Investigating the effects of a car culture on a child's spatial skills

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Abstract

One obstacle in the creation of a walking culture is an increasing reliance on the car. Car use is displacing walking for a wide variety of journeys. Personal factors, such as the convenience of making door-to-door journeys, have combined with changes in the layout of our towns and cities, to produce a culture of car dependence. Using the car for a journey is a choice that is made by adults, but if those adults are parents, then their children will be carried along as passengers. The speed, range and convenience of car travel can help parents to cope with the often complex logistics of childcare. For instance, there is pressure on parents to provide a wide range of out-of-school activities for their children, and it has become increasingly acceptable for parents of young children (indeed it is seen by many as necessary) to travel by car.

Whilst it is recognised that there is a price to be paid for the convenience of car travel, in terms of road traffic accidents, environmental impact and financial cost, the impacts for the passengers are not always considered. The increase in time spent in car travel, and the time spent in structured play has reduced the time available for unstructured, independent travel and play. Travelling by car has potential implications for both physical health, in terms of the physical activity lost through not walking or cycling, and for the development of cognitive skills by changing the child's interaction with the environment.

This paper presents at some of the methods being used in the CAPABLE project to look at children's spatial awareness and to examine how it may be influenced by their interaction with the environment, which includes travel and play. This investigation is part of an ongoing study into children's interaction with the local environment. The work discussed in this paper involved Primary School children (aged 8 to 10 years). A variety of methods are being used to investigate children's spatial representations, including sketch mapping tasks, direction estimation and landmark recognition. In addition, tests of spatial reasoning and travel questionnaires are being administered.

Initial results, comparing the accuracy of sketch maps produced by children who regularly walk, and those who regularly use the car, suggest that those who regularly walk have more accurate spatial representations.

Biography

James Paskins is a Research Fellow in the Centre for Transport Studies at UCL. He is currently working on the CAPABLE project, examining children's behaviour in their local environments and studying for a part-time PhD. He has previously worked on projects investigating children's car use and transport-related social exclusion.

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Introduction

The way in which young children travel in their local environments has undergone a marked change. In Great Britain, both the mode and the level of independence granted to children have been changing for the last 20 years. This can be seen in the journeys that children make to and from school. The journey to school is a regular part of most children's daily lives, at least during the school term, and one which generates a lot of interest and discussion. National Travel Survey figures (Department for Transport, 2005) show that between 1992/94 and 2004 the percentage of 5-10 year olds who walked on journeys to and from school fell from 61% to 40%, with a corresponding increase in car travel from 30% to 41% over the same period. With the increase in car journeys, which do not allow the possibility of allowing a child to travel alone, it is perhaps not surprising that the number of children allowed to complete the journey unaccompanied has fallen from 14% in 1992/94 to 9% in 2004. Taking a longer view, comparing figures from twenty years ago reveals an even larger change: in 1985/86 walking made up 67% of journeys and car use only accounted for 22%, and the percentage of children travelling to school alone was higher at 21% (Department for Transport, 2004).

It is clear then that the way in which children travel is changing, and has been changing for a number of years. What is not completely clear is why these changes are occurring and, perhaps more importantly, what effect this has upon the children themselves.

Children's day-to-day travel is an important factor in the way that they interact with their local environments (Hillman, Adams, & Whitelegg, 1990). The local environment provides a venue for a wide range of experiences; presenting opportunities for play and learning, and the opportunity to observe and participate in a variety of social interactions. Travel, whether it is a journey with a definite purpose or a less structured journey, such as those associated with children's play, has the effect of expanding the range of these opportunities, as well as being an experience in itself.

One consequence of the ongoing shift to the car is that children are probably spending less time outside in their local environments, with less opportunity to take part in the social and environmental interactions that can be important learning experiences. Different modes of travel allow for different types of interaction. When travelling by car for instance, a child is not only deprived of an opportunity for physical activity, but is also prevented from direct interaction with the environment. There is a possibility that the differences in the style of interaction whilst travelling will be reflected in cognitive representations. The different ways that children travel and play will effect the way that they interact with, and encode information about, their local environment. As passengers, children do not need to make any decisions to navigate, nor do they need to assess the road safety situation; there is a possibility that this will be reflected in their cognitive maps. Good spatial knowledge is required for successful way-finding and children who are regular car users may not be developing the skills required to become confident independent travellers.

The term cognitive map (Tolman, 1948) is often used to refer to the mental representation of knowledge about the environment, and spatial relationships. This term has been used to cover any aspect of environmental knowledge, including routes, landmarks, directions, and even impressions and beliefs about places (Kitchin & Blades, 2002). In the context of this study the term is being used to cover the knowledge that children learn, store and recall about the configuration of spatial elements in their environment, the representations that are utilised when planning or recalling a route to travel from one place to another.

A number of techniques exist for assessing children's knowledge about large-scale environments. Each technique has its own strengths and weaknesses, and may involve the use of skills that mask a child's true competence (Matthews, 1992).

The relationship between the way in which children experience their local environments, and the spatial knowledge that they build up is being investigated as part of the CAPABLE project. The study is employing a range of tasks to assess the children's environmental knowledge, these have been piloted and we are preparing to gather a large sample of primary school children (aged 8-10) over the next academic year (2005/06).

The CAPABLE research project

CAPABLE stands for **C**hildren's **A**ctivities **P**erceptions **A**nd **B**ehaviour in the **L**ocal **E**nvironment, the research is being funded for 2 years, starting in August 2004, by the UK Engineering and Physical Sciences Research Council (EPSRC). It is being carried out at UCL as a joint project between the Centre for Transport Studies, the Centre for Advanced Spatial Analysis, the Bartlett School of Planning and the Psychology Department.

The approach is to develop research tools to investigate children's spatial behaviour, perceptions and relationship networks, and parental attitudes, to use these to analyse how children use open spaces and to develop new models of children's outdoor movement patterns.

The research tools being developed include:

- Accurate and objective methods to measure children's travel and activity patterns This is being achieved by using of compact electronic monitors in addition to travel and activity diaries. Physical activity is measured using an accelerometer and location is measured by GPS (global positioning satellite) receivers.
- Questionnaire surveys of children and their parents, carried out through schools
- Interviews with parents and with children, including mapping exercises to reveal the nature and extent of parent's and children's social networks.
- A battery of tests which investigate children's environmental knowledge, including sketch mapping tasks to test children's recall of the local environment, direction estimation tasks and a test of spatial reasoning.

Investigating children's spatial skills

I will use this paper to take a brief look at some of the methods that we are using to investigate children's spatial skills.

Landmark recognition task: The landmark recognition test asks children to identify a number of landmarks taken from the area around their school. The position of each of the landmarks to be identified was indicated on a map by a numbered arrow, the number on the arrow corresponded to the question number on a worksheet. Children have to read a map to find the location of the landmark and then choose its picture from those given on the worksheet. Each question on the worksheet presented the correct landmark mixed with three distracters. A point is given for each correctly identified landmark.

Area mapping task: For the area mapping task each child is given a sheet with a plan view of the school in the middle. Children are told which direction in the classroom corresponds to North or upwards on their sheet and were then asked to draw a map of the area around the school. Children are encouraged to include as many objects and places from the vicinity of the school as they could remember, including buildings, roads, junctions, areas such as parks, playgrounds or car parks and any other landmarks they could think of. The children were encouraged to place the elements of the map as accurately as they could, both in relation to the school and any other elements they included. Children were also asked to name as many of the elements that they added as possible. Figure 1 shows an example of an area map.

Figure 1: Example of an area sketch map

Route mapping task: For this mapping task each child is given a blank sheet of paper. Children are then asked to draw a map of the route they followed to get to school that morning. They are instructed to try and draw a map that would allow someone to follow the route that they took and, just as in the area mapping task, to try to include and name as many landmarks as they could remember. Figure 2 shows an example of a route sketch map.

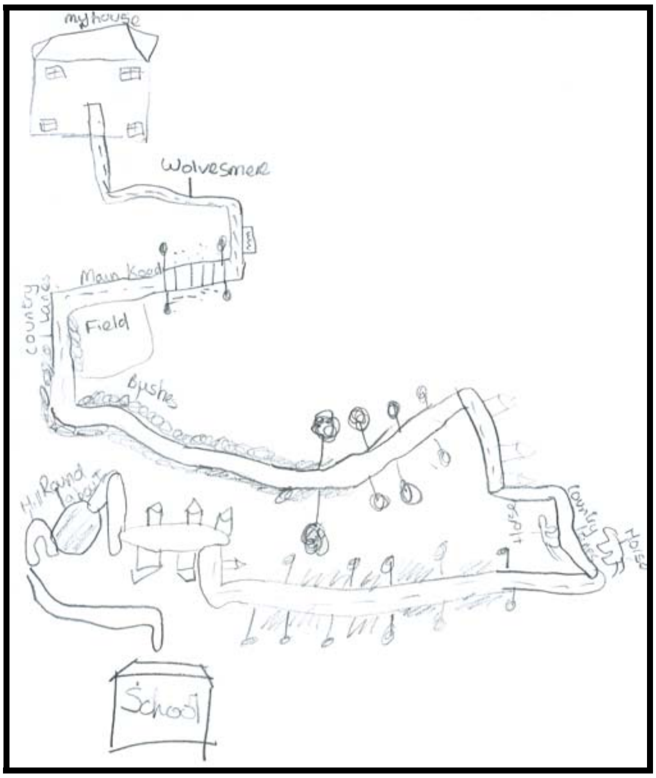

Figure 2: Example of a route sketch map

Spatial reasoning test: This test published by NFER Nelson provides a standardised measure of spatial reasoning ability. The test assesses pupils' ability to manipulate shapes and patterns, and think in three dimensions, allowing an independent assessment of a child's spatial abilities.

Direction estimation task: This involves children pointing to a series of unseen, distant landmarks taken form the local area. It is being used as measure of spatial knowledge that does not rely on drawing ability.

Combining GPS output and sketch maps

The use of GPS monitors allows the possibility to match up children's recall of their journeys to school, as measured by the route sketch map, with the actual routes followed over two school days. It may also be possible to relate the performance on the area sketch map with the environmental interaction shown by the GPS trace over the monitoring period. Figure 3, below, shows the output from a GPS monitor for the first few minutes of a school lunch break. The map shows one short "event" in detail, the time between lessons ending for lunch and the child going inside to eat their lunch. GPS monitoring will cover four full days and will allow similarly detailed views for each event.

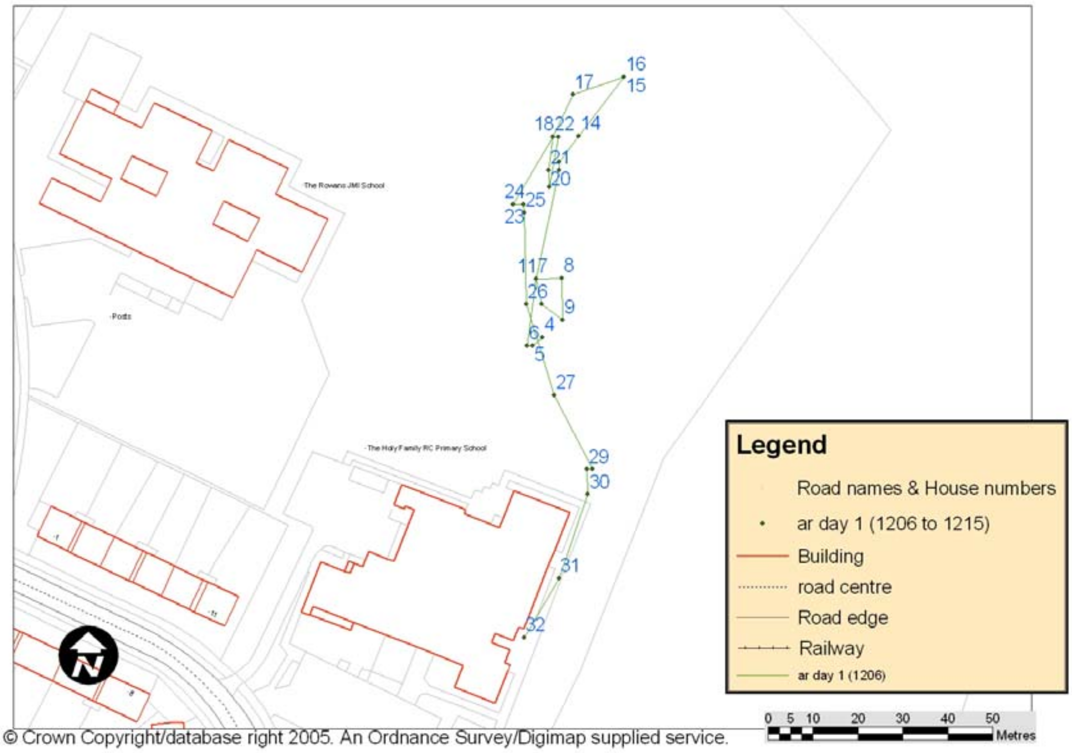

Figure 3: Example of the output from a GPS monitor

Analysing the sketch maps

Analysis of the mapping tasks is not as straightforward as the analysis of the recognition task or the spatial reasoning test, which only involve counting up correct responses. The sketch maps produce a far richer set of data, for instance, there are interesting differences in the style of maps, with some children producing sketch-maps using a top-down view and others employing a side on view, as if the building was being viewed from the street. These differences are interesting, and may be investigated at a later stage, but the initial focus is on aspects that are most obviously linked to a child's awareness of the local environment, the detail contained in, and the accuracy of, their sketch-maps.

One way to measure accuracy is to compare positions of landmarks on a sketch map with the position of the same landmark shown on an Ordnance Survey map of the area. The initial analysis compared the accuracy of sketch maps drawn by children who usually used the car to travel to school and children who usually walked to school. The difference in accuracy was calculated using bidimensional regression (Friedman & Kohler, 2003) to calculate a regression coefficient for the fit between the landmark locations on the sketch map and the real-world locations.

Initial piloting and analysis has suggested that there is a link between children's mode of travel on the journey to school and the accuracy of their spatial representations. The sketch maps produced by the children who usually walked to school were significantly less distorted than those produced by the children usually used the car. Interestingly, the results also suggested that independence on the journey to school might be also factor in explaining the differences in the accuracy of spatial representations. A more complete description of this analysis and results from earlier piloting can be found elsewhere (Paskins, 2005). It will be interesting to see if the relationships between mode and independence on the journey to school and accuracy of spatial representations hold for other types of journeys.

These initial results were based on a small sample (59 children) and did not take into account a number of important factors, including innate spatial abilities and broader environmental experience. It is the aim of the CAPABLE project to provide a fuller picture of the behaviour patterns of the children who take part in the study and to use a broader range of instruments (described above) to investigate spatial knowledge.

Conclusions

Initial results have suggested that children's travel, at least on the journey to school, can influence spatial knowledge. The sample in the initial work was small, and the other travel and environmental interactions were not considered in great detail. The daily journey to school is only one element of children's travel, and only one part of their environmental interaction. This part of the CAPABLE project aims to take the detailed picture of the young children's behaviour, that will be provided using questionnaires and electronic monitors, and to relate it to the battery of tests covering spatial and environmental knowledge, described above. In this way it may be possible to determine what impacts the changes in children's behaviour, brought about by a growing reliance on the car, are having on children's cognitive development.

Acknowledgements

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