

Anonymized Pre-Registration Form Open Science Framework

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Title: Young Infants' Attentional Preference for Social Interactions

Research Questions

From early on, humans preferentially attend to social (versus nonsocial) signals such as human faces, bodies or voices. A great number of studies has investigated the ontogenetic development of this so called 'social orienting'. However, it has not been directly examined yet, whether infants preferentially orient towards others' social interactions. Therefore, the currently planned study aims to investigate (a) whether young infants (7.0-11.0 months) have an attentional preference for social interactions. Since previous research suggests qualitative changes concerning the social-cognitive development around 9 months of age, we further intend to investigate (b) whether the preference for social interactions increases with age, i.e., is stronger in infants older than 9 months (9.5-11.0 months) compared to infants younger than 9 months (7.0-8.5 months). To address research questions (a) and (b), infants will participate in a preferential looking task in which their looking times (as measured via eye tracking) will be compared between two simultaneously presented video stimuli: one video showing two actors turning towards one another engaging in social interaction, and one control video presenting two actors turning away from one another without social interaction taking place (for further information about the video stimuli see section "Manipulated variables"). Besides measuring looking time, we will code infant's active social engagement behavior in an additional free play phase. Based on previous research we (c) intend to replicate the finding that children older than 9 months display more joint engagement behavior compared to children younger than 9 months. Moreover, we want to (d) explore possible connections between the attentional preference for

others' social interactions (during eye tracking), and own active social engagement behavior (during free play).

Hypotheses

Hyp. (a): If infants have an attentional preference for social interactions, they should look more than 50% of the total looking time at videos in which two actors socially interact with one another.

Hyp. (b): If the preference for social interactions increases with age, then infants older than 9 months of age (9.5-11.0 months) should have a stronger preference for social interactions compared to infants younger than 9 months (7.0-8.5 months).

Hyp. (c): If active joint engagement behavior increases with age, then infants older than 9 months of age (9.5-11.0 months) should show more joint engagement behavior compared to infants younger than 9 months (7.0-8.5 months).

(d) No specific predictions are made concerning the connection between the preference for others' social interactions and active social engagement behavior.

Sampling Plan

Existing Data

Registration prior to creation of data.

Data collection procedures

Participants will be recruited from a shared database of [name deleted to maintain the integrity of the review process]. All infants have mixed socio-economic backgrounds. Since two age groups are tested, participants must be between 7.0 and 8.5 months (group 1) or between 9.5 and 11.0 months old (group 2) to participate in the study. Both age groups are planned to be gender balanced, with half of the participants being male, half female. The parents

and their children participate voluntarily and receive a small gift (a toy) as thank you for their participation.

Sample size

It is intended to include the data of $N = 40$ infants in the final analyses, consisting of $n = 20$ participants between 7.0 and 8.5 months (group 1), and $n = 20$ participants between 9.5 and 11.0 months of age (group 2).

Sample size rationale

The calculation of sample size has been based on previous eye tracking studies using similar paradigms (e.g., Wahl, Michel, Pauen, and Hoehl, 2013).

Stopping rule: We plan to test as many participants as needed to have valid eye tracking data of $n = 20$ infants per age group, i.e., $N = 40$ infants in total (see section "Sample size"). "Valid eye tracking data" means, that infants viewed all twelve experimental trials. According to this criterion, participants will be marked as drop-outs when the testing session needs to be aborted. This could be due to technical reasons (e.g., eye tracker breaks down), problems with calibration, or because the child does not want to participate. All these kinds of drop-outs will be replaced by additionally tested participants.

Variables

Manipulated Variables

In the eye tracking study, we manipulate the degree of social interaction (socially interacting vs. not interacting). For this purpose, we have created two kinds of dynamic video clips. Based on a preferential looking paradigm, they will be presented simultaneously to the participants: One video clip (social stimulus) shows two women turning towards one another, engaging in one of three different social interactions (playing an interactive clapping game, leaning towards one another, or touching each other's right palm). The second video (control stimulus), presents the same two women turning away from one another without social

interaction taking place. Acting individually, both actors perform the identical movements as they do in the social stimulus while they stand back to back with their dyad partner. To manipulate the degree of interaction, we vary the relative positioning of the actors (facing one another versus standing back to back), as well as physical contact between them (mutual touch versus no touch). Further information about the stimuli are given in the attached file. To additionally assess infants' active joint engagement, participant's behavior will be observed during free play with their mother. No variables will be manipulated in this phase.

Measured Variables

To assess infants' attentional preference, we will measure their looking time towards the social stimulus and the control stimulus (averaged over all trials). For this purpose, we will define two areas of interest (AOIs) for each trial: one AOI covering the social stimulus, and one AOI covering the control stimulus. R software will be used to create AOIs. For statistical analyses, we will combine both looking times in one relative looking time toward social stimuli, as further described in section "Indices". To measure the participant's gaze, we will use an SMI eye tracker (SensoMotoric Instruments, Red 7.2) and SMI eye tracking computer programs (Experiment Center 3.5.101 and BeGaze 3.5.74). At the beginning of each test session, the eye tracker will be calibrated individually to the eyes of the participants, using SMI five-point calibration with validation. Data will be recorded separately for the left and the right eyes at a sampling frequency of 250 Hz. The amount of active social engagement will be coded from video-taped free play sessions between infant and mother. Three kinds of social engagement behaviors will be coded: 1) looking at the mother, 2) mutual gaze between mother and infant, and 3) joint attention looks. See attached file for more detailed information on the coding scheme.

Indices

For statistical analyses, we will combine the looking times toward social and control stimuli in one relative looking time toward social stimuli. The relative looking time toward

social stimuli will be calculated by the cumulative length of fixations within the social AOI relative to the cumulative length of fixations within both AOIs (sum of fixation lengths of social and control AOI). Using relative instead of total fixation length allows to overcome inter- and intra-individual variances in looking time between and within trials. Every participant will be confronted with a total number of 12 trials (see attachment for further information). First, we will calculate the relative looking time toward the social stimulus for each trial and participant. In a subsequent step we will average the data over all trials for each participant, resulting in one mean relative looking time (or proportion of looking time) toward social stimuli (see also Vaillant-Molina Bahrck, & Flom, 2013).

Design Plan

Study type

Experiment - A researcher randomly assigns treatments to study subjects, this includes field or lab experiments. This is also known as an intervention experiment and includes randomized controlled trials.

Blinding

No blinding is involved in this study.

Study Design

The study is based on a preferential looking paradigm, in which participants' looking time is measured while they are simultaneously confronted with two kinds of video stimuli, depicting two levels of social interaction (social interaction, no social interaction). Every infant is confronted with the same twelve experimental trials, whereby the order of trials is randomized for each participant (see attachment in section "Indices" for further information). Age is included as between-subjects factor, taking two levels (group 1, group 2). We further code participants' active social engagement behavior from video-taped observations during free play with their mother.

Randomization

The order of trials is randomized for each participant. Additional information about the twelve trials are attached to section "Indices". For randomization, the presentation software of SMI (SMI Experiment Center) will be used.

Analysis Plan

Statistical models

Hyp (a): We will use an appropriate one-sample test to determine whether the mean relative looking time to social stimuli (dependent variable) significantly differs from (i.e., is greater than) 50%. Depending on the structure of the data, parametric (such as one-sample t-test) or non-parametric tests (such as one-sample Wilcoxon sign-rank test) will be used.

Hyp (b): We will conduct a GLM for the mean relative looking time to social stimuli (dependent variable). Age will be used as categorical predictor (group 1, group 2), tested between-subjects. To control for gender, we will further include gender (male, female) as between-subjects factor in the model. Before running the model we will check the assumptions. If assumptions are not fulfilled, we will modify the model appropriately.

Hyp (c): We will conduct a GLM for active joint engagement behavior (dependent variable), using age as categorical predictor (group 1, group 2), tested between-subjects. To control for gender, we will further include gender (male, female) as between-subjects factor. Before running the model we will check the assumptions. If assumptions are not fulfilled, we will modify the model appropriately.

Transformations

We are not planning to transform any variable. Active joint engagement behavior during the free play sessions will be coded (see section "Measured variables" for the coding scheme). A blind second rater will code a random 20% of the free play sessions to check the intercoder reliability (Cohen's Kappa).

Follow-up analyses

Hyp (b): We are planning post-hoc analyses, if age differences in mean relative looking-time to social stimuli are found. Post-hoc analyses will be done separately for both age groups. For each age group, we will run an appropriate one-sample test to determine whether the mean relative looking time to social stimuli (dependent variable) significantly differs from (i.e., is greater than) 50%. Depending on the structure of the data, parametric (such as one-sample t-test) or non-parametric tests (such as one-sample Wilcoxon sign-rank test) will be used.

Hyp (c): Since we do not know whether the coded behaviors "interest in mother", "mutual gaze" and "joint attention looks" follow a different developmental pattern, we will run separate analyses with all three behaviors.

Inference criteria

All tests of significance will be two-tailed with an alpha-level of .05. For post-hoc analyses, we will adjust the alpha-level via Bonferroni correction to control for multiple testing.

Data exclusion

As described in section "Stopping rules", we will only use the eye tracking data from those participants who complete the total experimental session. All of these participants will be included in the final analyses, regardless of whether they are outliers or not. Only drop-outs (as described in section "Stopping rules") will be excluded from statistical analyses.

Missing Data

For each participant, the eye tracking data of all 12 experimental trials will be averaged (see section "Indices"). If some of the trials do not contain any data (e.g., due to look-aways), they will not be considered. In these cases, the data of the remaining trials will be averaged. Missing data during free play will not be replaced, since active social engagement behavior is included as additional measure.

Exploratory analysis

With regard to research question (d), we will look for relationships between the preference for others' social interactions and active social engagement behavior. Since we do not have any precise predictions, we will follow two different approaches: (1) Exploring the relationship individually for each of the three categories of active social engagement behavior ("interest in mother", "mutual gaze", and "joint attention looks"). (2) Integrating the three categories in one overall score of active social engagement behavior.