steps. First, we provided a description of the elements in the drawings (roads, crossroads, road legends, traffic signs, buildings and other landmarks). Second, we ordered these features in relation to other people's perspective. In this second step, we evaluated the features according to their relevance to give orientation to another person. We also looked for paths and landmarks, as proposed by Lynch (1960) in the differentiation of elements to represent urban space.

The *paths* in the drawings of children were usually simple. Indeed, some drawings contained only one line linking two buildings. In a first step, we looked at the number of roads represented, the type of roads (line and arc), the type of crossings (in "T", "L", "Y" or "X") and the road's legends or labels (if any exist). In a second step, the way to order the description of clues was really simple: it depended on the presence or absence of a crossroad. Our implicit conception was that when a child draws the route to her/his school she/he must draw both the route itself and the roads *not* to be taken. The crossroad was an indicator of the perspective taken. Naturally, the number and type of crossroads were not good indicators of decentration, because children did not have the same number of crossings on their routes.

Regarding *landmarks*, we categorized elements for wayfinding on the map as follows:

- Buildings – school, home, friend's house, bakery, gas station, etc.
- Traffic signs – linear marks on the road, zebra crossroad, traffic lights, stop signs, bus stop, etc.
- Other landmarks – elements of natural environment such as trees, flowers and pets; elements of material environment such as a staircase and wall; and drawings of persons such as a friend or the school crossing patrol. The features in this group were generally not useful to find the way, but they showed the effort expended to include landmarks in the maps, even if they were not geographically relevant to give any orientation to others.

Next we organized the landmark elements in a hierarchical way. In order to categorize all elements of the whole drawing, we looked mainly at whether a feature was present or absent. In "buildings" we took into account the presence of the school, the child's house and any other buildings. In "traffic signs" and "other landmarks", a drawing might contain more than one type of such features, so we also categorized the drawings by defining rules for these features. As part of the qualitative analysis, we list the number[1] of drawings containing elements for each of the above categories (for "traffic signs" and "other landmarks", the order of presentation corresponds to the priority order).

Paths

Crossroads: at least one crossroad, 150; no crossroad, 85.

Landmarks

- Buildings: only school and home, 96; at least one other building, 139.
- Traffic signs: zebra crossings, 92; other traffic signs, 32; others road signs (e.g. bus stop), 25; none, 86.
- Other landmarks: persons, 62; natural environment, 92; material environment, 49; none, 32.

Elements of spatial expression were also observed. In this study, legends or labels were the only clues taken into account. The categorization of the legend associated with landmarks in the map was the following: street's name, building's name and friend's name. To synthesize the result, we differentiated three levels: high (street's name, building's name), 102; low (bus, school, home, friend's name), 74; and none, 59.

Measurement of reliability

To measure the reliability of our analysis, we randomly selected 33 drawings and analyzed them twice. Two different persons categorized these drawings, and then an agreement percentage was computed. We found the following accuracy in the data:

- Buildings – 90%
- Crossroads – 90%
- Traffic signs – 87%

For the category of "other landmarks" (persons, elements of the natural environment and elements of the material environment) it was more difficult to achieve reliability. However, we will see further that this category will play a marginal role in the results.

Results

Analysis of spatial cognitive ability on maps

Effects of age and gender on the spatial representation

Considering the perspective of another person, the results show a regular improvement of the drawings with age. This is similar to the assumptions derived from the Piagetian theory: children's map drawings will progress from the egocentric to a decentered view, and the maps will progress from pictorial to abstract symbolic representations of reality (Harwood, 1999). Three indicators reflect this evolution in the collected drawings: the presence of crossroads, the presence of buildings different from home or school and the inclusion of a legend. The graphs given in Figures 1–3 show the assessments performed.

We use chi-square statistics to test the dependence between our qualitative variables. As we can see in the results shown in Figure 1, regarding the presence of crossroads, there are no differences concerning gender. On the other hand, age produces a general trend toward more and more children drawing at least one crossroad (chi-square (3) = 35; $p < .0001$).

Regarding landmarks, observe in Figure 2 that as the children become older their drawings contain more landmark buildings (chi-square (3) = 40; $p < .0001$). As gender had no effect in this study, we did not include it in the other two figures.

Finally, a last indicator of perspective taking is related to the presence of a legend (see Figure 3, chi-square (6) = 66; $p < .0001$). Legends become common from age 10 onward. A more detailed analysis shows that at the age of 9 years, the high-level legend passes over 50%.

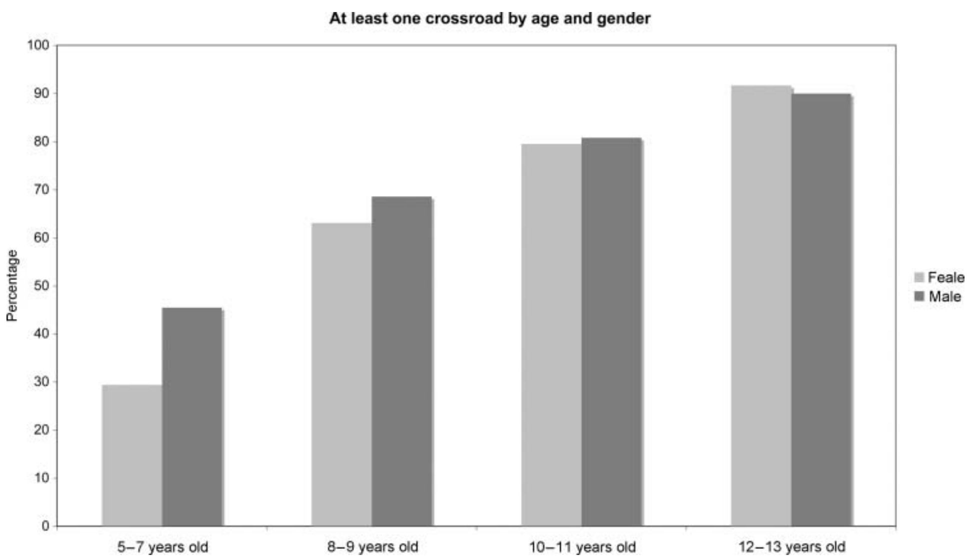

Figure 1. Percentage of children's drawings containing at least one crossroad broken down by age and gender.

Figure 2. Percentage of drawings containing different types of buildings broken down by children's age group.

The results show an evolution in the map drawings taking place throughout childhood. The indicator that we retain for capturing the decentration of children is precise: we observe the progressive presence of landmarks and paths that are useful to give orientation to someone else to find the way (the path *not* to be taken, buildings and a legend). At the age of 8 years, the majority of the children's maps contained buildings and crossroads.

For "traffic signs" and "other landmarks", the evolution in the children's drawings is not so clear. We recall that these indicators in the map drawings concern landmarks that are not

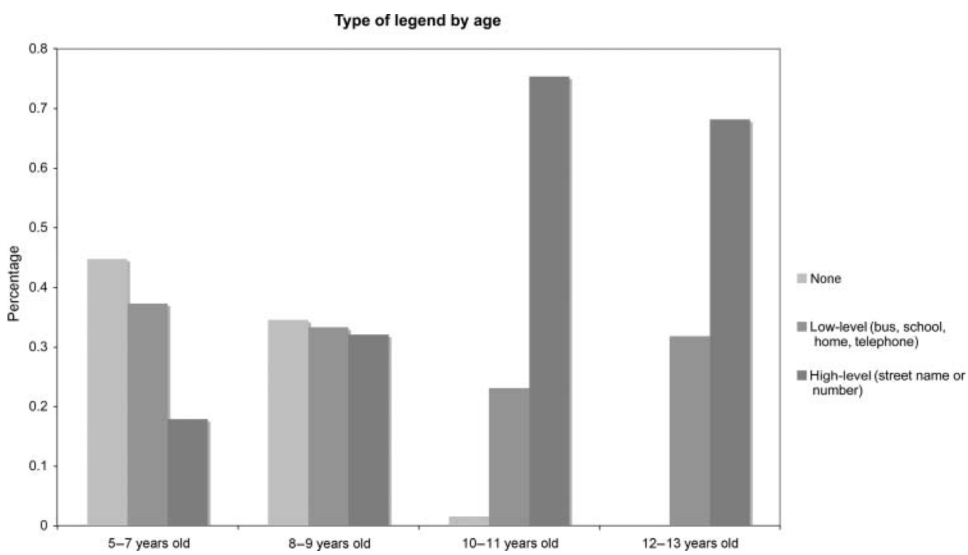

Figure 3. Percentage of children's drawings containing a legend.

very useful in showing the route. In general, “other landmarks” were more decorative than informative, since, except remarkable trees or walls, flowers or pieces of stone do not give in general any information specific to path finding. Very young children drew no traffic signs, while 60% of the drawings of 8-year-old children contained zebra crossings. Probably the children became more aware of zebra crossings because of learning about security. As for “other landmarks” such as drawings of persons and of the natural environment, we could see the egocentric perspective of the young children who often included references to a friend or school crossing patrols in their drawings.

Differences and similarities between countries in the spatial representation

One original aspect of our study is the amount and variety of the collected data. As we have collected drawings from Switzerland and Brazil, we can provide a comparison of the map drawings made in the two countries. However, we have to be careful with this comparison because the pupils’ physical space in the Swiss town is not identical to that in the Brazilian town.

A comparison was performed with drawings by children in similar age groups from La Chaux-de-Fonds and Lafaiete. We took into account only maps of 5- to 11-year-old children because we did not have older participants in the other Swiss towns (see Table 1).

Indications of perspective taking – crossroads, buildings and legends – show similar evolution with age in both countries, except for the presence of crossroads. The 8- to 9-year-old children in Lafaiete are ahead (92% against 58%), though 5-year-old children are not as good as in La Chaux-de-Fonds (18% against 53%).

For the presence of “traffic signs”, the drawings from Brazil and Switzerland differ considerably because of the respective local realities. In the surroundings of the school in Lafaiete, there are no zebra crossings in the streets, nor any traffic lights, so drawings contained no traffic signs at all. In La Chaux-de-Fonds, there are many traffic signs.

For the presence of “other landmarks”, another difference was observed: drawings from Lafaiete contained more natural elements such as trees and flowers (69% against 20% in La Chaux-de-Fonds), and drawings from La Chaux-de-Fonds contained more references to persons (36% against 13%).

As the differences mentioned above are not related to elements that orientate someone, the differences between the countries do not interfere with the general trends noticed.

Typology of drawings

In order to synthesize the results of the whole analysis, we have described all drawings on the basis of the categories of crossroads, buildings, legends and other landmarks. The criterion of ordering the drawings is always the presence of features useful to give orientation to someone else (decentrated map).

Drawings containing no crossroad:

- *Line only* – no crossroads, no buildings and no traffic signs.
- *Line and traffic signs* – no crossroad, no buildings and some traffic signs.
- *Line and legend* – no crossroad, no buildings, some high-level legend and some traffic signs.

Drawings containing at least one crossroad (traffic signs not yet taken into account):

- *Crossroad* – at least one crossroad, no buildings and no high-level legends.
- *Crossroad and legend* – at least one crossroad, no buildings other than home or school and at least one high-level legend.

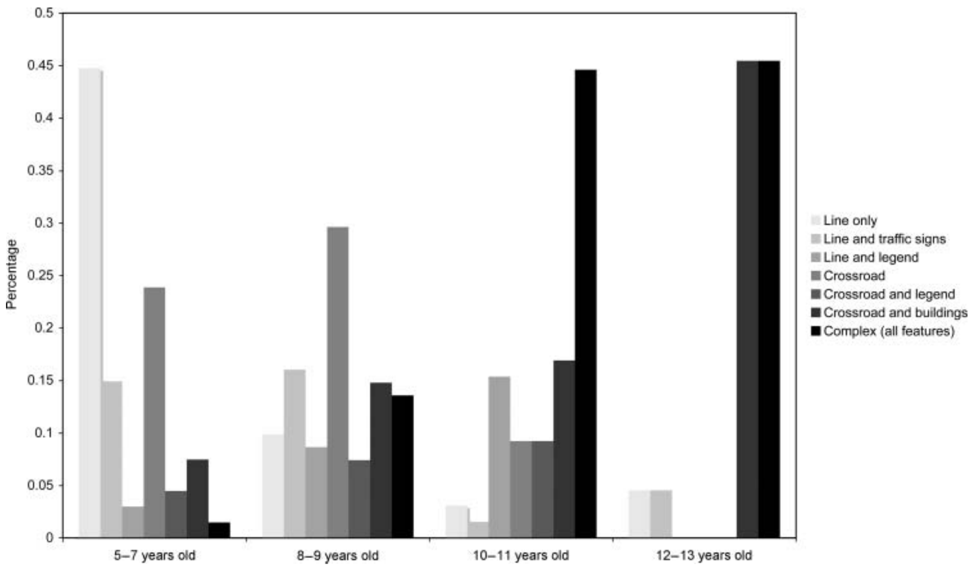

Figure 4. The typology of drawings related to age group.

- *Crossroad and buildings* – at least one crossroad, at least one building other than home or school and no high-level legends.
- *Complex* – at least one crossroad, at least one building other than home or school and at least one high-level legend.

As we can see in Figure 4, the typical drawing of children from 5 to 7 years of age is a line linking home to school without landmarks. With development, the inclusion of landmarks becomes more frequent and the drawings more complex. At 8 and 9 years of age, they begin to include some relevant features to give orientation to someone, but these are limited in quantity and quality. Appendix 1 presents examples of the most common types of drawings ("line only", "crossroad" and "complex"). This typology shows the changes in cognitive abilities to draw a map at different ages.

Discussion

Our results allow us to discuss a few points in relation to questions in the literature. As concerns the pupils' development stage and the debate on the underlying cognitive operations considered indispensable for map drawing, the analyzed maps show an interesting process.

Age differences

Children as young as 5 years old understand the task and draw their way from home to school. The outstanding feature typical of this first drawing is that children represent a route as a line more or less directly connecting the two places. It is a topological representation. Sometimes the connection is not a straight line but is without landmarks or crossroads. These early abilities should be put in relation to our task: drawing a familiar route. Children have to represent their daily journey. This familiarity is certainly favorable to the task. Progressively, children try to give some landmarks and clues on how to find their home.

The first elements given are often not very useful. Flowers and friends are not stable landmarks that allow anyone else to find the way. Nevertheless, they show the beginning of given features to orient someone else. The problem at this age is that it does not seem pertinent to orientate someone else. At the age of 8 years, more than half of the children gave precise features for navigation: some crossroads and buildings other than home or school. The maps became more accurate and complex. High-level legends were present for more than half of 9-year-old children. This development provides evidence for the debate on what content to teach at schools.

Children as young as 5 years old are able to understand some aspects of map representation even if this understanding is limited. We agree with Davis and Huyn (2005) and Blaut (1997a) that it is never too early to teach map work. However, this teaching should not be too ambitious. Children construct their global, cognitive abilities through exercising knowledge on elementary aspects of map representation (Vygotsky, 1987).

Gender differences

Gender did not cause differences in the map drawings in our study. Our global analysis picks up some general cognitive abilities to represent space in drawings which are not different between girls and boys (Harwood & Usher, 1999; Umek, 2003). The children in our samples show similar performance. This is a result in favor of an explanation of gender differences as being acquired. This suggests that gender differences in map abilities could arrive later in development, but we did not notice that in our study.

Country differences

Regarding the data from La Chaux-de-Fonds and Lafaiete, we found a similar general trend in the two towns, even if local differences exist. One particular example of such a trend is the extensive signalization of zebra crossings in the maps of young Swiss children and none in the Brazilian ones. The reason of this difference is obvious: there are no such traffic signs in the real streets in Lafaiete. So, we can put forward that when a child becomes aware of the necessity of putting landmarks on the map, she/he will draw what is significant in her/his own experience of the journey and not what is useful for someone else to understand (egocentric landmarks). As the reality of the children of our study was objectively different, we found such different egocentric landmarks in our results. However, it is egocentric in both places. Apart from local geographic differences, the maps from La Chaux-de-Fonds and Lafaiete were similar.

Conclusion

Our results were then in favor of general abilities in space representation, which was in accordance with the classical Piagetian view. Complex representation of space on a map became dominant after 10 years of age. However, children as young as 5 years old understand the task and are able to draw a map that displays rudimentary map-making ability. This is in favor of early introduction geography in the curriculum (Catling, 2005). Children's drawings of navigation maps are related as much to mental maps as to cognitive operations (Denis & Briffault, 1999). They first contain representations of motor displacement (line between two buildings) that is a topological space for young children. Then, they contain representation of mental space when they put landmarks and crossroads in their drawings that are geometrical and projective spaces.

Our study confirms well-known developmental performance in map drawings by children (Wiegand, 2006). Our approach about a very familiar journey favors the movement of developmental clues from local, egocentric and topological space to global, decentered and projective space. Referring to a familiar route, very young children can understand the task and begin to work on geographical clues. The observational approach we adopted allows us to describe maps from children having different environment and to put forward the general trend of their developmental process.

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Note

1. These frequencies are given as a result of the qualitative analysis itself. They will be presented in relation to age groups in the result part of the paper.

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Appendix 1: Examples of drawings' type

Type Line Only (5-year-old child, Lausanne)

Type Crossroad (8-year-old child, La Chaux-de-Fonds)

Type Complex (11-year-old child, Lafaiete)