Data Request form YOUth (version 6.0, February 2020)

Introduction

The information you provide here will be used by the YOUth Executive Board, the Data Manager, and the Data Management Committee to evaluate your data request. Details regarding this evaluation procedure can be found in the Data Access Protocol.

All data requests will be published on the YOUth researcher's website in order to provide a searchable overview of past, current, and pending data requests. By default, the publication of submitted and pending data requests includes the names and institutions of the contact person and participating researchers as well as a broad description of the research context.

After approval of a data request, the complete request (including hypotheses and proposed analyses) will be published. If an applicant has reasons to object to the publication of their complete data request, they should notify the Project Manager, who will evaluate the objection with the other members of the Executive Board and the Data Management Committee. If the objection is rejected, the researcher may decide to withdraw their data request.

Section 1: Researchers

In this section, please provide information about the researchers involved with this data request.

- Name, affiliation and contact information of the contact person
- Name and details of participating researchers (e.g. intended co-authors)
- Name and details of the contact person within YOUth (if any)

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Section 2: Research context

In this section, please briefly describe the context for your research plans. This section should logically introduce the next section (hypotheses). As mentioned, please note that this section will be made publicly available on our researcher's website after submission of your request.
Please provide:

- The title of your research plan
- A very brief background for the topic of your research plan
- The rationale for and relevance of your specific research plan
- The specific research question(s) or aim(s) of your research (Please also provide a brief specification)
- A short description of the data you request

References can be added at the end of this section (optional).

Title of the study
Can inter-individual differences in facial-emotion recognition speed and neural facial-emotion processing in late childhood be explained by age, sex and social competence?

Background of the topic of your research plan, rationale, relevance (max. 500 words)
Social competence can be defined as the ability to engage in meaningful interactions with others (Junge et al., 2020). Emotion recognition (ER) helps us to navigate these social interactions. Individuals differ in their ability to accurately identify emotions on faces and in the speed at which emotion recognition occurs. A meta-analysis shows that variation in ER accuracy relates to social competence (Trentacosta and Fine, 2010), but the relation between ER speed and social competence has yet to be studied. As the accuracy and speed of ER is partly heritable (Swagerman et al., 2015), inter-individual differences in ER can be the results of a genetic predisposition, experiences or gene-environment interactions. For example, enhanced amygdala reactivity in response to emotional faces is found in children exposed to bullying (Swartz et al., 2019) or adults exposed to childhood emotional maltreatment (van Harmelen et al., 2013). Differences in ER are also associated with psychiatric outcomes. For example, emotion-specific differences in labelling accuracy were associated with internalizing and externalizing problems in preschoolers participating in the Generation R cohort (Székely et al., 2014). Even more, difficulties in ER and altered brain activity in related regions are described in many childhood neuropsychiatric disorders, such as autism spectrum disorder (Harms et al., 2010) or mood disorders, anxiety disorders or attention deficit hyperactivity disorder (Collin et al., 2013). Aberrant developmental trajectories of ER may start early in life. Newborns are not able to differentially process emotional faces, but this ability rapidly develops in the first year of life and continues to improve during childhood (Bayet & Nelson, 2019). The ability to accurately label happy faces is thought to develop first, while for example the identification of fearful emotions has a more protracted developmental trajectory (Bayet & Nelson, 2019; Durand et al., 2007; Gao & Maurer, 2009). We know that brain structure develops throughout childhood, but we do not know if age- and sex-related variation in brain

function in response to emotional faces exists in late childhood. On a behavioural level, age- and sex- effects were found for both ER speed and ER accuracy in late childhood and adolescence (Gur et al., 2012). Furthermore, it remains unclear if ER speed is associated with neural processes during the processing of emotional faces.

Functional MRI (fMRI) can be used to map regions involved in the processing of emotional faces. The neural basis of facial-emotion processing requires different levels of specialization. One, basic visual processing is needed for face categorization, i.e. identifying that the stimulus is a face rather than another object such as a house. Two, the brain differentiates between emotional faces and neutral faces. Three, emotion-specific processes help to recognize, conceptualize and label the expressed emotion. A meta-analysis including mostly studies on adults showed the activation patterns during an emotional face task in adults (Fusar-Poli et al., 2009, **Box 1**). Neural processing of emotional faces in late childhood is not yet studied in large samples of typically developing children.

In this study we aim to investigate age- and sex-related differences in the behavioural recognition and neural processing of happy and fearful facial expressions in late childhood. Furthermore, we are interested in the link between these findings and social competence. Therefore, we additionally study the relation between ER speed, facial-emotion processing and social competence.

Box 1: Meta-analysis in adults by Fusar-Poli et al., 2009
Brain regions activated during an emotional face task per contrast

- Faces versus fixation:
    - Visual areas (fusiform gyrus, occipital gyri, lingual gyrus)
    - Limbic areas (amygdala, parahippocampal gyrus, posterior cingulate gyrus)
    - Putamen
    - Temporoparietal areas (parietal lobule, middle temporal gyrus, insula)
    - Prefrontal areas (medial frontal gyrus)
    - Cerebellum

- Happy versus neutral faces:
    - Amygdala
    - Fusiform gyrus
    - Anterior cingulate cortex

- Fearful versus neutral faces:
    - Amygdala
    - Fusiform gyrus
    - Anterior cingulate cortex

Other emotions studied are left out here because they are not of interest for this data request

The specific research question(s) or aim(s) of your research

1. Are there age- and sex-differences in the speed of identifying happy and fearful facial expressions?
2. Do age, sex, and ER speed associate with neural processing of happy or fearful faces?
3. Is there an association between ER speed and social competence?
4. Is there an association between neural processing of happy and fearful faces and social competence?

Summary of the data requested for your project: Please indicate which data you request to answer your research question.

Functional brain activity is acquired during the fMRI emotion task in which pictures of faces with happy, fearful or neutral expressions are alternated with pictures of houses. No behavioural data is collected in this passive watching task. However, the Penn Computerized Neurocognitive Battery (Penn CNB) (Gur et al., 2001; Gur et al., 2010; Gur et al., 2012) does contain behavioural emotion recognition measures, and is collected in the first wave of YOUth: Child & Adolescent. The Penn CNB contains an ER task, in which accuracy and reaction times are collected. To relate our main findings to social competence we request three surveys (listed in detail below). Apart from the fMRI emotion task and the Penn CNB data, we request age and sex because they may explain variance in emotion recognition speed or neural processing of emotional faces (Swagerman et al., 2016; Gur et al., 2012).

To control for possible confounders, we request the Penn CNB motor praxis data, IQ and order of testing day. One, the motor praxis data can be used to control for inter-individual differences in response time, irrespective of ER speed. Previous studies show that the correlation between motor speed and ER speed was 0.59 in the Penn CNB task (Gur et al., 2010). Two, because the Penn CNB ER task is a cognitive task, IQ may explain some of the variance (Swagerman et al., 2016). Three, the order of the testing day may influence brain activity based on whether the ER behavioural data was collected prior to the MRI scan or after. On the one hand habituation effects are described for ER (Herba & Philips, 2004), on the other hand children may be more engaged in the passive-viewing task if they were asked to identify the faces in the Penn-CNB ER task just before.

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Section 3: Hypotheses

In this section, please provide your research hypotheses. For each hypothesis:

- Be as specific as possible
- Provide the anticipated outcomes for accepting and/or rejecting the hypothesis

Hypotheses
H1. Older children are faster to correctly label happy and fearful facial expressions and girls outperform boys. H2. Variation in neural processing of emotional faces can be partly explained by age, sex and labelling speed, with older children, faster children and girls showing stronger activation patterns. H3a. Faster labelling speed is related to higher social competence. H3b. Stronger activation in response to emotional (happy or fearful) versus neutral faces is related to higher social competence.

Section 4: Methods

In this section, you should make clear how the hypotheses are tested. Be as specific as possible. Please describe:

- The study design and study population (Which data do you require from which subjects?)
- The general processing steps (to prepare the data for analysis)
- The analysis steps (How are the data analysed to address the hypotheses? If possible, link each description to a specific hypothesis)
- Any additional aspects that need to be described to clarify the methodological approach (optional)

Study design, study population and sample size (e.g. cross-sectional or longitudinal; entire population or a subset; substantiate your choices)
We will use cross-sectional data from the YOUth: Child & Adolescent 9y wave, because there is not sufficient 12y data available at this moment in time. We request the entire study population, because the reliability of fMRI in general is low to moderate. The intra-class correlation for this task is estimated around 0.5 based on the test-retest reliability of the YOUth MRI protocol assessed in a previous study on adults (Buimer et al., 2020). The large variation could be compensated for by including the entire sample.

General processing steps to prepare the data for analysis
Preprocessing and subsequent processing of fMRI scans will be done using SPM12 (http://www.fil.ion.ucl.ac.uk/spm/) in MATLAB 2020b (The MathWorks Inc., Massachusetts, United States). The steps described here are largely similar to previous studies using YOUth fMRI data (Buimer et al., 2020; Pas et al., 2021). In short, preprocessing will involve realignment, slice timing correction, spatial normalization to MNI-152 space, and smoothing (8 mm full width at half maximum) to correct for inter-individual differences. A global signal threshold of 80% will be used and subjects with voxels in the brain, excluding the cerebellum, below this threshold will be excluded.

Next, we will run general linear models on the whole-brain computing three contrasts: 1) faces versus houses; 2) happy faces versus neutral faces; 3) fearful faces versus neutral faces; 4) happy versus fearful faces. The first contrast does not answer one of our main questions, but will be reported for completeness as this is the first article on the emotion fMRI task in YOUth. Six realignment parameters will be added as regressors to the model to correct for head motion. All data will be high-pass filtered with a cut-off of 128 seconds to control for low-frequency drifts. Subjects exhibiting significant signal drops within the brain mask, leading to holes in the mask, will be excluded from the analysis (similar to Pas et al., 2021). These analyses will produce four t-maps for each participant. Voxels will be thresholded with a multiple comparison correction and a minimum cluster size. Next, we will do a visual check of the remaining clusters and use MarsBaR for cluster definition.

From the Penn CNB ER 40 task we will use speed computed over the correct trials:

- ER40FEARRT - Median Response Time for ER40 Correct Fear Identifications (ms)
- ER40HAPRT - Median Response Time for ER40 Correct Happy Identifications (ms)

Children with missing or unreliable results, i.e. continuously picking the same answer, will be removed from analyses.

Social competence will be defined using the Interpersonal Reactivity Index (IRI, Davis, 1983), the Network Relationships Inventory - Short Form (NRI-SF, Furman and Buhrmester, 1985) and the Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997, 2001). For each of the three questionnaires, YOUth only collects 5 items. Together the questionnaires tap different aspects of social competence (Junge et al., 2020). For each child, we will compute a social competence total score by summing the items on the three questionnaires. Items that indicate negative social competence, will be coded reversely. Depending on the distribution of the data, we may use cut-offs to get to binary scores per item. Furthermore, it may be necessary to rescore the data for example with z-transformations if the scoring is not comparable across questionnaires.

Specific processing and analysis steps to address the hypotheses

First, we will investigate the effect of age, sex and confounding variables on ER speed using linear models in R. We will run these analyses separately for happy and fearful faces. After the behavioural analyses, we will investigate the effects of age, sex and ER speed on neural processes. To this end, individual levels of activation (t-map contrasts) in each cluster will be modelled as dependent variables, and ER speed, age and sex will be modelled as independent variables in linear models in R. Analyses for each contrast and each cluster will be ran separately. Next, we will investigate whether order of the testing day, motor praxis response time or IQ confounds are findings. Lastly, we will investigate the relation between the activation in each cluster and social competence, and between emotion labelling speed and social competence.

Section 5: Data request

In this section, please specify as detailed as possible which data (and from which subjects) you request.

Data requested

From YOUth: Child & Adolescent: wave 9y we request the following:
 	
● **Neuroimaging data** (from all 9y participants):
  ○ fMRI emotion task + corresponding T1 anatomy scans for registration
 	
● **Behavioural ER data** (from all 9y participants)**:**
  ○ Penn CNB - Emotion Recognition task
 	
● **Social competence** (from all 9y participants)**:**
  ○ IRI (Child report)
  ○ NRI-SF (Child report & Parent/tutor report)
  ○ SDQ (Parent-report)
 	
● **Covariates** (from all 9y participants)**:**
  ○ Age (2 decimals)
  ○ Sex
 	
● **Potential confounders** (from all 9y participants)**:**
  ○ Order of testing day, preferably including times of the day
  ○ Penn CNB - Motor praxis task
  ○ IQ

Data request for the purpose of:

■ Analyses in order to publish

☐ Analyses for data assessment only (results will not be published)

Publication type (in case of analyses in order to publish):

☐ Article or report

☐ PhD thesis

■ Article that will also be part of a PhD thesis

Would you like to be notified when a new data lock is available?

☐ Yes

■ No

Upon approval of a data request, the complete request will be made publicly available on our researcher's website by default.

Do you agree with publishing the complete request on our researcher's website after it is approved?

■ Yes

☐ No. Please provide a rationale