What's life in a baby buggy like?:
The impact of buggy orientation on parent-infant interaction and infant stress

Research Study carried out by

Dr. M. Suzanne Zeedyk

in collaboration with the National Literacy Trust

17 November 2008

Funders
This research was supported by a grant from the Sutton Trust.

Acknowledgements
Sincere thanks are expressed to the following groups and individuals for their contribution to this work:
- to the many volunteers throughout the UK who donated their time to carry out observations in Study I;
- to the Hauck Group and Chicco, for kindly donating the buggies used in Study II;
- to the mums and babies who so enthusiastically volunteered to take part in Study II, even on the days when the weather was miserable;
- to Dr. Clifford Davies for discussions of methodological and statistical issues;
- and to Hannah Young and Maheshika Mackenzie, the research team overseeing data collection and analysis, for their commitment and diligence in completing this project.

Further details regarding this project
Dr. Suzanne Zeedyk, Principal Investigator, can be contacted on m.s.zeedyk@dundee.ac.uk.
Liz Attenborough, Manager of the Talk to Your Baby Campaign of the National Literacy Trust, can be contacted on liz.attenborough@literacytrust.org.uk.

What's life in a baby buggy like?:
The impact of buggy orientation on parent-infant interaction and infant stress

Executive Summary

The aim of the present research project was to investigate the impact of baby buggy design on interaction between parents and infants and on infant stress levels. This is a novel piece of work, given that there appears to be no previously published research on this issue.

It is an important issue because of the large body of evidence that now exists within the psychological, educational and medical literatures confirming that early interactions between parents and infants have a long-term effect on children's development. The present research project arises out of recent suggestions that baby buggies may inadvertently be generating such stressful circumstances for infants. While this may seem a strong assertion, it is unarguable that, over the last few decades, pushchairs in the UK have undergone a change in design, such that most buggies now face forward (ie., away from the parent), in contrast to the design in earlier decades, where buggies faced backwards toward the parent. Research repeatedly shows that infant development is best nurtured when their parents are emotionally and cognitively available to them, able to respond to the subtle bids that they make for attention and comfort. Buggies that face away from parents do not promote such conditions; indeed, they are likely to interfere with parents' ability to tune in quickly to infants' needs and interests.

Thus, it is not as surprising as may first appear to question the extent to which contemporary buggies nurture children's psychological health, especially in the face of survey findings that British children spend, on average, up to two hours per day in away-facing buggies. This issue seems worthy of investigation, so that parents and manufacturers can make informed choices about the products available on the market. Yet we can locate no published empirical studies that have examined the impact of buggy design on parent-child interaction. The aim of this project was to begin addressing that gap.

The project was comprised of two studies. The first was a national observational survey, conducted on High Streets in 54 locations throughout the UK and eventually comprising 2722 observations of parent-child pairs, which systematically documented the social interactions of families occurring during buggy use. The second was a small-scale experimental study with 20 mother-infant pairs, which built on the findings of Study I by monitoring both mother-infant interactions and indicators of infant stress, during journeys in the two buggy orientations.

The results of Study I showed that the majority of buggies observed were away-facing. Away-facing buggies were found to be associated with a reduction in speaking for both parents and infants; for infants, the reduction rate was one-third and for parents, the rate of speech halved. Interestingly, infants in toward-facing buggies were twice as likely to be sleeping as infants in away-facing buggies, an unexpected finding that has tentatively been interpreted as an indicator of stress levels.

The results of Study II confirmed that mothers spoke more when travelling with their infants in toward-facing buggies; when they were in away-facing buggies, maternal speech dropped by half. They also showed that mothers and infants were both more likely to laugh in the toward-facing orientation, and that mothers were aware of and surprised by this overall change in communicative interactions with their babies. Finally, the results yielded further tentative evidence for the possibility that buggy orientation could influence child stress: infant heart rates fell slightly when moved into a toward-facing orientation, and they were also more likely to fall asleep in this orientation.

The title of this report asks 'What's life in a baby buggy like?'. The results from these two studies suggest that the answer is that it is more isolated than many adults realise – and may be more emotionally impoverished than is good for children's development. These findings encourage us, as a society, to take infants' experience more seriously.

If there is any possibility that the design of buggies is failing to promote infants' development, then this is a considerable concern. Virtually every family in the UK who has a child under the age of 3 years will own a buggy. If it can be confirmed, in future research, that 'turning the buggies around' makes a different to child development, then the manufacturing of 'emotionally healthy' baby buggies could be an easy, affordable, and achievable means of facilitating long-term mental and physical health. Considerable effort is now being devoted by the UK government and UK charities to providing support to parents and families during the earliest years of children's lives. It is worth at least investigating the extent to which buggy design might fit with this agenda.

This is an issue with relevance to the health, academic and social care sectors. This makes it an issue not only for parents, but for the whole of society – including buggy manufacturers. Ultimately, though, it is parents who will have the greatest investment in this issue. If buggy design does hold consequences for infant development, as the results of these two studies suggests it does, then they deserve access to this information, in order to make decisions about how best to care for their children.

What's life in a baby buggy like?: The impact of buggy orientation on parent-infant interaction and infant stress

Background

The aim of the present research project was to investigate the impact of baby buggy design on interaction between parents and infants and on infant stress levels.

This issue is important because a large body of evidence now exists within the psychological, educational and medical literatures confirming that early interactions between parents and infants have a long-term effect on children's development. The diverse areas that interactions have been shown to impact include social skills, cognitive abilities, language aptitude, emotional health, and neurological development (e.g., Barker, 1992; Francis & Meaney, 1999; Hirsh-Pasek & Golinkoff, 2003; Perry, 1997; Sroufe, 2005; Zanarini, 1997). Gerhardt (2005) summarises these findings by stating that a parent's positive facial expressions are the most vital stimulus for growth of the infant's social brain. Schore (2001) has argued that the child's relationship with a primary caregiver "permanently moulds the individual's capacity to enter into all later emotional relationships", for better or for worse. Prescott (1989) has put it even more starkly: "the easiest and quickest way to induce depression or alienation in an infant or child is not to touch or hold it". Such conclusions have convinced a number of international, state, and charitable bodies, whose aim it is to improve children's life outcomes and reduce the risk of violence in later years, to focus preventative efforts on the early years period between birth and 3 years (e.g., World Health Organisation, Worldwide Alternatives to Violence Trust, Scottish Violence Reduction Unit).

In short, every occasion that a baby has for interacting with an adult is a valuable one. Neuroscience has revealed that the synapses in a child's brain multiply 20-fold between the birth and 3 years of age, a rate that is faster than at any other time in life (Gerhardt, 2005). Infants are born with brains that are already tuned into, and dependent upon, social responses from other people. Thus, on every occasion that a baby has a need for a communicative response from his or her parent, but is unable to obtain it, this creates a low-level stress response in the infant. When such instances of stress occur repeatedly and frequently, they become damaging to infants' neural, physiological, and psychological development.

The present research project arises out of recent suggestions that baby buggies may inadvertently be generating such stressful circumstances for infants. While this may seem a strong assertion, it is unarguable that, over the last few decades, pushchairs in the UK have undergone a change in design, such that most buggies now face forward (ie., away from the parent), in contrast to the design in earlier decades, where buggies faced backwards toward the parent. This shift has occurred as a result of changing cultural demands (e.g., the need to fold up a pram and fit it into a car boot) and technological capabilities (e.g., the ability to build prams that fold up), and beliefs about babies' needs (e.g., that they benefit from looking out onto the world around them).

A cultural belief also appears to exist in the UK (and amongst manufacturers) that, once they can sit up, babies benefit from looking out onto the world around them. However, research repeatedly shows that in order for babies to make effective use of that experience of the wider world, they need parents to help mediate and make sense of it for them. That is, they need parents to be emotionally and cognitively available to them, able to respond to the subtle bids that they make for attention and comfort. Buggies that face away from parents do not promote such conditions; indeed, they are likely to interfere with parents' ability to tune in quickly to infants' needs and interests. It is not parental actions in and of themselves that are crucial to infant development, but rather their reciprocal relation to infants' needs, what Swain et al. (2007) call "contingent loops of interactions".

Thus, it is not at all extreme to question the extent to which contemporary buggies nurture children's psychological health, especially in the face of survey findings that British children spend, on average, up to two hours per day in away-facing buggies (National Literacy Trust, 2005). This issue seems worthy of investigation, so that parents and manufacturers can make informed choices about the products available on the market. Yet we can locate no published empirical studies that have examined the impact of buggy design on parent-child interaction. The aim of this project was to begin addressing that gap.

Design

The project was comprised of two studies. The first was a national observational survey, conducted in more than 50 locations throughout the UK, which systematically documented the social interactions of parents and children that occurred during buggy use. The second was an experimental study, which sought to investigate in more depth key findings emerging from Study I. Mother-infant interactions, as well as indicators of infant stress, were monitored during two buggy journeys, one in an away-facing orientation and the other in a toward-facing orientation. Study II was designed to discern the extent to which behaviours observed in Study I could reasonably be attributed to buggy orientation. If the conclusion was that there were reasonable grounds doing so, then that would provide a strong basis for carrying out future work in an area that has received no empirical attention, despite the clear implications it has for infants, parents, and society more generally.

Study I

Aim

The aim of Study I was to gain systematic insights into the ways that young children are being transported on UK high streets, and the way in which these influence interactions with parents. A large observational study (eventually representing 2722 parent-child pairs) was carried out in order to ensure that the findings were nationally representative.

Research Questions

1. How frequently are the four main modes of infant transport being used: away-facing buggies, toward-facing buggies, being carried, and walking?
2. How are children behaving in buggies -- vocalising, silent, seeking parent, crying, sleeping – and does buggy orientation influence this behaviour?
3. How often are parents speaking to children – and does buggy orientation influence this behaviour?
4. Does parent talking predict child vocalising?

Observers

Observations were carried out by volunteers, recruited through networks associated with the National Literacy Trust. Volunteers were sent a set of recording sheet and instructions for carrying out observations (see Appendix 1). The instructions had been piloted in order to ensure that observations could be carried out consistently without further training. By the study's end, observations had been submitted by a total of 57 volunteers.

Sample

The final sample comprised data on 2722 parent-infant pairs.[1] This derives from a total of 39 hours of observations carried out by the 57 volunteers, conducted over two months during the summer and autumn of 2008 (August and October). Observations were collected in 54 cities and towns throughout the UK, located in 22 regions. A complete list of these locations is provided in Appendix 2.

Protocol

Observations were carried out in 30-minute blocks. Observers were asked to choose a site that afforded them a view of the High Street, such as a bench or café overlooking the street. A high street location was proscribed because this offered consistency across the diverse set of towns and cities included in the sample, and because pilot observations had confirmed that a large number of families with buggies used high streets. Observers were asked to record target features (described below) of all parent-child groups who passed in front of them, where the child was approximately 3 years of age or under.

Features recorded

The following features were recorded for each parent-child pair observed.[2] For each feature, observers were asked to tick a box indicating which of the sub-categories applied (as shown on the recording sheets in Appendix 2).

Parent	Mother	Father	Both		
Estimated age of child[3]	Less than 1 year	1 - 2 years	2+ years		
Mode of child transport	Buggy	Walking	Being carried		
Orientation of buggy	Away-facing	Toward-facing			
Child behaviour	Vocalising	Silent	Seeking parent	Crying	Sleeping
Parent behaviour	Talking to child	Not talking to child			

[1] It is of course possible that the adults accompanying children were not their parents. They could have been grandparents, aunts, nannies, friends of parents, or other temporary guardians of the children, although the greatest likelihood is that they are parents. Because there is no way of making such distinctions, for the purposes of this study we have treated all adults in the sample as parents. The conclusions that will be drawn from this study, regarding the extent to which infants are experiencing interactions with adults during outdoor journeys, are in no way compromised by this decision.

[2] It was also recorded whether or not parents were travelling with more than one child (for example, a young infant and a toddler, perhaps with one in a buggy and one walking, or alternatively with both in a double buggy). This grouping information was included in the survey because it was helpful to observers in their efforts to keep track of what they were observing. This feature is less relevant to the questions being addressed in this study, though, and has therefore not been included in analyses.

[3] Estimations of child age were made on the basis of infant size and physique. Distinctions between approximate ages are not difficult to make, especially as the age categories being used here were quite broad.

Results[4]

General characteristics of sample

What was the distribution of ages observed? Of the full sample of 2722 parent-child pairs observed, children's estimated ages were distributed as follows. The distribution is surprisingly even, with each age category representing roughly one-third of the sample.

<1 year of age:	N=843	32% of sample
1 – 2 years of age:	N=991	37% of sample
2+ years of age:	N=834	31% of sample

Which parent was most likely to be accompanying the child? Unsurprisingly, mothers were most likely to be the parent taking responsibility for the child, at all ages. Fathers taking sole responsibility for the infants were relatively rare. In a fair proportion of cases both parents were present.

		Mother (N=1865)	Father (N=207)	Both (N=585)
Parent	N			
<1 yr	842	69%	6%	25%
1-2 yrs	986	69%	8%	23%
2+ yrs	829	73%	9%	18%
Overall	2657	70%	8%	22%

Research Questions

1. *How frequently were the different modes of transport used?* Buggies were a major form of transport at all ages. Away-facing was the most popular of the two buggy orientations, at all ages. Buggy use did decrease over age, with more than half the sample walking by the time children were over 2 years. There were also some children being carried at each age, but this proportion was always minimal.

		Buggy - Away (N=1650)	Buggy - Toward (N=340)	Carried (N=99)	Walking (N=556)
Age	N				
<1 yr	839	60%	34%	6%	0%
1 – 2 yrs	978	86%	4%	3%	7%
2+ yrs	828	37%	2%	3%	58%
Overall	2645	62%	13%	4%	21%

2. What were the children doing? In the majority of cases, children were silent, at all ages. The proportion of silent children is highest at 1 – 2 years. Below 1 year, a high proportion of

[4] The figures relevant to each analysis will differ slightly and may not always equate to the total sample of 2722. This is because information was occasionally missing for some of the parent-infant pairs. Calculations for each analysis are based on the set of observations for which all relevant information is available.

children were sleeping. By 2+ years, more children were vocalising, but the proportion, at just over one-third of children is still quite low.

Age	N	Vocalising (N=501)	Silent (N=1584)	Crying (N=55)	Seeking parent (N=99)	Sleeping (N=386)
<1 yr	828	5%	57%	2%	2%	35%
1 – 2 yrs	980	15%	69%	2%	6%	8%
2+ yrs	817	38%	54%	2%	4%	2%
Overall	2625	19%	60%	2%	4%	15%

3. Did buggy direction influence child behaviour? Yes. Children in away-facing buggies were more likely be silent than were children in toward-facing buggies (as highlighted in bold). Overall, these figures indicate that the majority of children, overall, were silent at the point at which we observed them. The distribution shows that there was a higher rate of vocalising for children who were walking (and thus who were, proportionally, older than those in the other modes of transport), but the numbers might still be regarded as low, with only 50% talking.

Transport Mode	N	Vocalising (N=503)	Silent (N=1592)	Crying (N=53)	Seeking parent (N=103)	Sleeping (N=394)
Buggy - Away	1659	10%	**70%**	2%	5%	13%
Buggy - Toward	340	9%	**43%**	2%	1%	45%
Carried	99	27%	55%	5%	1%	12%
Walking	547	50%	46%	2%	2%	0%
Overall	2645	19%	60%	2%	4%	15%

Interpretation of the above distribution is complicated by the high proportion of children who were sleeping (particularly in toward-facing buggies). If these 394 sleeping infants are removed from the calculation, the distribution alters as shown below. It emerges that infants in toward-facing buggies are more often vocalising than infants in away-facing buggies (as highlighted in bold). Interestingly, the proportional difference in vocalising rates of the toward- and away- groups (i.e., 5%) is not taken up in silent behaviour (which remains near 80% for both groups!), but in seeking behaviour. A greater proportion of children in the away-orientation are turning around, seeking their parents' attention (as highlighted in bold).

Transport Mode	N	Vocalising (N=503)	Silent (N=1592)	Crying (N=53)	Seeking parent (N=103)
Buggy - Away	1431	**12%**	80%	2%	**6%**
Buggy - Toward	187	**17%**	79%	3%	1%
Carried	87	31%	62%	6%	1%
Walking	547	50%	46%	2%	2%
Overall	2251	22%	71%	2%	5%

4. How often were parents speaking to children?[5] The answer to this question is: not very often. For the sample as a whole (excluding children who were sleeping), parents were observed speaking to their children in less than one-quarter of cases. When the three age groups are considered separately, it becomes clear that parents most often spoke to those in the oldest age group. For the two youngest age groups, parents were observed to be speaking in well under 20% of cases. (Note, as per Footnote 5 below, that these calculations are based only on children who were not sleeping, for it would not be expected that parents would be talking to sleeping children.)

Age Group	N	Parent Talking (N=498)	Parent Not talking (N=1724)
<1 yr	533	13%	87%
1-2 yrs	894	17%	83%
2+ yrs	795	35%	65%
Overall	2222	22%	78%

5. *Did buggy direction influence parental behaviour?*[6] Yes. Of the four transport modes observed, parents spoke least when they were using away-facing buggies. They were more than twice as likely to be speaking if using a toward-facing buggy (as highlighted in bold). However, buggies yielded less interaction from parents than did the other two forms of transport of walking or carrying – a pattern that chimes with the results discussed earlier for child behaviour. These findings are worrying given that away-facing buggies have already been identified as the most common form of transport.

Transport Mode	N	Parent Talking (N=498)	Parent Not Talking (N=1736)
Buggy - Away	1421	**11%**	89%
Buggy - Toward	185	**25%**	75%
Carried	87	46%	54%
Walking	541	47%	53%
Overall	2234	22%	78%

[5] These data pertain to only those infants who were awake. It is unlikely that parents would be talking to sleeping infants, so observations for those infants were removed from the present calculation, in order to gain a more accurate distribution of infant behaviour. Sleeping infants have also been removed from calculations for Research Questions 5 and 6.

[6] These calculations apply only to children who were awake. See Footnote 5.

6. *Did parent talking predict infant vocalising?*[7] Yes. If parents were talking, children were more likely to be talking. Similarly, if parents were silent, children were more likely to be silent. The proportions associated with this pattern are striking, with a match of 70% or greater for each of the two categories (as highlighted in bold).

Parent behaviour	N	Child vocalising (N=501)	Child silent (N=1596)	Child crying or seeking parent (N=156)
Talking	502	**70%**	19%	11%
Not talking	1751	9%	**86%**	5%
Overall	2253	22%	71%	7%

The following breakdown shows that this pattern held up across all ages. When parents are speaking, children are more likely to be speaking, and vice-versa (as highlighted in bold). The association is particularly strong at the oldest age (2+ years), with the match for both talking and not talking applying to 80% of the sample. It also clearly applied at the two youngest ages, albeit the association for both parties talking was weakest for the youngest age. Overall, these figures indicate that the association between parent and infant talking (and, likewise, parent and infant silence) begins to be established long before children are able to use language – a finding that other literature supports.

Age & Parent behaviour	N	Child vocalising (N=494)	Child silent (N=1576)	Child crying or seeking parent (N=152)
<1 yr				
Talking	71	**44%**	42%	14%
Not talking	462	2%	**94%**	4%
1-2 yrs				
Talking	153	**61%**	24%	15%
Not talking	741	7%	**86%**	7%
2+ yrs				
Talking	274	**81%**	11%	8%
Not talking	521	16%	**79%**	5%

7. *How often did children attempt to get their parents' attention (when in away-facing buggies) – and were the children generally successful?* By and large, children who were deliberately seeking out parents' attention failed to obtain it, at all ages. This insight can be gained by focusing only on away-facing buggies, since this is the orientation in which children's attempts to gain parental attention were most obvious. (Thus, other forms of transport, including toward-facing buggies have been excluded from this analysis.) There are two ways in which children could seek parents' attention while in an away-facing buggy: either by turning around in the buggy or by crying. The tables below show the breakdown for each of these strategies, in association with the proportion of parents who responded by talking.

The outcomes show that there were only a small number of children in away-facing buggies who were deliberately attempting to get parents' attention (115 of 1431 = 8%). However, the important insight is that these children were largely unsuccessful. Crying was

[7] These calculations apply only to children who were awake. See Footnote 5.

the most successful form of attention seeking, in that 40-50% of children who were crying received a response from parents. Turning to find the parent was much less successful, with success rates ranging between only 9% and 33%. These data suggest that away-facing buggies interfere with parents' ability to meet their children's needs for attention in a timely fashion.

Seeking behaviour & Age	N	Parent Talking (N=33)	Parent Not talking (N=82)
Turning around			
<1 yr	11	9%	91%
1-2 yrs	49	20%	80%
2+ yrs	24	33%	67%
Crying			
<1 yr	8	50%	50%
1-2 yrs	17	41%	59%
2+ yrs	6	50%	50%

8. *Did rate of sleeping differ for buggy type?* Yes. Infants who were in toward-facing buggies were almost twice as likely to be sleeping as were those in away-facing buggies. This analysis focuses only on infants in the youngest age group, because there were so few children in toward-facing buggies at the older ages. This outcome is one of the most surprising outcomes of the study, for it was not anticipated. We have interpreted it as an indicator of stress level. Infants sleep most easily when they feel safe and relaxed. A cautious interpretation of these findings would be that a toward-facing buggy reduces infant stress levels, because parents are emotionally available, and that allows them to drift into sleep.

Buggy Orientation	N	Infant Sleeping (N=287)	Infant Awake (N=105)
Away	492	27%	73%
Toward	274	52%	49%

9. *Did observers' comments support the observed patterns*? Yes. Many of the observers spontaneously included written notes with their postal submissions. These show a consistent pattern, with observers disheartened and surprised by the low levels of interaction they had observed between parents and infants. A sub-set of such comments are provided below. The full set of comments received from observers can be found in Appendix 3.

> What an eye-opener! I felt like cheering every time I heard a child or parent talk. We clearly have a lot of work to do in our area, around parent-child interaction. When I moved to the location where I carried out my second observation session, there were several small fairground rides, and I anticipated lots of opportunities for interaction. I was so disappointed that most of them were missed.
>
> Where both parents were present, they were often talking to each other but not to the child.

> Why don't people talk to their children more? Missed opportunities for a bit of fun! ... The one person who stopped for a length of time at the benches to chat to the child was a 'granny type'. Most people were busy just rushing along.
>
> So many parents were on mobiles!
>
> I was hoping for more interaction in my Sunday observation session, as people would be in less of a hurry. But while people were in less of a hurry, they still weren't interacting with their children!
>
> I carried out my observations on a damp and misty morning. The weather may have made things more difficult, as the number of children totally enclosed in plastic covers was astounding! It also gives a rather depressing picture of how little interaction went on – perhaps if the weather had been sunny and the children more visible, this may have helped things?
>
> The only communication seen today was when giving the child sweets and crisps.
>
> My sad general observation is that nobody talks very much!

Conclusions of Study I

The results of this observational study clearly demonstrate that buggy direction is associated with differences in parent-child interaction. Both child behaviour and parent behaviour showed a less engaged pattern for away-facing buggies than for toward-facing buggies. Moreover, away-facing buggies were the most popular choice at all three age groups. Within the wider body of knowledge that now exists regarding the importance of early social interaction for infants' long term development, these initial findings signal concern about the impact that buggies may be having on the emotional and cognitive development of UK infants.

Insights offered by these findings include the following:

- Impoverished interaction patterns were always associated with away-facing buggies. Both parents spoke less and infants vocalised less in this orientation. For infants, the rate was approximately one-third less; for parents, the rate was half. That is, using a toward-facing buggy double the rate of parents' talking.
- Yet, of the two orientations, away-facing buggies were by far most popular. This was especially true for the age group 1- 2 years, when few children were yet out walking and even fewer were travelling in a toward-facing buggy. This indicates that these children, as a group, may receive the least interaction from parents.
- Well over half of infants under 1 year of age were being transported in away-facing buggies. Although this is in some sense unsurprising, given that the general advice has been to turn infants outward facing at about 6 months, the whole of the first year is an age at which facial expressions and bodily postures are the crucial means of communication between infant and parent. The inability to see infants' faces presented by an away-facing buggy will interfere with this process, long before infants have language for crafting other strategies for engaging.
- The silence that prevailed amongst children was exceedingly high. In both toward- and away-facing orientations, 80% of children were silent. Even those who were walking – the group with the highest rate of talking – yielded a rate of only 50% talking.
- Parents spoke most often to children in the older age group (2 years or above). This is likely to be because children are using representational language by this age, and are able to engage their parents in linguistic conversation. Perhaps many parents simply do not realise that talking to their young babies matters. But research has demonstrated beyond doubt that infants are tuned in to parents' voices from before birth, and

therefore continuing to hear (and see) it directed toward them makes a tremendous difference to their emotional and cognitive development.

- This developmental relationship, with parent behaviour affecting child behaviour, can be seen in this data set. Our observations showed that if parents were talking, then infants were very likely to be vocalising – and vice versa. The association was very strong (i.e., 70% for talking and 86% for not talking). Parental talking generates not only vocalisations on the part of the child, but it also generates for them reassurance, emotional affirmation, and guidance as to what is interesting to look at in the world.
- Buggy design may be having an influence on more than the child's social and cognitive development. The finding that buggy orientation is associated with sleeping patterns suggests that it might also be influencing stress levels to some degree. Children are best able to sleep when they are relaxed and feeling safe. It makes sense that a toward-facing orientation would promote this experience. It will be important for future research to use other measurements of stress to evaluate this possibility in more depth. Even the tentative possibility raised here helps to make the point that buggy design may be having an impact on children's physical health and physiological development.
- The previous point is reinforced by the finding that there were a small minority of children who were attempting to get their parents' attention, but failing to do so. These children will have even higher stress levels, as they seek out parents either through crying or through turning around, yet fail to obtain a response. For these children, a buggy ride may go from being stressful to being traumatic. This is not too strong a statement, because young children's coping systems are immature. To be left on their own, coping unassisted with discomfort for too long, constitutes trauma for a young child. If parents cannot easily see their infants' faces, they may not realise in just how much distress their children are.

Are there critiques that might be made about the design used in this study? One concern may arise from the 'snap-shot' observational methods employed in the study. Each family was observed for only a few seconds, leading some to object that the behaviour observed for this single moment of time may not be representative of the wider interaction patterns for each family, for they might have been behaving differently a bit further down the street. While this is true, for parents (or children) may have altered their behaviour once they were beyond our observational zone, such methodological concerns dissipate when group trends are being examined, as they are here. The fact that the observation was made at a random point in each pair's journey means that we have adequately sampled trends for the sample as a whole. Statistical logic allows us to predict that, if talking behaviour was random, we should have observed parents talking as often as we observed them not talking. The fact that we have not observed talking in such equal proportions indicates that some other factors are at play – the UK population's inclination to talk to children in buggies. It also means that the patterns we have observed are 'real', rather than a consequence of our chosen methods of observation.

A second critique might be that parents who choose a toward-facing buggy (especially for children of older ages) may have sought it out especially because it affords more interaction with the child. Thus, the behaviour we observed may be due to more than simply buggy orientation; it may represent personality characteristics of the parents (e.g., talkativeness or preferences for particular interaction styles) as well.

This second concern will be addressed in Study II. In it, we sought to explore whether the patterns of parent talking that we observed on high streets were a consequence of parent personality or whether parent behaviour really is influenced by the orientation of a baby buggy. That is, if each parent had a chance to use either type of buggy with their child, would their behaviour change substantially?

Study II

Aim

A key finding of Study I's observational survey was that parents were found to be talking more often to infants in toward-facing buggies than in away-facing buggies. Study II sought to investigate this outcome in more depth, by examining the difference in orientations experimentally. We invited volunteer mothers and infants into our Infant Study Suite and asked them to undertake buggy journeys in both orientations.

During the journeys, we measured the amount of social interaction (i.e., talking and vocalising) that occurred between the pair. This experimental design allowed us to test whether changing the orientation of the buggy actually alters the amount that mothers and infants talk to one another during a buggy journey – or whether the differences we observed in the Study I could more reasonably be attributed to personality characteristics (e.g., talkativeness) of the mother, which should be less affected by merely changing a buggy's orientation. If Study II did show that reversing the orientation alters verbal interaction, then it would also provide an indication of how large that change was.

Study II also allowed us to extend investigation of another of the outcomes emerging from Study I – the surprising finding that infants were more likely to be sleeping when in toward-facing buggies than in away-facing buggies. We have suggested this could be interpreted as indicative of stress levels. That is, infants who have easy access to their mothers may be more relaxed and emotionally secure and thus more easily fall asleep. If this is the case, then it strongly suggests that toward-facing buggies are beneficial not only for social interaction, but also for infants' physical health. We investigated this possibility by measuring infant heart rate during both buggy journeys. Heart rate is a popular means of assessing stress levels, with higher heart rates indicating higher levels of stress. If infants' heart rates were higher, on average, in the away-facing condition than in the toward-facing condition, this would suggest that away-facing buggies might possibly indeed be heightening infants' stress levels.

Study II was intended as a pilot project. It did not aim to provide definitive conclusions regarding infants' or mothers' buggy-related behaviour. Rather, it was seen as providing a starting point for such questions. Our aim was to gather enough evidence to assist the field in deciding whether or not undertaking more extensive investigation would be worthwhile – and, if so, to identify the factors on which future investigations might focus. A pilot approach allowed us to work with a small, but statistically robust, sample size of 20 mother-infant pairs, and to focus on the two domains of social interaction and stress. Given that research on the effects of baby buggies -- not only on infants' psychological, but also physiological, development – has been so absent from the scientific literature, the results of even a small pilot project such as Study II stand to generate valuable insights.

Hypotheses

1. Mothers will talk more to infants in the toward-facing orientation than in the away-facing orientation.
2. Infants will vocalise more in the toward-facing orientation than in away-facing.
3. Infants' heart rate will be lower in the toward-facing orientation than in away-facing.
4. Mothers will report different levels of enjoyment and comfort for the two types of buggies.

Sample

A total of 20 infants and their mothers from the Tayside area took part in the study, 10 girls and 10 boys. Ages of infants ranged from 9 months to 24 months (mean age = 13.6 mos). All

mothers reported their educational level to be at highers or above, with the majority also having completed university. The majority of participating mothers used away-facing buggies in their daily lives; only three reported owning toward-facing buggies. When asked how long they tended to use the buggy during the day, half reported 1- 2 hours, eight reported less than an hour, and two reported more than 2 hours. Families had been recruited to take part through posters, internet parenting lists, toddler groups, and friendship circles. An additional five pairs also participated in some portion of the study, but their data were excluded either because of equipment malfunction or adverse weather conditions.

A sample size of 20 was chosen because, while small, it was of a sufficient size to generate statistically reliable data sets. Sample sizes of 20 are not uncommon within psychological studies of parent-infant interaction, in part because of the time-consuming (and thus expensive) nature of working with young infants. As discussed below, we ensured that the study yielded as much statistical power as possible by choosing a 'within' experimental design. Thus, a sample of 20 was well suited to the pilot nature of this study, for it was sufficient to reveal any consistent patterns within the data set while also limiting the funding required to undertake the work. If robust, statistically significant patterns did emerge, this would signal the merit of further investigation of this issue.

Protocol

Mother-infant pairs were asked to come to the Infant Study Suite at the University of Dundee. We began the session by gathering basic demographic information (e.g., infant age, usual transport preferences) and explaining to participants that they would be taking two buggy journeys, one in an away-facing buggy and one in a toward-facing buggy. We encouraged them simply to have a good time during the journeys, treating them as if they were a pleasant stroll. Equipment for audio and heart rate recording were then attached, with mothers aware of all equipment being used. The journey route that we wished them to follow was described, and mothers were provided with a map (although the route was very straightforward and familiar to most of the mothers, as it went through a popular area of the city).

We provided mothers with the buggies for the journeys, with one oriented in the toward-facing direction and the other in the away-facing direction. (See Appendix 4 for photos of the buggies.) Mother-infant pairs were randomly assigned to orientation conditions, with half taking the first journey in an away-facing buggy and half in a toward-facing buggy. At the end of the first journey (a duration of approximately 15 minutes), they were met by a member of the research team, who helped them to transfer the infant into the second buggy and asked them a complete a brief questionnaire about their experience of the journey. The mothers then continued on the pre-determined route, which returned them to the Study Suite, again a duration of approximately 15 minutes. At the conclusion of the study, participants were given a T-shirt as a token of our appreciation, with an appliqué that read 'I have contributed to the advancement of science'. (See Appendix 5 for photos of several of the participating infants wearing their t-shirts.)

This protocol was approved by the Research Ethics Committee of the School of Psychology, University of Dundee.

Measures

Three different variables were assessed: parent-child interaction, infant stress, and parent preferences.

Parent-child interaction was measured via audio recordings of the verbal exchanges within the pair. The taped recordings were transcribed and then coded for utterances, as described below.

Infant stress was measured via heart rate. We used a portable heart rate monitor to record infant heart rate throughout the journey. Monitors function via sensors attached to an infant's foot, with average heart rate over the period later calculated from the data record. Measuring heart rate during a buggy journey is challenging, for monitors are affected by excessive movement (which is of course likely during buggy journeys). Thus, we regarded the data provided by this procedure as tentative, rather than definitive.

Parent preferences were measured through the use of quantitative ratings and narrative comments. At the end of each of the two journeys, we asked mothers to rate four aspects, using the following questions.

How comfortable did you feel during that walk?
How comfortable did you think your baby felt during that walk?
Do you think your infant felt stressed at all during that journey?
How enjoyable was that walk for you both?

Each question was answered using a standard likert-scale format ranging from 1 to 4, with 1 indicating 'not at all [comfortable]' and 4 indicating 'very [comfortable]'. After the conclusion of both journeys, we also encouraged mothers to talk about the journeys. These comments were recorded on the audio equipment and later transcribed.

Coding of verbal exchanges

The following excerpts are typical of the verbal exchanges that occurred between mothers and infants during the buggy journeys, as captured on audio recordings.

Age: 12 months		Age: 22 months	
Mum:	Is that comfy, that one?	Mum:	Are you comfy-humfy?
	Comfy buggy?	Baby:	ah hum
Mum:	Whoop la.	Mum:	ah hum
	That's a difficult one isn't it?		Good.
	Bump off the pavement.	Baby:	ah huh u huh huh
Baby:	eeeeeng		
	mmmmm	Mum:	What's wrong?
Mum:	mm hmm	Baby:	huhhh huhhh
Baby:	mmmmm		
	muuurrrmurrr	Mum:	You see all the girls?
Mum:	Yes.		They'll be meeting for coffee, eh?
	You going to pull that sock off?		Awww.
Baby:	achwa		Big hugs.
			That's nice isn't it?
Mum:	Did you manage to get your sock off?		Big hug when you meet someone.
	Where did you throw that?	Baby:	mmmmm
	There it is.		ah huh huh huh huuuuh
	There it is.		
	Look.	Mum:	What else can you see?
	I've got it.		Look there's a church.
Baby:	achwownowon		With a great big tall spire.
	aaaaaah		Oh here's somebody with a lovely pink umbrella.
Mum:	Starting to rain, isn't it?		You see it?
	I think I'd better put this on you.		It's over their heads.
Baby:	aaaauuuuh		To stop the rain from falling on their heads.
Mum:	Hey hey.		That's what an umbrella does.
	Hey hey.		Stops the rain from getting to you.
	I'll take that.		
Baby:	nnngrrrngrrrr		

Verbal exchanges were coded for four variables.

1. *Total amount of speech spoken by mother and by child.* Units were counted in terms of utterances, defined by a pause at their end. For mothers, utterances often took the form of a sentence ('Do you see the leaves?'), but might be only a phrase ('Ooooh'). For infants, utterances were often a string of syllables ('eiiiya'), but also might be single words ('Dog!') or short sentences ('Mummy, look!').

2. *The types of topics that mothers talked about*. Mothers used their speech to talk about a variety of things. We noted what the most common topics were, and then coded how often each mother spoke about each of the following five topics.

Topic	Example
1. Present events	'Yes, that's a dog!'
2. Future events	'When we finish here, we'll go see Grandma.'
3. Baby's mood	'You look comfortable in there!'
4. Showing the baby something	'Look at the truck!'
5. Using the baby's name	'Joshua, are you unhappy?'

3. *Laughter*. The number of times that mothers and infants each laughed during a journey was counted.

4. *Infant crying*. The number of times that infants cried during a journey was counted.

Because the lengths of journeys varied slightly, rates for each of the above variables were calculated on a proportional basis. That is, we calculated how often relevant utterances occurred per minute of the journey. This calculation allowed us to compare, amongst the mother-infant pairs, how often utterances occurred, irrespective of the actual length of a journey.

Additionally, we extracted from the calculations the length of any periods for which infants slept during a journey. A number of the infants fell asleep for some portion of the time, which could be detected within the audio recordings by mothers' tendency to comment on the child's drowsy state ('Oh, you are dropping off now, are you?'), and also because infant vocalising stopped. This ensured that our comparisons of maternal and infant talking applied only to periods in which infants were awake.

Design and Analysis

A 'within-subjects' experimental design was employed for this study. This design involved mothers and babies taking part in both conditions, that is, making journeys in both types of buggies. A within design is one of the standard designs employed within experimental research, and contrasts with a 'between' design, which involves participants taking part in only one condition. The advantage of a within design is that it is more statistically robust than between designs, because it reduces variance between the data points, and is thus particularly valuable for small samples such as the present one.

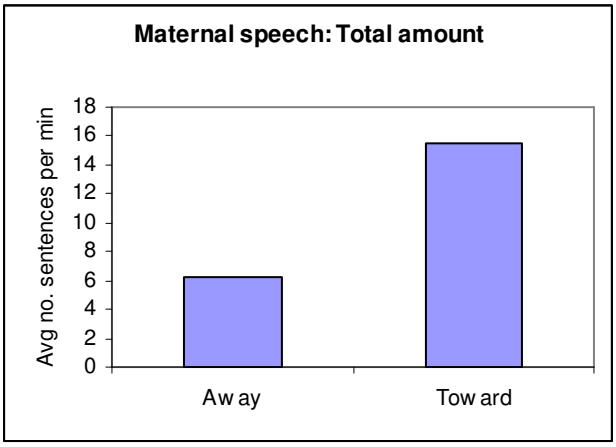
The data were statistically analysed using paired-samples Wilcoxon tests. The aim of statistical analysis is to determine how likely it is that a study's outcomes would have occurred by chance; if that likelihood is very low, then one can reasonably safely attribute the outcomes to the factors one is testing. Wilcoxon tests were chosen because they are suited to non-parametric, within-subjects data sets such as this one, their purpose being to evaluate the consistency of the pattern of change. We used one-tailed tests because our hypotheses

predicted a particular direction of effect (e.g., that utterances would be higher in the away-facing condition). For mothers' responses in the questionnaires, we were unable to confidently predict a direction and therefore used two-tailed tests. We used mixed ANOVAs for these comparisons, given that the data set was parametric.[8]

Results

1. Did mothers speak more to their infants during the toward-facing journey than during the away-facing journey? Yes. Mothers spoke more than twice as much during journeys in toward-facing buggies. On average, mothers spoke 15.50 sentences per minute during the toward-facing journey, but only 6.11 sentences during the away-facing journey, as depicted in Figure 1. Moreover, 18 of the 20 mothers demonstrated this pattern, speaking more during the toward-facing journey. The Wilcoxon comparison confirmed that this pattern of change was statistically significant and unlikely to have occurred by chance [$z=-3.03$, $p<.01$]. We can thus conclude that buggy orientation has an impact on maternal speech: mothers talk more to their infants when they can see them.

Figure 1. Total amount of maternal speech



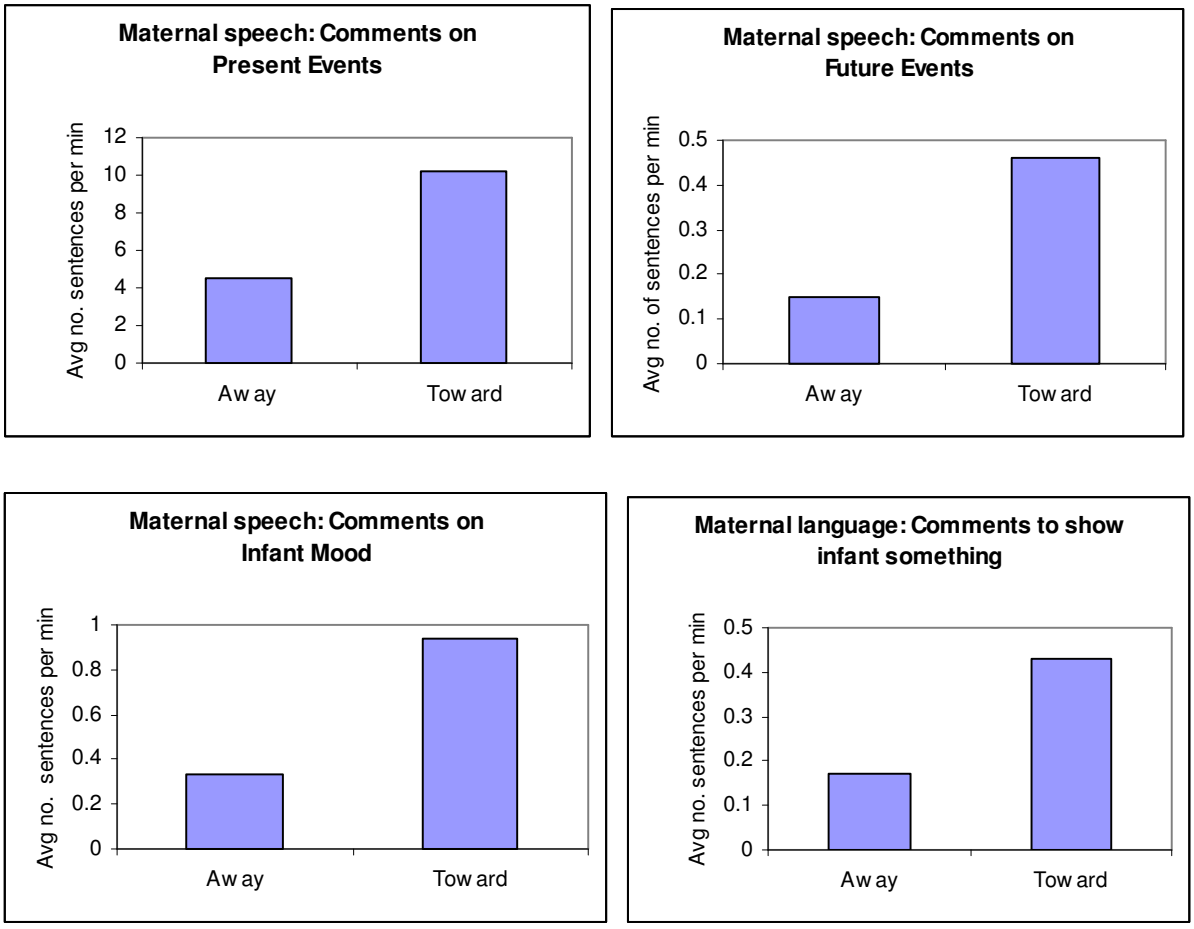
2. Could the difference in total amount of maternal speech also be seen in the specific types of topics they talked about? Yes. The ways in which mothers used their talk differed between the two journeys. During the toward-facing journey, they talked more often about each of the topics we assessed: present events, future events, baby's mood, showing the baby something, and using the baby's name. For each of these topics, the increase in the rate at which they talked about each of these topics was at least double, as depicted in Figure 2, and the number of mothers demonstrating an increase during the toward journey ranged between 11 and 16. Statistical analysis confirmed that each these comparisons either achieved

[8] For those unfamiliar with statistical logic, it may be helpful to note that probability values (p-values) of .05 or below are regarded within the psychological field as being of statistical significance (i.e., indicating that the probability of that outcome occurring by chance was less than 1 in 20, and thus unlikely to have occurred by chance). P-values between .05 and .10 are regarded as trends, which signal that the outcome is worthy of attention but providing weaker supporting evidence for the hypothesis under consideration. We have applied these standard frameworks in this study. We have taken note of trends, given the exploratory nature of this study.

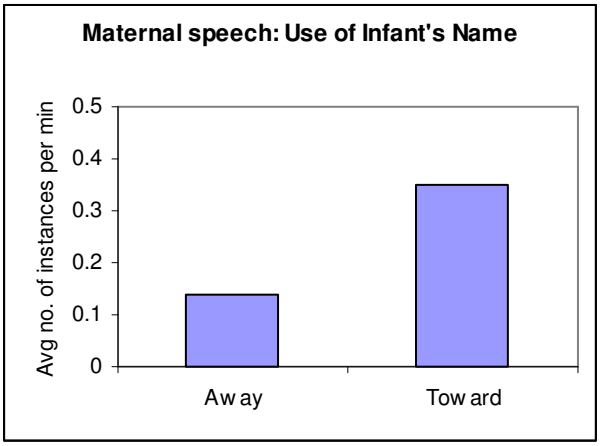
statistical significance[9] [Present events: z=-2.68, p<.01; Future events: z=-2.34, p<.05; Name: z=-2.17, p<.05], or that there was a trend toward significance [Mood: z=-1.56, p=.057; Show: z=-1.45, p=.074]. In summary, these results suggest that babies in toward-facing buggies hear not only more speech, but also more varied and interesting speech.

Importantly, in no case did the infants hear more of a particular kind of speech in the away-facing condition. This might have been predicted for some topics, such as Show, given that when the infants are turned in away-facing buggies to 'face the world', there is more about the world that their mother could be pointing out to them. However, this was not the pattern that was observed here. The converse was true; although the difference was weak, when mothers did point things out to infants, it was more likely to occur in a toward-facing orientation.

Figure 2. Maternal references to topics



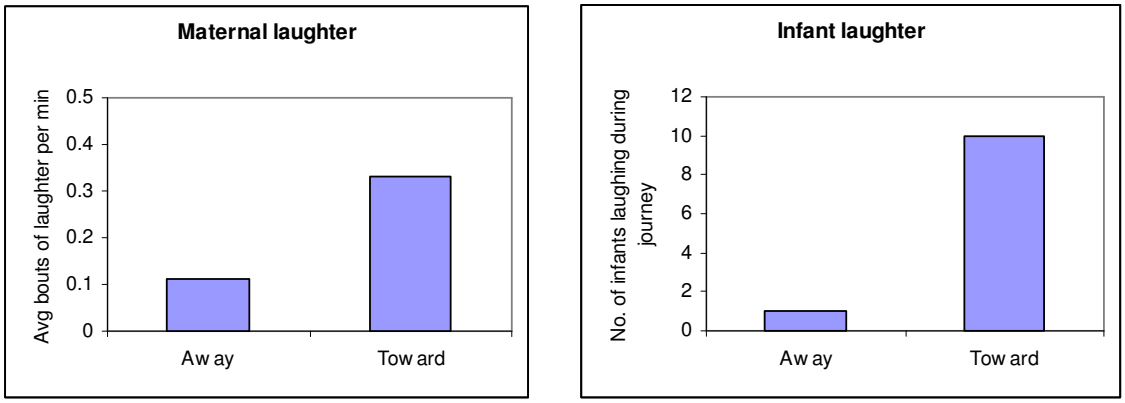
[9] The set of statistical analyses is complicated by the fact that the topics are not independent. Sentences could be classified within more than one topic (e.g., present events and showing; mood and name). Thus, the results yielded by the analysis should not be treated as definitive differences, but rather treated as providing insights into the ways that mothers use their talk during buggy journeys. Future research can draw on the insights emerging from this pilot study to identify the most important elements for investigation in larger studies. Other ways of coding maternal language could also be considered, for example interrogatives vs. declaratives (questions vs. statements).



3. Did infants vocalise more in the toward-facing buggy than in the away-facing? No. Although infants did make more utterances during the toward-facing journey (M=3.84 per minute) than during the away-facing journey (M=3.31 per minute), which was in the predicted direction, and although 10 of the infants did show the predicted pattern change, the overall pattern of change was not sufficient to achieve statistical significance, [z=-.936, p=ns). This suggests that neither buggy direction nor maternal language is having a direct impact on infant vocalisations, at least at the ages of infancy that we examined in this study (9 - 24 months). However, the following analysis shows that differences can be detected in another area of infant behaviour: laughter.

4. *Did mothers and infants laugh more during the toward-facing journey than the away-facing journey?* Yes. Both mothers and infants displayed more laughter during the toward-facing journey. For mothers, the instances of laughter tripled on average (M = .33 vs. .11 instances per minute), with 14 mothers showing more instances during the toward-facing than the away-facing. For infants, the striking change was that only one baby ever laughed during the away-facing journey, while 10 did so during the toward-facing journey. These comparisons, depicted in Figure 3, were both statistically significant [mothers: z=-2.54, p=.006; infants: z=-2.19, p=.014]. It would appear that journeys in toward-facing buggies are more enjoyable for both mothers and infants.

Figure 3. Maternal and infant laughter



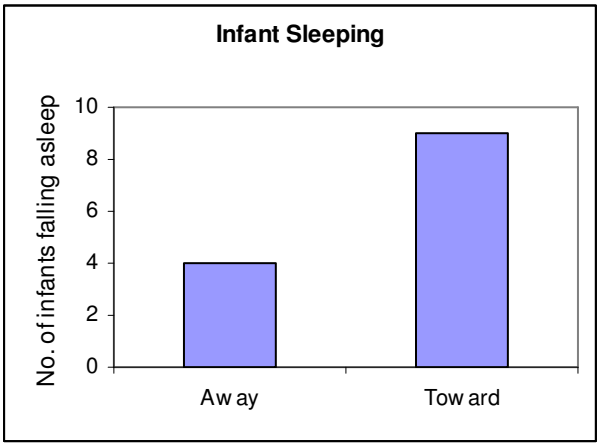
5. Was there a difference in the number of times children cried during the two journeys? Yes, but not in the predicted direction. Infants cried more often during the toward-facing journey: on average, .03 times per minute in the away condition and .26 times per minute in

the toward condition. The Wilcoxon test confirmed that the predicted hypothesis that infants would cry less in a toward-facing buggy was not confirmed [z=-1.96, p=ns]. Although this finding at first appears surprising, the explanation may be that only nine infants cried at any point during the buggy journeys. Thus, crying does not appear to be representative of the group as a whole and may not be the most useful measure of infant experience. A better measure may be sleeping, as discussed next.

6. *Was there a difference in the tendency of children to fall asleep?* Yes. More infants fell asleep during the toward-facing journey than during the away-facing journey. This was a difference that surprised us, for we had not anticipated it. It was a pattern that we noticed only during the later stages of data analysis. However, it concurs with the finding in Study I that infants who were in toward-facing buggies were twice as likely to be sleeping as those in away-facing buggies. The findings from the present study show that nine infants fell asleep at some point during the toward-facing journeys, but only four infants did so during the away-facing journey, as depicted in Figure 5. A Chi square analysis confirms that this pattern presents a weak trend toward significance [X(19)=2.85, p=.09]. That is, it is unlikely that this pattern has occurred randomly and it can tentatively be linked to buggy orientation.

This outcome suggests that infants' sleeping patterns in buggies were not simply a matter of babies' individual temperaments or the amount of time that had elapsed during experimental session. Because the infants had been randomly assigned to the order of conditions, with half beginning in the facing orientation and half in the away orientation, it becomes possible to determine whether sleeping patterns can in fact be attributed to buggy orientation. The results suggest that they can: infants are more likely to fall asleep in a toward-facing buggy. This complements the findings for heart rate (to be discussed below), indicating that toward-facing buggies may reduce infants' stress levels, and it is this reduction that allows them to drift off to sleep more easily.

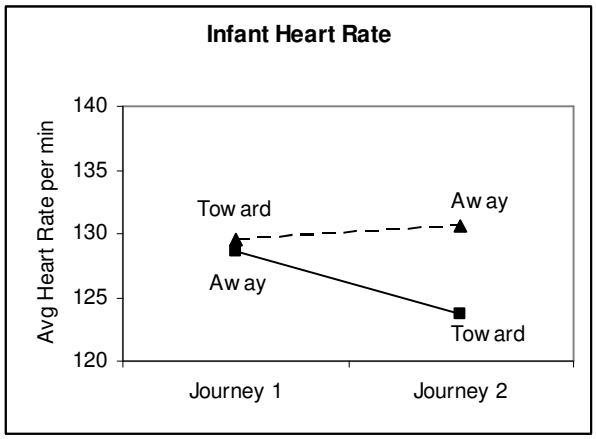
Figure 4. Infant sleeping



7. Was infant heart rate lower during the toward-facing journey than during the away-facing journey? Yes, although the findings present a complicated picture of heart rate. As shown in Figure 5, during the first journey, there was little difference between average heart rate for infants in away-facing and toward-facing buggies. The two data points were within the mid-range that is usual for infants (approximately 120 – 140). An effect of the two conditions became more apparent during the second journey. For infants who had begun in the toward-facing orientation, their average heart rate increased only minimally during the

second (away) journey. For infants who had begun in the away-facing orientation, however, heart rate decreased in their second (toward) journey. Two separate Mann Whitney comparisons for the two conditions showed that there was no significant difference during the first journey [U= -.282, p, ns), but a weak trend toward significance in the second [U=-1.29, p=.10]. This suggests that infants' heart response to buggy orientation showed a slight difference for the two conditions. The effect is very tentative, but is in the predicted direction, with a change to a toward orientation producing a decrease in infant heart rate and thus, possibly, stress levels.

Figure 5. Infant heart rate

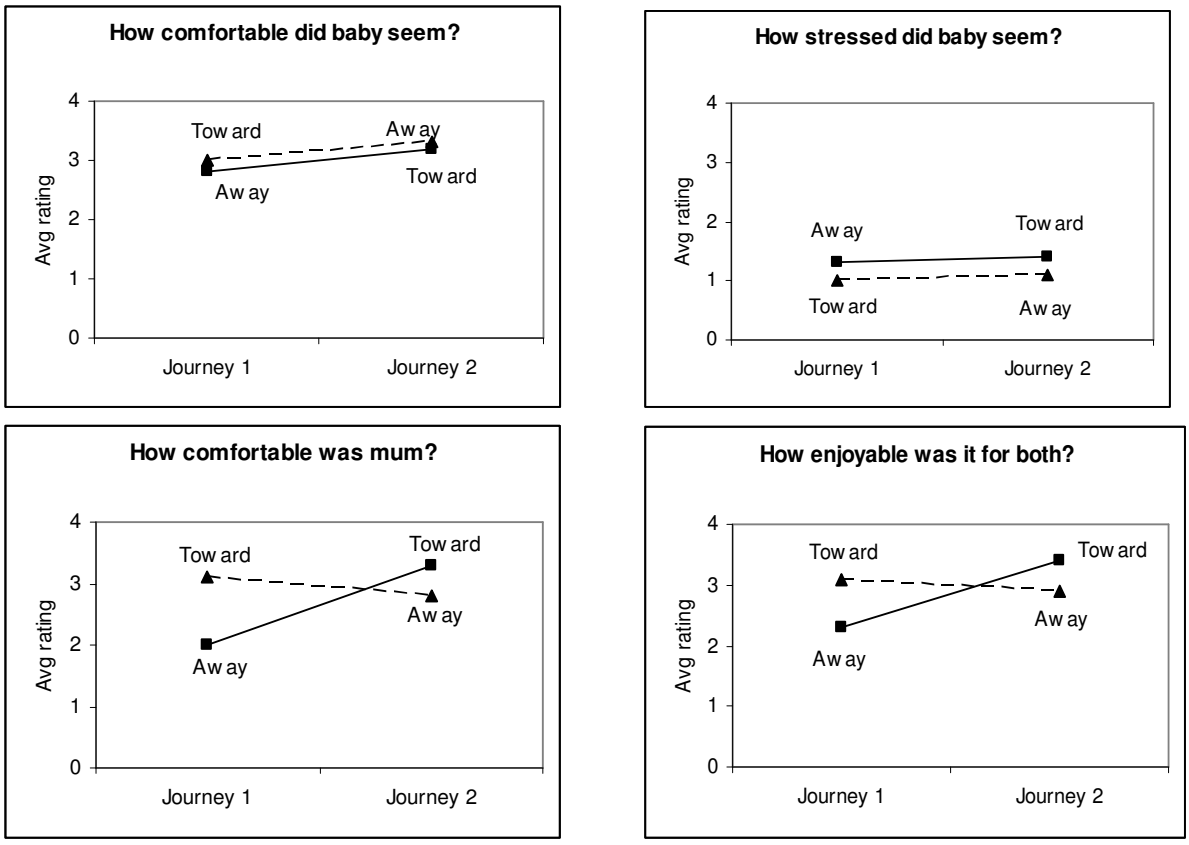


8. *Did mothers report different experiences of the two journeys?* Yes. After each journey, we had asked mothers to rate the journey for the infant's comfort levels, their own comfort levels, the infant's stress levels, and enjoyment for them both. We then compared the group's ratings for the two journeys, by orientation. The results are depicted in Figure 6 below.

They show an interesting pattern. Mothers did not perceive any difference in their infants' comfort or stress levels, as shown by ANOVAs [comfort: $F(1,18)=.049$, $p>.05$; stress: $F(1,18)=1.00$, $p>.05$]. Mothers did, however, rate their own experience of the two types of journeys very differently, for both comfort and enjoyment [comfort: $F(1,18)=16.23$, $p<.001$; enjoyable: $F(1,18)=9.22$, $p<.01$]. As shown in Figure 6, mothers whose first journey was in the toward-facing orientation gave high ratings of comfort and enjoyment; when they switched to an away-orientation, these experiences decreased. In contrast, mothers whose first journey was in the away-facing orientation started with low ratings, which increased substantially when they shifted to toward-facing. Crucially, the size of the increase shown by this group was greater than the decrease shown by the other group.

In short, these findings suggest that while mothers experienced the two orientations differently, they did not think their infants did (at least in terms of comfort or stress). Moreover, mothers who started in the away-facing orientation felt that shift more intensely than did mothers who began the session in a toward-facing buggy. This suggests that there was something particularly powerful about being able to shift to a toward-facing orientation. It may be that mothers who were able to begin with this orientation experienced a carry-over effect, which helped to maintain an emotional connection between herself and her infant, even when they can no longer see one another so easily. This is an interesting and unexpected possibility.

Figure 6. Mothers' ratings of buggy journeys



9. Did mothers' comments about the journeys support these quantitative findings? Yes, absolutely. When we asked mothers to talk about the two journeys, it became clear that they had been very aware of different styles of interacting between themselves and their infants. Indeed, on many occasions we did not have to enquire about this, because mothers spoke about it spontaneously. They were surprised, and even delighted, by how much the change in orientation had enhanced their communication with their baby. A selection of their comments is recorded below.

> I would never have thought that it would make such a difference because of the way he faced. Because I've never had one that faced me while he was older, only when he was younger. I loved it, being able to see him. This has definitely changed my view. I mean, the change in him, who'd have thought! I'm away to spend my husband's money and get a new one now! Maybe it will even get me to go walking more, as well, because it would be more fun for me to see him.

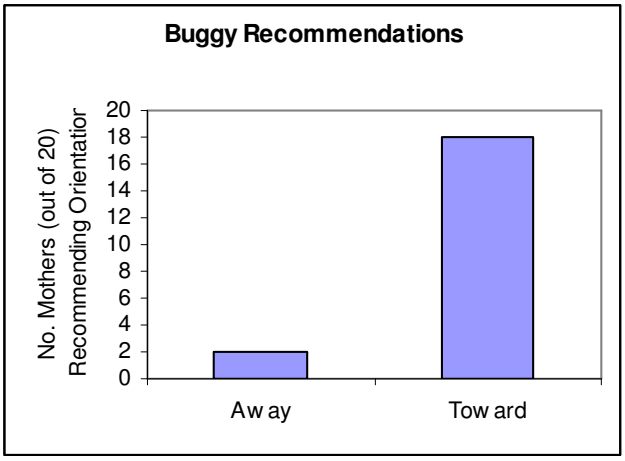
> It was interesting with her facing towards me. Because I was talking to her all the time, because she was looking at me and so you react with her. Whereas, when she's facing away, yes I talk, but not quite as much. Because, you know you can't see her facial movements and you know she's not looking at you to get feedback. So, it was very interesting! I didn't expect that. I thought if she was in one like this (toward-facing), she would spend most of her time craning out. Whereas she's seemed happier facing forward.

> The second journey (toward-facing) was nice for me. It's more sociable. I suppose the bond was there. She was lying flat, facing me in a pram, when she was 6 months old. So, it was more back to being like that again. Whereas at 6 months, we had to put her into a buggy. She faced out and you lost that kind of communication in a way.

> In the first walk, I felt comfortable, as I could chat to him, and when I asked him not to do something, he paid more attention to me. He was also smiling and chatting baby talk the whole journey. In the second walk, he moaned and cried a lot. I couldn't talk to him because I couldn't see him.
>
> I think he prefers facing out, but it was lovely for me to be able to see him and all the expressions he was making.

One other piece of data gathered in the experiment reinforces the point that mothers were aware of the altered interaction styles. In the questionnaire administered at the end of the session, we asked: If you were to recommend a new pram to a friend, would you choose the one during Walk 1 or Walk 2? Of the 20 participating mothers, the response given by 18 of them to this question pertained to the walk in which they had had the toward-facing buggy. An illustration of the size of this difference can be seen in Figure 7. This response rate represents an endorsement of toward-facing buggies by 90% of the group. Such an endorsement is made more striking by the point that a) 90% of the group currently owned away-facing buggies and b) their infants are all of ages for which an away-facing buggy is currently seen in society as most appropriate.

Figure 7. Which buggy did mothers recommend?



9. Did mothers' comments contain other insights regarding general buggy preferences?
Yes. When mothers were asked about how they had chosen the buggy that they currently owned, it became clear what a wide range of factors parents balance in deciding which buggy to purchase. Practicability, ease of use, and cost are key factors. It was rare for parents to have made a choice that ensured they could see and interaction with their child. (Indeed, only 2 parents possessed toward-facing buggies). The comments below illustrate the various pressures that parents are dealing with.

> The buggy we have doesn't face me, so there's no choice about it. I always wanted her to face toward me, but the kind of buggy we have meant we had no choice. We got that pram that we have because it was compact and it folds, so it was going to fit in our car. We wanted a pram where she could like flat when she was little. We didn't want a carry cot because they are big and bulky, and the two bits would need to come off and we would need a huge car. And the one we got would solve the problem, because it does both. So we felt we were paying for less. We spent about £280, I think.
>
> Our buggy is large and comfortable for him, and its sturdy. It is sometimes difficult to steer, though, and is too bulky for getting on buses.
>
> My buggy is lightweight and easy to move, although it doesn't lie flat easily.

> One of the things I really like about my buggy is that it has lots of room for carrying shopping. Even with a heavy load, it is still easy to handle.
>
> We were looking for something that folded easily, so that we could get it in the car. And we didn't want to have to change buggies, so we wanted something that would do him from infancy right through toddlerhood. They are too expensive, otherwise!
>
> We chose one that faced both ways, but he was such a big baby that we had to put him in the outward direction earlier than we'd hoped, because he just didn't fit in the other one any more!

These comments illustrate that, even where parents would like to be able to face their child, competing demands often impinge on the options available to them. It is interesting to note, though, the comments in the previous section that suggest that even a brief period in a toward-facing buggy (such as the 15 minutes involved in the present experiment) may be sufficient to lead some to re-evaluate their decision. It is clear that, if professionals seek to make sense of parents' buggy-related choices, they must remain aware of the complex set of pressures that parents are forced to juggle. Were different models of buggies available on the market, parents' choices would not need to be so constrained.

Conclusions of Study II

The results of this exploratory study extend the findings of Study I by confirming that buggy orientation does influence parent-infant interaction. Simply by turning the buggy around, these mothers communicated differently with their infants. They talked and laughed more. The infants, too, laughed more. Moreover, tentative evidence has emerged that infant stress levels also reduced, with infants' heart rates falling slightly when moved into a toward-facing orientation and with more infants tending to fall asleep in this orientation. These findings are the first of their kind in the experimental literature.

They are valuable because they indicate that the patterns seen in Study I should not be attributed simply to personality characteristics of the parents we observed on the high street. The silent parents in Study I weren't 'not talking to their babies' simply because they 'don't like to talk'. The findings from this second study show that turning the buggy around so that parents and infants can see one another promotes parental speech – by a factor of two or more. Thus, we can conclude that the low proportion of talking observed amongst parents in Study I stems, at least in part, from the high number of away-facing buggies used by British families.

Key insights offered by these findings include the following:

- It is not difficult to increase the amount of interaction between parents and infants during buggy journeys. It happens 'naturally' once parents can see infants – and quite quickly, given that journeys were 15 minutes or less. Eighteen out of the 20 mothers participating in this study showed an increase in their talking during the toward-facing journey. Critics might point out that the mothers knew they were being recorded, and this might have prompted them to talk more. This is certainly possible, although it does not undermine the findings, for talking was still greater in one condition than another.
- Infant development may be negatively affected by buggy design. It would be inappropriate, at this early stage of this research programme, to make definitive claims in this regard. It might reasonably be argued that if infants are in buggies for only brief portions of the day, that an away-facing orientation is not particularly problematic. This will be a useful question for future research to address. However, the present data already flag the need for greater thought to be put into what constitutes an 'acceptable' amount of time in a buggy. The average amount of time spent in a buggy, for infants in this study, was reported by their parents to be 1 – 2 hours per day. Ten percent of the

sample spent two hours or more (with fifty percent reporting less than one hour per day). A recent survey by the National Literacy Trust (2005) found that infants spend up to two hours per day in buggies. These figures lead naturally to the question: if away-facing buggies do reduce interaction, is two hours a day spent in them 'too long'? On what basis would that determination be made?

- The findings show that mothers noticed, and were pleasantly surprised by, the impact of changing a buggy's orientation. Their quantitative ratings indicated that they enjoyed the toward-facing journeys more than the away-facing journeys, and their narrative comments indicate that they had not anticipated such a difference. This is likely to be related to the cultural belief that babies of the ages we were testing here prefer to look out on the world. The babies' increasing interest in the world beyond the buggy led many of our mothers to think that it was time to 'sacrifice' the bond they had been enjoying, by turning the baby around to face the front. Yet the data we gathered on maternal speech show, in contrast, how an infant's experience may be enriched by facing their parent.
- Our suggestion that baby buggies might be impacting on child stress levels is a novel and perhaps controversial one. It is certainly not one that has featured in the academic literature (given that there seems to have been no research conducted in this area) and that even the discussions of buggy orientation that have occasionally featured in the media have focused on social interaction rather than on stress levels. Yet the findings from Study II do point to the possibility that stress levels could be affected by buggy design. The rate of sleeping was higher in toward-facing conditions, and heart rates reduced slightly when infants moved from an away-facing to an toward-facing orientation. Both findings were tentative and relatively weak, so should at this stage be regarded as provisional. Finer grained methods are required in future research to pursue this avenue of investigation. These could include more robust measurements of heart rate or assessment of the stress hormone cortisol. Yet even the existence of tentative findings calls into focus the importance of this issue. If there is even the possibility that baby buggy design is aggravating children's stress levels, then this is a cause for concern. High stress levels interfere with functioning in a whole range of domains in infants' lives, and the physiological stress management systems that are established early in life continue to influence the way that stress is managed in later years.
- The findings yielded by this small-scale study need to be followed up with a comprehensive programme of research, in order to provide a more robust set of conclusions. Can the results obtained here be replicated with a larger sample? Does the pattern of results obtained with this sample generalise to other 'groups' of parents – those from other socioeconomic and cultural backgrounds, those from different age groups, those with differing interaction styles? Is it really justifiable to claim that children's development could be enhanced by simply 'turning the buggies round'? These are the kind of questions that cannot be answered by the present set of data – but they have established the value of pursuing such lines of investigation.

In summary, this small-scale study has been able to provide reliable evidence that buggy design does indeed influence parent-infant interaction and that it may also have an effect on infant stress levels. The study also confirms that it is fairly straightforward to conduct empirical investigations of this issue. It leaves one wondering, perhaps, why this hasn't been pursued earlier. The answer must lie, to some extent, in our cultural perceptions that child transportation methods are fairly inconsequential, as long as children are physically safe. It

may be that our concerns with physical safety have led us to overlook their needs for emotional safety.

Final conclusions

The title of this report asks 'What's life in a baby buggy like?'. These two studies suggest that the answer is that it is more isolated than many adults realise – and may be more emotionally impoverished than is good for children's development. These findings encourage us, as a society, to take infants' experience more seriously.

Why has more scientific attention has not been given to questions about the design of buggies? The answer may lie in the fact that the empirical evidence now available within the scientific community regarding the importance of social interaction for infants' neurological and physiological development is only beginning to infiltrate into societal awareness. Society and manufacturers may simply have not realised the importance of buggy design. It may also be that the lack of attention represents a broader underestimation on the parents (and manufacturers) of the important role that parents play in helping young children to make sense of and process their experiences. Certainly it is the case that as infants get older, they are more interested in the environment around them. Outward-facing buggies are seen as supporting that interest, giving infants 'more things' to look at, and preventing them from possibly being bored by being able to look 'only' at parents. But if children do not have parents' facial and body signals available to them, then they have no help available to determine whether those 'things' are safe or threatening or pleasant or interesting or dangerous. This is why it is the contingency of parental responses that plays such a role helping infants develop a means of regulating their own physiological systems and in learning what 'meaning' they should assign to the things in the world around them. It is this contingency of parental responses that away-facing buggies most interferes with. Finally, cultural beliefs are likely to play a role. Whatever we see around us, we take to be 'normal' and desirable. The popularity of away-facing buggies helps all of us (society members and scientists alike) to see them as normal. Yet in other countries (e.g., France, Denmark), outward-facing buggies are much less popular, and in many countries (e.g., India, Sri Lanka, Uganda), buggies are not used at all. It may be that a failure to adopt a cross-cultural perspective on this issue has prevented science and manufacturers from identifying buggy design as of matter of possible concern.

However, if there is any possibility that the design of buggies is failing to promote infants' development more than they might, then this is a concern. Virtually every family in the UK who has a child under the age of 3 years will own a buggy. If it can be confirmed, in future research, that 'turning the buggies around' makes a difference to child development, then the manufacturing of 'emotionally healthy' baby buggies could be an easy, affordable, and achievable intervention for facilitating long-term mental and physical health. Considerable effort is now being devoted by the UK government and UK charities to providing support to parents and families during the earliest years of children's lives (e.g., NESS, 2005; WAVE, 2005). It is worth at least investigating the extent to which buggy design might fit with this agenda.

In this report, attention has been drawn to the health-related aspects of buggy design. We have done this to help readers understand the potential importance of this issue. There will be a variety of professional sectors with an investment in buggy behaviour. It can, for example be characterised as an issue of play and socio-emotional abilities, given that relaxed, playful interactions with parents shape children's neurological and psychological development (Gerhardt, 2005). And it can be characterised as an issue of language development, an area of particular relevance to the concerns of the National Literacy Trust.

Hart and Risley (1995) have shown that by the time a child is 18 months of age, their vocabulary development has already been significantly affected by the linguistic interactions they have had with parents. By the age of 3 years, trajectories are in place that will affect their communicative and academic abilities for the rest of life. This is precisely the period of their lives that children spend in buggies. Our data suggest that the period between 1 and 2 year – the period that sees children's basic vocabulary being put in place-- is the time that UK children may be receiving least interaction from parents during buggy rides. This is the time they are most likely to be travelling in away-facing buggies, which produced the highest rate of parent and child silence. In short, if babies matter, buggies matter.

Ultimately, it is parents -- and perhaps buggy manufacturers -- who will have a particular investment in this issue. If buggy design does hold the consequences for infant development that these two studies suggests it might, then parents deserve access to this information, in order to make decisions about how best to care for their children.

References

BBC News. (2005). Pushchairs hinder baby talk. http://news.bbc.co.uk/1/hi/education/4527898.stm

Courier. (2003). Dundee top of teenage pregnancy league again. http://www.thecourier.co.uk/output/2003/11/27/newsstory5390023t0.asp

Gerhardt, S. (2005). *Why Love Matters: How Affection Shapes a Baby's Brain*. London: Routledge.

Hart, B., & Risley, T. R. (1995). *Meaningful Differences in the Everyday Experiences of Young American Children*. Baltimore: Paul Brookes Publishing.

National Literacy Trust. (2005). 'Talk to Your Baby' campaign survey. www.talktoyourbaby.org.uk

NESS. 2005. Early impact of Sure Start local programmes on children and families: Report of the cross sectional study of 9- to 36-month-old children and their families. *Research Report FR/013*. London, DfES.

Perry, B. (2002). Childhood experience and the expression of genetic potential: What childhood neglect tells us about nature and nurture. *Brain and Mind*, 3, 79-100.

Trevarthen, C. (1979). Communication and co-operation in early infancy: A description of primary intersubjectivity. In M. Bullowa (Ed.), *Before Speech*. Cambridge: Cambridge University Press.

Stern, D. (1985). *The Interpersonal World of the Child*. New York: Basic Books.

Volker, S., Keller, H., Lohaus, A., Cappenberg, M., & Chasiotis, A. (1999). Maternal interaction behaviour in early infancy and later attachment. *International Journal of Behavioral Development*, 23, 921-936.

WAVE Trust. (2005). Worldwide Alternatives to Violence Trust. *Violence and What to Do About It.* http://www.wavetrust.org.

Appendix 1
Instructions and recording sheet used by observers

Thank you for agreeing to assist with this observational survey. We are conducting the work under the guidance of Dr. Suzanne Zeedyk, of the School of Psychology at the University of Dundee. The survey is intended to help us learn more about the buggy-related behaviour of parents in the UK.

We are lucky to have had a number volunteers offer to assist us, from a wide range of cities through the UK. This Instruction Sheet tells you how to carry out the observations and how to use the recording sheets. The procedures have been approved by the Research Ethics Committee of the University of Dundee.

Getting started

Find a non-obtrusive site on your **local high street** from which you can watch passers-by. This might be a bench, a comfortable wall, or a window in a café. (We are focusing on high streets so that there will be some similarity across the many different towns and cities our volunteer observers will be working in for this survey.)

Choose a time during the day that is likely to have reasonably heavy pedestrian traffic.

On the coding sheets provided, **please record your name, contact details, and the town/city** in which you are carrying out observations. Please also **record the start time and end time** of your observation period. **This should be 30 minutes in total.** It is fine to carry out more than a single observation session, but each individual observational session should last for no more and no less than 30 minutes. You might choose to carry out another session following directly on from the first one, or you might wish to go to a different place on the high street, at a different time of day or on a different day. You are welcome to carry out as many or as few observational sessions as you wish. **The only restriction is that each session be 30 minutes in length.**

It is expected that you will need several coding sheets for each observational period. Please therefore **record the page number** of the set of sheets you use for each observational session, so that we can keep track of the order of the sheets. If you are able, **it would be helpful if you could staple together, in order, the full set of sheets you have used during each observational session**. If you carry out more than one session, be sure that individual sessions are stapled separately.

Coding your observations

The focus of this survey is to record key pieces of information about each parent-child group that passes your site during the observational session. Include only those groups who pass on your side of the street. There is no need to worry about those on the other side of the street, as you are unlikely to be close enough to observe relevant characteristics anyway.

You will see, on the coding sheet, that we are collecting information about 6 aspects of each group. Thus, for each parent-child group that passes by you, please tick the most relevant characteristic for each column. The aspects we are surveying are listed below.

1. **Gender of parent(s)**:
    a. Mother
    b. Father
    c. Both

    It is of course possible that the adult may not be the child's parent, but rather a grandparent, aunt/uncle, or another type of carer. But because we cannot know this, we are going to assume for the purposes of this survey that they are a parent.

2. **Number of children in the group:**
    a. 1
    b. 2
    c. 3 or more

    If there is more than one child in the group, then please fill out a separate row relevant to each child. (For example, one child may be in a buggy, with parent not talking to them, while another child may be walking beside the buggy, with the parent speaking to them.) Please then link the two rows, to show that they are the same group, by putting a circle around the two row numbers (e.g., 3&4 or 8&9, etc.).

3. **Child's mode of transport:**
    a. Being carried
    b. Walking
    c. In a buggy – facing toward the parent
    d. In a buggy – facing away from the parent

    It may be the case that, at the time you make your observation, the group is not actually moving, but standing still. That is fine. The survey's results won't depend on knowing whether the group is moving or standing. Ticking the box that indicates how the child is being transported will be sufficient for our needs here.

4. **Approximate age of child**:
    a. Less than 1 year of age
    b. 1 – 2 years of age
    c. 2+ years of age

    We know that sometimes you may have to guess children's ages, but give it your best shot.

5. **Child's behaviour:**
    a. Talking to parent
    b. Crying
    c. Silent (but awake)
    d. Turning to find parent
    e. Asleep

    We think this may be the only category for which there may be some overlap of characteristics, sometimes making it hard to choose only one characteristic. (For example, a child could be crying while also trying to turn around in a buggy to find a parent.) If it feels you are missing out on crucial information about behaviour, then feel free to tick two characteristics for this category. Or make a note in the margin that provides more information about the behaviour of the group.

6. **Parent's behaviour:**
    a. Talking to child
    b. Not talking to child

    Our key aim here is to try to determine whether parents are interacting with children in some way. Talking is the most likely means of doing that. If you see other interactive behaviour that you think is noteworthy, feel free to make a note of that in the margin.

Please know that there are many aspects of family's behaviour that may strike you as interesting, which we haven't coded for here. That's because we haven't been able to capture all interesting elements in a single survey. So feel free to include any comments, either on the recording sheet or on extra sheets, that you think it would be interesting for us to know about.

When you have completed your chosen set of observation sessions, please send the sheets to Liz Attenborough, at the NLT Head Office. Please be sure to get your observation recording sheets in by the stated deadline.

Many thanks for your assistance and enthusiasm.

2008 NLT Observational Survey of Buggies

Page _____

Observer's name: _____

Observer's contact details: _____

_____

Date of observation: _____

Town/City of observation: _____

Site/location of observation: _____

Start time of observation: _____

End time of observation (should be 30 mins later): _____

For each parent-child group you observe, please tick the most relevant characteristic in each column.

If more than one child in the group, code characteristics for each child on separate rows, and then link the two rows by putting a single circle around the two row numbers.

	Parent(s)	**No. of Children**	**Child's mode of transport**	**Approximate age of child**	**Child's behaviour** (feel free to tick multiple characteristics)	**Parent's behaviour**
1.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child
2.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child
3.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child
4.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child
5.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child
6.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child
7.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child
8.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child
9.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child
10.	Mother Father Both	1 2 3+	Carried Walking Buggy-toward Buggy-away	<1 yr 1-2 yrs 2+ yrs	Talking Crying Silent Turning to find parent Asleep	Talking to child Not talking to child

Appendix 2
Regions and towns in which observations were carried out

Region	Towns/Cities		
Cornwall	Truro		
Essex	Southend-on-Sea		
Surrey	Cheam	Kingston	
	Richmond	Croydon	
London	West Hampstead	Northfields	North London
	West Ealing	Pinner	Middlesex
	Islington	South London	Harrow
	Vauxhall	Chiswick	
Lancashire	Bury	Wigan	Leigh
	Prescot	St Helens	
Yorkshire	Leeds		
Lincolnshire	Ashby		
Staffordshire	Stoke-on-Trent	Stafford	
Manchester	Manchester		
Scotland	Glasgow	Perth	Falkirk
	Edinburgh	Dundee	
Nottinghamshire	Mansfield		
Wales	Aberaeron	Swansea	Pontypridd
	Aberystwyth	Carmarthen	Aberdare
Warwickshire	Leamington		
Worcestershire	Bromsgrove	Kidderminster	
	Worcester	Droitwich Spa	
Berkshire	Maidenhead		
Bedfordshire	Bedford		
Leicestershire	Leicester		
Norfolk	Kings Lynn	Sedgeford	
Wiltshire	Swindon		
West Midlands	Birmingham		
Buckinghamshire	Aylesbury	High Wycombe	
Kent	Margate		

Appendix 3
Spontaneous written comments from observers in Study I

My sad general observation is that nobody talks very much! More specifically, as well as being aghast at the sight of the 'ipod buggies', I also witnessed the 'parent facing' trendy ones, which seem to have two hoods enabling you to completely enclose the baby in darkness. I couldn't actually be certain what was in the buggy – which presumably means neither could the parent? I did witness one heartwarming interaction between a young parent and her toddler, which made me want to give her a 'good talking' sticker! Thanks for giving me a fab topic of conversation at recent dinner parties!

I thought it worth pointing out that, as a schools therapist, I still see children arriving at school in buggies – children in Reception and Year 1, who really should be walking to school!

While doing this observation, I was struck by a feeling that I was observing the wrong setting. The High Street is not necessarily a natural opportunity for children to speak or read or do anything. But when sitting on a bus, I was struck by the buggies. I saw lots of buggies parked, with children over 2 years, in the bus buggy section, with dummies left in children's mouths, while parents sat down and made telephone calls, chatted to friends or read the paper. Children were observed to squirm to find parents, to cry, and to try to get out of their buggies. Maybe your next campaign should be a 'take a book along' one, ready for the bus, train, or other stationary talking opportunity. And get rid of dummies in children over 6 months!

I carried out my observations on a damp and misty morning (although I was cosy in a coffee shop!). The weather may have made things more difficult, as the number of children totally enclosed in plastic covers was astounding! It also gives a rather depressing picture of how little interaction went on –if the weather had been sunny and the children more visible, this might have helped things?

Why don't people talk to their children more? Missed opportunities for a bit of fun! I noticed a number of occasions where the child was babbling to itself, playing with pram toys, or babbling to a doll, but because the buggy was facing away, the parent was unable to join in with or encourage this interaction. There were many silent children being pushed, with the buggy facing away, and silent parents pushing – such a missed opportunity for chat! On one occasion, a mum was busy talking to her friend and ignoring her toddler's request for attention. He eventually threw a tantrum and was strapped back in his pushchair! He'd only wanted to look at the automatic doors into Boots! The one person who stopped for a length of time at the benches to chat to the child was a 'granny type' – an older lady. Most people were busy just rushing along.

Where both parents were present, they were often talking to each other but not the child.

What an eye-opener! I felt like cheering every time I heard a child or parent talk. We clearly have a lot of work to do in our area around parent-child interaction. When I moved to the location for my second observation, there were several small fairground rides, and I anticipated lots of opportunities for interaction. I was so disappointed that most of them were missed.

Couldn't there be sideways facing buggies, where the child can see the parent and the world at the same time, and engage? I've looked on the internet, but couldn't find any that met this criterion!

After doing the observations, I saw a 'Quinny type' pushchair, where the child sits higher than normal, being pulled along the side of the front bar, and the mum actively engaging with the child. Lovely to watch. And there were lots of parents who got the children out as soon as they reached the park and engaged while the child walked with them in the park.

Lots of people came past with their dogs, and at least half were talking to them, but not the children! And so many parents on mobiles!

I was hoping for more interaction in my Sunday observation session, as people would be in less of a hurry. But while people were in less of a hurry, they still weren't interacting with their children!

Older kids (say over 3 years) seemed to be getting lots of interaction, but these weren't surveyed here, as there was no scope for recording 'scooter' [and such transport]. I couldn't hear the interaction from inside my café, though – maybe the parents were telling them to stop at the road and not go so fast!

I found myself wondering what the 'aim' of a buggy experience is – for parents as opposed to child experts?

By the end of my session, it was windy and it had started to rain. Many buggies had rainwear that 'boxed in' the child.

The only communication seen today was when giving the child sweets and crisps. If we observed in a part would we see more interaction? On the High Street, all the families observed appeared to be on a mission to get things done – the majority were in an away-facing buggy, so therefore highly unlikely to see any interaction. Some families have told me they felt it was the right thing that once baby could sit up that they could then see the world, rather than mum. So misinformed.

Appendix 4
Buggies used in Study II

Away-facing buggy

Toward-facing buggy

Appendix 5
Photos of infants who participated in Study II, in their Thank You T-shirts

Parents gave permission for infants' photos to be used publicly in this report.