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ORIGINAL ARTICLE

On screen experiment showed that becoming a parent for the first time shifted people's priorities from themselves to their infant at 1 year of age

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Abstract

Aim: This study used a screen-based perceptual matching task to see how non-parents, people trying to get pregnant, and those who had given birth prioritised shapes and labels relating to self or infant conditions.

Methods: The study took place at Aarhus University Hospital in Denmark from December 2016 to November 2021. Recruitment methods included family planning clinics, social media, online recruitment systems and local bulletin boards. The modified perceptual matching task linked five shapes to five labels, including self and infant.

Results: We found that 67 males and females with a mean age of 24.4 ± 3 years, who had no plans to become parents in the near future, reacted faster and more accurately to self-shapes and labels ($p < 0.001$), which validated the experiment. The 56 participants aged 27.1 ± 4.4 years who were actively trying to become parents showed no statistically significant prioritisation. A subset of 21 participants aged 28.7 ± 4.4 years showed faster response times to infant than self-shapes and labels 1 year after giving birth ($p < 0.001$).

Conclusion: Healthy first-time parents showed faster reactions to infant than self-conditions 1 year after giving birth, in contrast to the other two groups.

KEYWORDS
infant, parenting, perception, pregnancy, self-prioritisation

1 | INTRODUCTION

A growing body of scientific literature has emerged over the years on the topic of self-prioritisation. The self-prioritisation effect is a phenomenon where a person prioritises information that relates to them over other information. A classic example is the cocktail party effect, first documented in 1959 by Moray, when people reacted to their own name when it was mentioned in a room full of background noise.[1] Moray tested whether people could recollect words that were presented to them in one ear, while they repeated light fiction passages that were presented to them in the other ear.[1] The participants could only remember when their own name was mentioned during the task and this provided the first evidence for the self-prioritisation effect.[1] Since then, several studies have found

Abbreviation: 95% CI, 95% confidence interval.

similar self-prioritisation effects in other cognitive domains, including attention,[2,3] perception,[2,4] memory,[5,6] motor responses[7] and decision making.[2]

It has been suggested that the self-attention network is the neural network that drives self-prioritisation effects.[8] Most research has agreed that the ventromedial prefrontal cortex and the left posterior superior temporal sulcus play important roles in the self-prioritisation effect.[8–10]

Importantly, there is now neuroimaging evidence for a parental brain network, both in non-parents[11–14] and parents.[15–18] The parental brain network involves areas that are important in reward processing, emotion regulation, empathy and mentalisation processes.[12,15,19–21] It includes both the ventromedial prefrontal cortex and the left posterior superior temporal sulcus. These key areas in the parental brain network undergo both structural and functional changes when people become parents for the first time.[16]

This raises the key question about whether the structural and functional brain changes that take place in regions known to be involved in self-processing, when people become parents, could also have behavioural consequences.

We hypothesised that becoming a parent for the first time would alter an individual's self-prioritisation behaviour. In order to examine this hypothesis, we modified the original screen-based perceptual matching task created by Sui et al.,[4] which matches shapes to labels, to include an infant condition. It was then tested it on three different groups of people. Group 1 consisted of people who were not parents and had no immediate desire to become parents. Group 2 consisted of heterosexual couples who were trying to get pregnant for the first time. Group 3 was a subgroup of Group 2 who had later become parents for the first time.

Key Notes

- A screen-based task was used to see how non-parents, people trying to get pregnant, and those who had given birth prioritised shapes and labels relating to self or infant conditions.
- The Danish study matched five shapes to five labels, including self and infant.
- Healthy first-time parents showed faster reactions to infant than self-shapes and labels 1 year after giving birth, while those with no current plans showed the opposite.

2 | METHODS

The same stimuli, task, procedure and analysis were used on the three groups of participants. All the participants were recruited through family planning clinics, social media, such as Facebook, local newspapers, bulletin boards at Aarhus University, word of mouth and a local research recruitment portal called Sona Systems (Sona Systems, Ltd.). Group 2 were also recruited through fertility clinics. Facebook is widely used in Denmark and 76.5% of the entire population had user profiles on Facebook in November 2021.[22] The age group with most users were 25–34 years of age with an almost equal gender distribution.[22] Facebook is a commonly used recruitment tool in Denmark, as it is very representative of the population. All participants were given unique numbers to ensure their anonymity. The Declaration of Helsinki was followed in all experimental procedures. The research was approved by the specific ethics boards mentioned below.

Group 1 consisted of 67 young adults aged 18–34 years who did not want children in the near future. The 20 males and 47 females had a mean age of 24.4 ± 3 years. All the participants were screened for inclusion and exclusion criteria and filled out a consent form before taking part in the study. The inclusion criteria were healthy adults aged 18 years or above who were able to communicate in Danish or English. The exclusion criteria were wanting to have children within the next couple of years, being a biological or adoptive parent already, already expecting a baby, having a psychiatric disorder and having an uncorrected visual impairment. This part of the cross-sectional behavioural study was approved by the Aarhus University Research Ethics Committee (approval number: 2021-41). The participants completed the experiment at Aarhus University Hospital in October and November 2021.

Group 2 consisted of 28 couples aged 20–42 years who were actively trying to become pregnant. The 28 males and 28 females had a mean age of 27.1 ± 4.4 years. Group 1 was significantly different from Group 2 in terms of age ($p < 0.001$). All the participants were screened for the inclusion and exclusion criteria and filled out a consent form before taking part. The inclusion criteria were healthy men and women wanting to become parents for the first time. The exclusion criteria were already expecting a baby, uncorrected visual impairment and psychiatric disorder. The study was approved by the Ethics Committee of the Central Denmark Region (approval number 1-10-72-221-15). It took place at Aarhus University Hospital from December 2016 to February 2020.

Group 3 was a subset of Group 2 who had taken part in a longitudinal study. We followed up 28 couples aged 23–41 years of age 1 year after they had become parents and they had a mean age of 28.7 ± 4.4 years. We were only able to follow-up 21 participants, 11 males and 10 females, as the study was suddenly disrupted by the COVID-19 pandemic. The inclusion and exclusion criteria was that same as for Group 2, but the parents had to live with the child for at least 50% of the time. Group 3 was covered by the same ethical approval as Group 2. This part of the study took place at Aarhus University Hospital from August 2017 to February 2020.

2.1 | Stimuli and task

The experiment was carried out using E-Prime software, version 2.0.10.356 (Psychology Software Tools). The stimuli were displayed on a 24-inch monitor at full high definition 1920 × 1080 at 60 Hz. The

stimuli consisted of five geometric shapes: a triangle, square, diamond, pentagon, circle. These had five different labels: infant, you, friend, mum, stranger. All the stimuli were shown as white shapes or labels on a grey background for 100 ms. The shapes were presented above a white fixation cross in the centre of the screen. They appeared for 500 ms before the stimulus was presented and 800–1650 ms after it was presented. The labels were shown below the fixation cross. The distance from the fixation cross to the shape and the label was the same. The participants judged whether the pairing of the label and the shape was correct or incorrect by pressing either the n key or m key on the keyboard and they could do this for 500 ms after the images appeared. The shape and label pairings, and the response buttons, were randomised with regard to which shapes and labels were matched and the sequence the pairings were presented in, both on the information screen and in the experiment. The responses buttons, n or m, that needed to be pressed to reply yes were also randomised.

2.2 | Procedure

The experiment was conducted in a behavioural lab at Aarhus University Hospital. Before they started the experiment, the participants watched a short introduction video that explained how the experiment would be carried out. During the experiment, the participants were first shown a screen informing them of their randomised pairings of labels and geometric shapes. For example, this could include you are represented by a circle, the triangle represents your infant, the square represents your mum, the pentagon is a stranger and the diamond a friend. The participants were then asked to judge whether the shape and label pairing that was shown was correct or incorrect. Whether the response was correct, false or too slow would appear on the screen for 500 ms before the next trial started The first 20 pairings were a practice run and were not included in the analysis. The subsequent three blocks of 120 pairings were used for the data analysis.

2.3 | Analysis

The behavioural log files were extracted into Microsoft Excel for Mac, version 16.54 (Microsoft Corp) using a custom-made C++ script in Visual studio 2019 (Microsoft Corp) written to process the log files of the experiment. Accuracy and response times were recorded for each trial. The response time was defined as the time from the presentation of the stimulus to the moment when the participant pressed the response button. Trials with a response time below 150 ms were excluded, regardless of accuracy, as this was considered non-conscious. In Group 1, one participant was excluded because they responded to less than a third of the trials. In Group 2, two participants were excluded because they misunderstood the experiment and/or responded to less than a third of the trials. No participants were removed from Group 3. Lastly, we identified the response time outliers using the robust regression and outlier removal method in Prism 9 software (GraphPad Prism),[23] with Q set at 1%. In total, <3% of the trials from Group 1 and 2 were removed and 1% of the trials from Group 3 were removed. The remaining trials were grouped according to the five shapes and whether these had, or had not, been matched to the five labels: infant, self, mum, friend and stranger. This created 10 different conditions (Figure 1D). Matched was used when the shape and label pairing was correct. Non-matched meant that the shape and label pairing was incorrect. The accuracy was the percentage of times the participant correctly identified the shape and label pairing as matched or non-matched.

Because none of the datasets were normally distributed, all 10 conditions were bootstrapped. We have reported the bootstrapped statistics, using standard error of the mean and 95% confidence intervals (95% CI), using MatlabR2016 (MathWorks Inc). In addition, function of accuracy scatter plots were created for the response times using MatlabR2016 (MathWorks Inc), while forest plots were created in Microsoft Excel for Mac, version 16.54 (Microsoft Corp). *p* Values was calculated using the Mann–Whitney *U* test in MatlabR2016 (MathWorks Inc). A *p* value equal or less than 0.05 was considered significant. Only scatterplots for the matched datasets are presented, as there were no significant differences among the conditions in the non-matched datasets.

3 | RESULTS

Group 1, who were young non-parents with no desire to become parents soon, clearly prioritised themselves over all other conditions, according to the scatterplots in Figure 2. They showed shorter response times ($p<0.001$) and higher accuracy ($p<0.001$) to self than to any other condition, including infant. This impact vanished, at least with regard to the response time ($p<0.001$), for Group 2, who had decided to try to become parents. Then it changed to an infant-prioritisation effect 1 year after childbirth in Group 3. The self, infant and mother condition varied between appearing in a cluster in Group 2 or separating into two clusters: Group 1 was either self and infant-mum and Group 2 was infant and self-mum. In addition, a constant friend-stranger cluster occurred in all three groups. The non-matched datasets did not differ statistically significantly from one another and have not been included in this paper. The statistical significance of the clusters may be seen more clearly in the forest plots in Figure 3.

4 | DISCUSSION

The present results showed that young people who were not parents prioritised information about themselves higher than information about others. This effect was absent when young non-parents were actively trying to become parents for the first time and it had shifted towards infant-prioritisation effect 1 year after giving

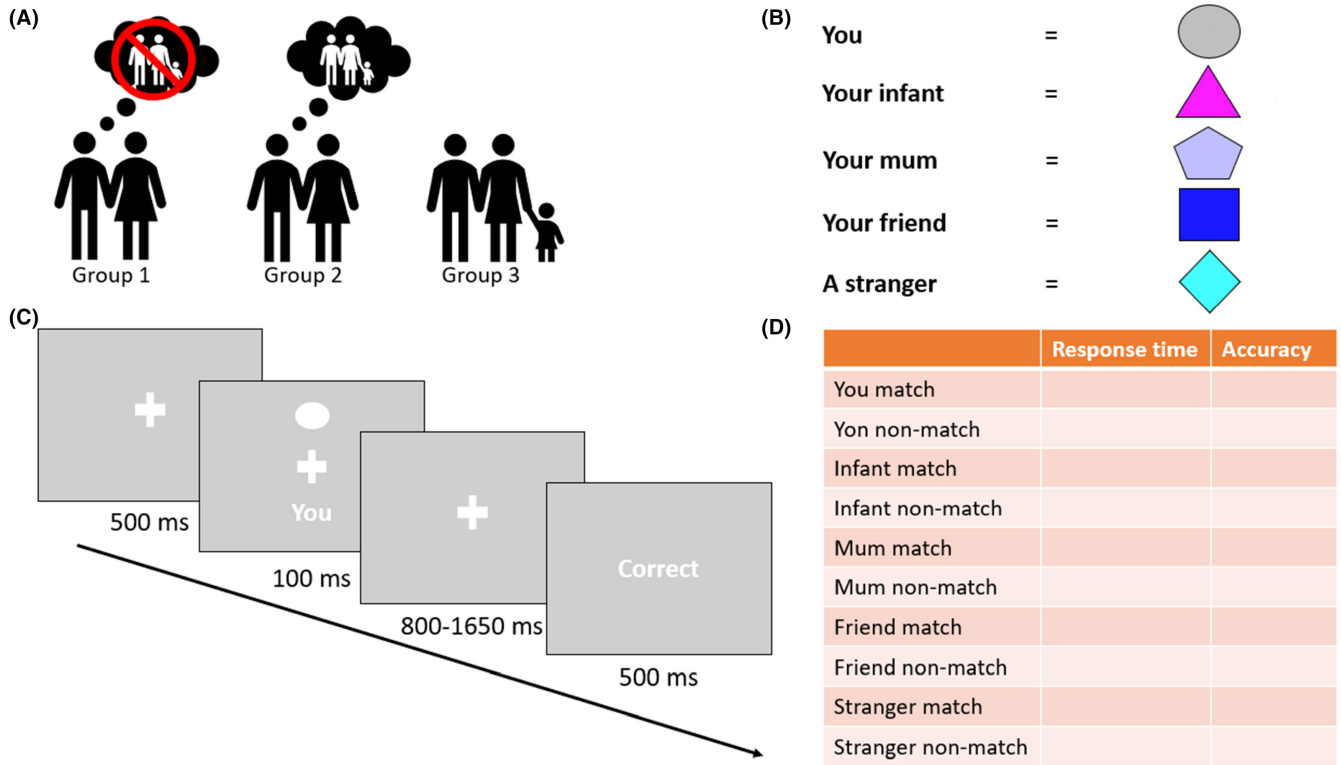

FIGURE 1 Overview of the experimental design and Groups 1–3. (A) Representation of the three groups. Group 1: young adults with no immediate wish to become parents within the next couple of years. Group 2: young adults actively trying to become pregnant. Group 3: a subgroup of Group 2 one year after giving birth. (B) First, the participants spend a few minutes learning the shape-label pairings, for example self was represented by a circle. (C) Next, the participants had a practice run of 20 trials before starting the actual experiment. During the actual experiment, the participants saw a white fixation cross in the centre of the screen for 500 ms, then the pairing appeared for 100 ms, after which the participant had 800–1650 ms to respond. Whether the response was correct, false or too slow would appear on the screen for 500 ms before the next trial started. (D) The response time and accuracy were extracted for both matched and non-matched trials resulting in 10 conditions. See main text for further details.

birth. This behavioural change is yet another demonstration of the importance of the changes associated with looking after infants and of how experiences dynamically shape complex information processing and concepts such as self-prioritisation, which guides human behaviour.

The findings reported here differ from those in previous papers in three ways. First, we introduced a new infant condition in the perceptual matching task. Second, we tested people who wanted to become parents for the first time. Third, most of the other papers used a maximum of three conditions, while we used five conditions.[4,5,24]

Experiment 1 showed that using five conditions instead of three did not alter the self-prioritisation effect. Using more conditions produced a pattern of 2–3 clusters appearing, with the most consistent cluster being the friend-stranger cluster. Meanwhile, the other three conditions formed different clusters in the three groups (Figures 2 and 3).

It was noticeable that the infant condition in Group 1 showed the same accuracy and response time as the mum condition, rather than the friend-stranger cluster. As such, these results could derive from the parental instinct that was even found in non-parents in neuroimaging studies by Kringelbach et al.[11–14] However, we did not obtain information from the non-parents on how much time they had spent with babies.

There was a difference in the self-prioritisation effect between the younger group of non-parents who did not have an immediate desire to become parents and the older group of couples who wanted to become parents. This could potentially be due to maturation of an innate parental instinct. However, previous studies have not found that the self-prioritisation effect disappeared with age.[25]

Another concern could be the stress of trying to conceive in Group 2, especially for couples receiving fertility treatment.[26] Stress can cause negative moods, which have been shown to diminish the self-prioritisation effect.[27] This could potentially explain the lack of self-prioritisation in Group 2. None of the participants suffered from depression, as this was one of the exclusion criteria. However, future studies should include measures of stress and mood to examine whether this could be a potential factor for the lack of self-prioritisation in Group 2.

Unlike the other two groups, Group 3 went through the experiment twice, once before pregnancy and a year after giving birth. This could have caused a spacing effect, meaning that they improved due to practising the experiment and performed better the second time.[28] However, there was a minimum of 1 year and 9 months

between the two trials and it is unlikely that a spacing effect would have occurred, since repetitions usually need to happen hours to days after a trial in order to improve over time.[28]

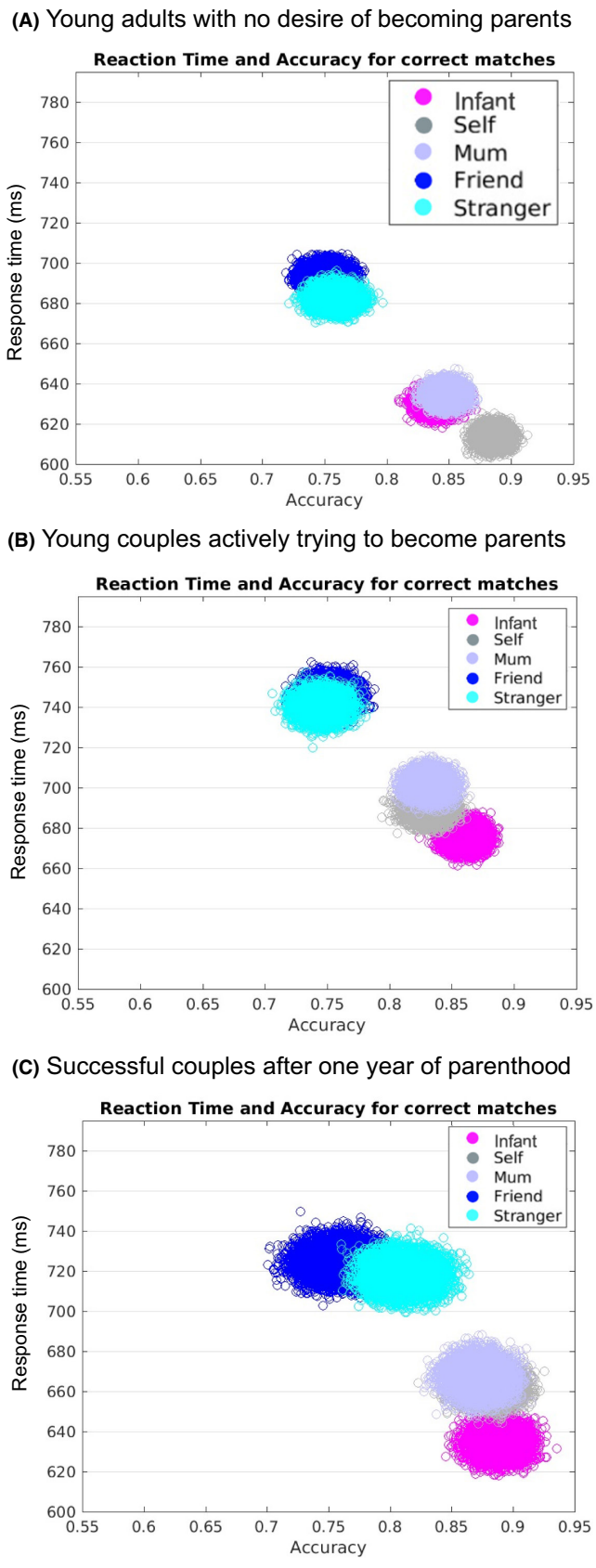

FIGURE 2 Scatterplots for the three groups. Scatterplots of response time and accuracy of the bootstrapped data sets for the five conditions: infant, self, mum, friend, stranger. Notice how Group 1 (A) had the highest accuracy and fastest response time in the self-condition (lower right corner). In Group 2 (B), there was an insignificant trend towards infant prioritisation, which became significant in Group 3 (C).

Interestingly, a study by Jiang and Sui[29] investigated the self-prioritisation effect in new mothers within the first couple of years of giving birth. They used names and faces as stimuli and found that motherhood may enhance the boundary between family and non-family, while still maintaining the self-prioritisation effect.[29] These results were similar to our findings for Group 1. Our study differed from the study by Jiang and Sui in three ways. We included both men and women, the infants were younger and we used geometric shapes instead of faces and names to test the self-prioritisation effect. Thus, the infant-prioritisation effect we observed in Group 3 may have been due to the mixed gender design, including data from both the mother and father. Unfortunately, the COVID-19 pandemic ended our data collection prematurely and we did not have enough data for a gender subanalysis. Another explanation for the difference in results could be that the infant-prioritisation effect was only present within the first year of parenthood. Finally, the use of different stimuli may have accounted for the differences in results. It is possible to avoid the effect of familiarity by using geometric shapes, instead of well-known faces or names, but more research is needed to understand what causes the differences in these results.

Potential limitations of this study included the smaller number of participants in the follow-up study and the limited information on interactions with infants by non-parents. In addition there was a significant age difference between the non-parents with no desire to have children in the near future and the couples trying to get pregnant. However, asking specific questions about the participants' plans to become parents might, in itself, have introduced potential bias. That is why we would suggest using an age-matched design in future studies. This should include more participants and ask about parental status after the experiment. Furthermore, it would be interesting to include adults who have actively decided not to have children, instead of young adults that do not have any current plans to have children. Moreover, we only included first-time parents 1 year after giving birth, as we were studying the effects of the caregiving experience within the first year of parenthood. However, we suggest that future studies should include data from parents with multiple children, as well as data from the perinatal period, to investigate the effects of pregnancy and birth on the self-prioritisation and infant-prioritisation effect.

Finally, it would be interesting to test whether there is a correlation between infant-prioritisation and parental behaviour, to understand whether infant prioritisation is linked to higher levels of caregiving capabilities. We suggest that future studies should examine the clinical relevance of the perceptual matching task we used, both in healthy new parents and parents suffering from postnatal depression. Our hypothesis was that the infant-prioritisation effect

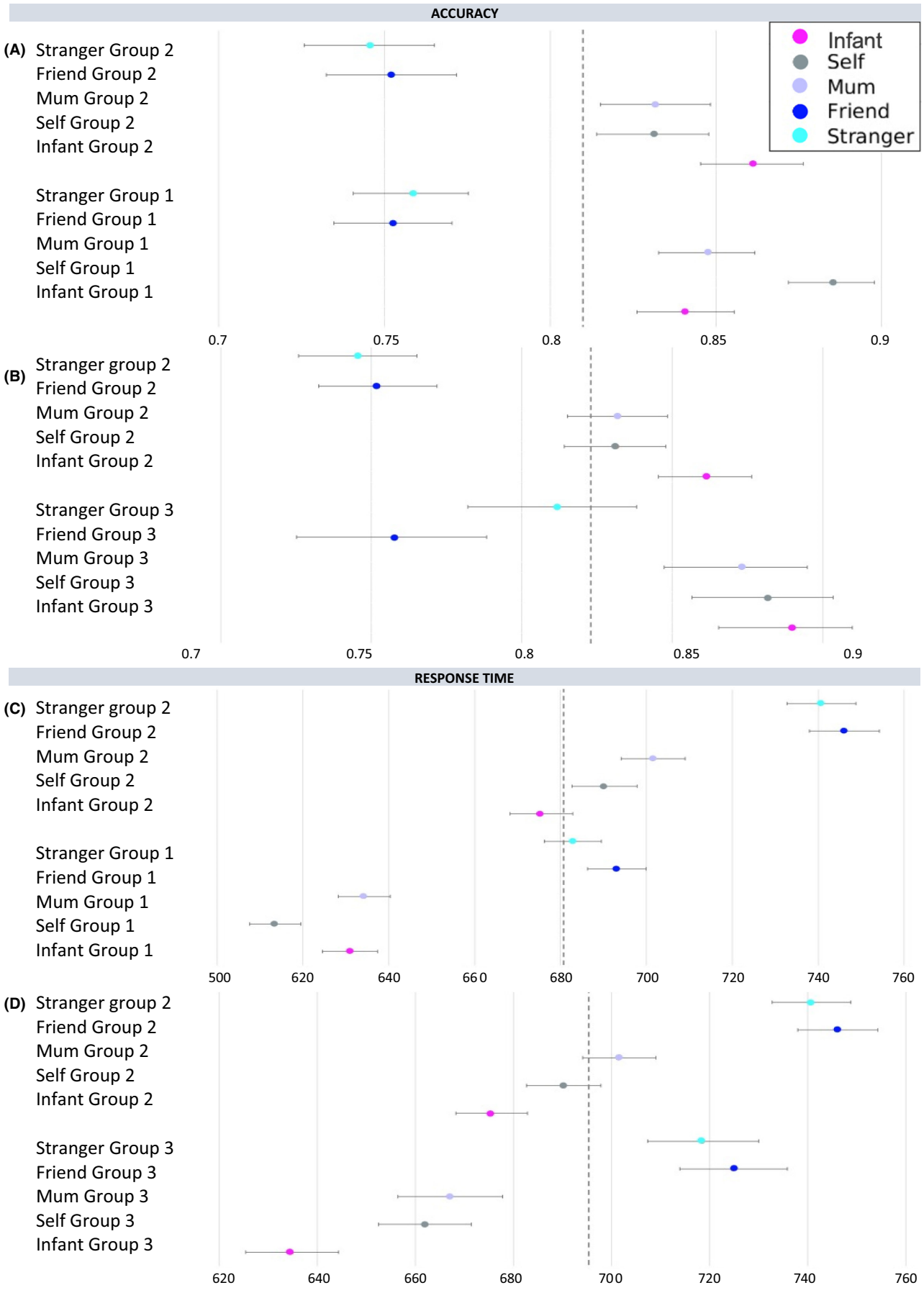

FIGURE 3 Forest plots for the three groups. (A, B) Forest plot of the mean and 95% CIs regarding accuracy for the three groups. Notice how Group 1 exhibited a clear self-prioritisation effect, while this vanished in Groups 2 and 3. (C, D) Forest plot of the means and 95% CIs of response times for the three groups. Notice how Group 1 again showed a clear self-prioritisation effect, which this disappeared in Group 2 and turned into a clear infant-prioritisation effect in Group 3. The dashed line represents the mean of all the datapoints.

would be reduced or potentially missing when parental sensitivity towards infant communication cues, such as crying, were severely reduced. This would potentially provide clinicians with a simple objective diagnostic tool to identify families at risk. However, more research is needed to understand whether this would be a potential use of the method.

5 | CONCLUSION

This study used a screen-based perceptual matching task to see how non-parents, people trying to get pregnant and those who had given birth prioritised shapes and labels relating to self or infant conditions. We found that the group who had no plans to become parents in the near future, demonstrated higher levels of self-prioritisation than infant prioritisation, which validated the experiment. The participants who were actively trying to become parents showed no statistically significant prioritisation between the two conditions. In contrast, participants who had become parents in the last year showed higher infant prioritisation than self-prioritisation a year after giving birth.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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