Linking movement execution and perception in Autism Spectrum Disorder

Published: 17-01-2019
Last updated: 11-04-2024

1) Assess whether individuals with ASD perform pantomimes with similar kinematics to typical individuals, and whether the typicality of their kinematics can be explained by motor impairment.2) Assess whether individuals with ASD are able to utilize...

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Communication disorders and disturbances
Study type	Observational non invasive

Summary

ID

NL-OMON46081

Source
ToetsingOnline

Brief title
Atypical movement and perception in ASD

Condition

- Communication disorders and disturbances

Synonym
Autism Spectrum Disoder; Asperger syndrome

Research involving
Human

Sponsors and support

Primary sponsor: Radboud Universiteit Nijmegen
Source(s) of monetary or material Support: NWO

Intervention

Keyword: Autism, Communication, Gesture, Kinematics

Outcome measures

Primary outcome

Production Experiment

Executed kinematics will be quantitatively measured using the Microsoft Kinect, which captures multi-joint, 3-dimensional movement of the upper body. The following kinematic features will be calculated for each of the executed acts, using Kinect data processing scripts developed in our previous study [1]:

• Vertical Amplitude (greatest vertical height achieved by either hand),

• Holdtime (amount of time without significant movement, during the main act),

• Peak Velocity (measured from the right hand),

• Submovements (number of individual movements made by the right hand).

As participants will perform each act multiple times, we can calculate the mean and standard deviation for the kinematics of each act, for each individual participant. Typicality of a gesture will also be assessed to determine to what extent individuals with ASD execute these gestures differently from typical individuals.

fMRI Experiment:

Stick-light figures were generated from the Kinect motion capture data acquired in our earlier study [1] and will be the source of the stimuli . Observed kinematics are those captured in a previous study, during which the stimuli were created. The same kinematic features will be used, allowing direct

comparison.

For the fMRI analysis, the main study parameter will be the blood-oxygen level dependent (BOLD) MRI signal as modelled while participants perform a semantic comprehension task. This will be used to calculate network connectivity measures.

Secondary outcome

We will collect questionnaire data from the Actions and Feelings Questionnaire to assess social motor cognition. We will carry out the Purdue Pegboard Test to assess general motor coordination. These data will be collected in order to determine whether action recognition performance can be explained better by kinematics or by general social and motor impairment. They will also be used to characterize the two groups.

Study description

Background summary

Although social and communication deficits are the main diagnostic feature of ASD, movement abnormalities are characteristic for this clinical population.Moving in an atypical manner is thought to contribute to social and communicative difficulties in ASD. Every day human communication relies heavily on communicative actions, such as co-speech gestures, action demonstrations or pantomimes. In order to convey the communicative intention, actors tend to exaggerate certain kinematic features, which allows the underlying intention to be read and the meaning to be understood. In other words, communicative success may be partially explained by how the gesture is produced at a kinematic level. Difficulty in producing pantomimes is well known in children with ASD, however there is currently little research describing the kinematics of pantomimes production in ASD adults. If communication relies on exaggerating kinematics, then atypicalities in gesture kinematics may interfere with the communicative success of the gesture. Therefore it is important to determine whether gesture production in adults with ASD is characterized by typical or atypical kinematic profiles.

Studies have also shown that individuals with ASD sometimes show deficits in understanding gestures, and often have difficulty using kinematic information for action understanding. Particularly, children and adults with ASD fail to use kinematic cues for predicting a future action and the end goal of an action. An open question is whether the difficulties in action understanding are underlined by the inability to process fine-grained movement kinematics. Our previous study showed that in neurotypical adults communicatively intended pantomimes are produced with an exaggerated kinematic profile. Specifically, spatial (such as overall size segmentation of individual movements) and temporal (such as peak velocity and use of gesture holds) features were increased in a more- compared to less-communicative context. This kinematic exaggeration leads to improved comprehension by observers. When observers must quickly interpret the meaning of the gesture, the use of holds led to better recognition performance. Here we will address whether individuals with ASD are able to comprehend pantomimes, and whether kinematic exaggeration aids their comprehension.

Furthermore, understanding how the brain of an ASD individual utilizes movement information to inform action recognition is an important piece to the puzzle. As it is currently unclear whether the kinematic modulation present in communicatively modulated actions will be noticed by individuals with ASD, neuroimaging can provide additional clarification about how kinematics are processed during semantic processing. Semantic recognition of pantomimes requires the so-called fronto-parietal *action observation network* that is sensitive to processing human movements. Specifically, connectivity between distinct areas of the network may be important in order to integrate various sources of information, such as movement goals, fine grained human movement kinematics, or use of objects. Previous studies found reduced connectivity in ASD, also specifically in the action observation network. This suggests that this atypical connectivity may be a unique marker of the ability to understand the actions of others. It remains an open question how differences in brain connectivity underlie the ability to take advantage of communicatively modulated signals for easier semantic recognition.

Study objective

1) Assess whether individuals with ASD perform pantomimes with similar kinematics to typical individuals, and whether the typicality of their kinematics can be explained by motor impairment.
2) Assess whether individuals with ASD are able to utilize kinematic modulation to support semantic comprehension of pantomimes.
3) Elucidate the network connectivity topology underlying semantic comprehension of pantomimes, and assess whether differences in network connectivity can predict differences in the use of communicative kinematic modulation between autistic and typical individuals.

Study design

The study will be implemented in two experiments. The first is a cross-sectional behavioral study of approximately 30 minutes. The second part will utilize a task-based functional magnetic resonance imaging approach and will require 1 hour. In the scanner, we will collect T1 anatomical scans and implement a cross-sectional semantic comprehension task. The study will last approximately three hours, including breaks between study parts, and will take place at the Donders Centre for Cognitive Neuroimaging (DCCN). Participants will be brought to the specific locations within the DCCN by the experimenter, as well as to the cafeteria for breaks.

Study burden and risks

Participants must travel to the Radboud University for assessment, and risks include discomfort in the MRI scanner (Part 2), or fatigue experienced through the course of the day. All assessments will be collected in one day in order to reduce burden of travel, while fatigue will be reduced by providing longer beaks in between individual tasks. *
Although there is no immediate therapeutic or clinical benefit of this study, the present research allows us to form a more cohesive image of how certain symptoms in the autism spectrum relate to one another, and shed light on the neurocognitive mechanisms of ASD. This can lead to improved therapies and more effective patient-caregiver interactions.

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

Age 18-40, IQ > 85, right-handed, normal or corrected-to-normal vision.

Exclusion criteria

History of (neuro-)psychiatric disorders, brain surgery or brain trauma; use of anti-psychotic medication. For neuroimaging experiment: metal objects in the body that cannot be removed, such as pacemakers or metal prostheses, claustrophobia or panic in the scanner.

Study design

Design

Study type:	Observational non invasive
Intervention model:	Other
Allocation:	Non-randomized controlled trial
Masking:	Open (masking not used)
Control:	Active
Primary purpose:	Basic science

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	01-03-2019
Enrollment:	70

Type:	Actual

Ethics review

Approved WMO Date:	17-01-2019
Application type:	First submission
Review commission:	CMO regio Arnhem-Nijmegen (Nijmegen)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL66663.091.18