Using technology based interventions to facilitate emotion recognition in children with autism spectrum disorder

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Autism Spectrum Disorder

Criteria as outlined by the American Psychiatric Association (DSM-5):

1. Persistent deficits in social communication and social interaction across multiple contexts
2. Restricted, repetitive patterns of behavior, interests, interests, or activities

Three levels of functioning / required support
Technology in support of the clinic

- Prevalence of ASD on the rise
- Difficulties providing therapeutic support for all.
- Technology could support therapy and extend it.
- Enhancement of independence.
- Culture appropriate.
Technology based training for ASD

(Moore et al, 2000; Parsons & Mitchell, 2002)

- Predictable, consistent format.
- Doesn’t require social interaction / enables controlled interaction if desired.
- Enables gradual, controlled learning, tailored to individual pace and level.
- Immediate feedback, maintains motivation.
- Relies on strengths characteristic of ASD.
Skill meets Motivation - The Systemizing theory

(Baron-Cohen, 2002)

- Individuals with ASD are strongly attracted to rule based systems and predictable phenomena, and function in them as well as, and sometimes better than the general population.

- This preference for systems could arguably be harnessed to teach emotion understanding through systematic presentation of socio-emotional phenomena.
Skill meets Motivation - The Systemizing theory
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Individuals with ASD are strongly attracted to rule based systems and predictable phenomena, and function in them as well as, and sometimes better than the general population. This preference for systems could arguably be harnessed to teach emotion understanding through systematic presentation of socio-emotional phenomena.
Technological interventions in ASD
(Grynszpan et al, 2014)

• Various aims (e.g.):
  • Speech and language, literacy
  • Problem solving, safety
  • Socio-emotional understanding

• Various platforms:
  • Offline/online computer-based training
  • Virtual Environments
  • Robotics
  • Tablets and mobile phones
Children and adults with ASD experience significant difficulties recognizing others’, as well as their own, emotions and mental states (Baron-Cohen, 1995; Hobson, 1993), including: facial expressions, vocal intonation, gestures and body language, and their integration in context (Golan, Baron-Cohen & Golan, 2008).
Difficulties in ASD in ability to

- Direct appropriate facial expressions to others (Kasari et al, 1993)
- Modulate vocal intonation appropriately when expressing emotion (McCann & Peppe, 2003)
- Use appropriate gestures and body language (Attwood, 1998).
- Integrate non-verbal communicative cues with speech (De Marchena & Eigsti, 2010).
Can the good systemizing skills, characteristic of ASD be used to teach them about emotions?
The challenge: generalization of skills.

Mind Reading
a systematic guide to emotions

- 412 emotions in 24 emotion groups
- For each emotion: 6 facial expression videos, 6 voice recordings, 6 context examples and a dictionary definition.
- Emotions library, Learning Centre with lessons, quizzes, and rewards, and a Game Zone.

www.jkp.com/mindreading
Mind Reading
an interactive guide to emotions

Lessons & quizzes in the Learning Center

Sally is feeling kind

watch the videos, who is feeling kind, 1, 2 or 3?
Mind Reading
a systematic guide to emotions

‘Hidden face’ in the Game Zone
Evaluation Studies
Golan & Baron-Cohen, 2006; Golan, LaCava, & Baron-Cohen (2007)

- Evaluation studies with adults and primary school aged children with ASD, using software for 10 weeks.
- Improvement on face and voice emotion recognition using stimuli from software, with generalization in children.
- Improvement on mentalizing related social skills on a 1 year follow up.
Children evaluation study results (% accurate)

- **CAM-C**
  - faces-complex
  - voices-complex
  - % of complex concepts

- **Reading Mind in Eyes**
- **Complex emotion voice task**
- **Reading Mind in Films**

* *p < .01*
Educational aims

- Familiarise children with human faces and increase their exposure to facial expressions.
- Introduce emotional concepts to children
- Demonstrate the context of emotions (their causes and consequences)
- Link between the three
- Additional learning of social interaction scripts and theory of mind.
• RCT with 4-7 years olds with ASD watching the series daily for a month, compared to ASD treatment as usual and TD controls.

<table>
<thead>
<tr>
<th></th>
<th>ASD Intervention (n=20)</th>
<th>ASD Controls (n=17)</th>
<th>Typical Controls (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>5.6 (1.0)</td>
<td>6.1 (1.1)</td>
<td>5.3 (1.2)</td>
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<tr>
<td>Verbal IQ (BPVS)</td>
<td>98.9 (7.9)</td>
<td>98.8 (7.6)</td>
<td>102.8 (7.8)</td>
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<tr>
<td>CAST</td>
<td>24.0 (6.2)</td>
<td>23.8 (5.5)</td>
<td>6.0** (3.0)</td>
</tr>
</tbody>
</table>
Level 1: Defining emotion words

![Graph showing comparison between ASC intervention, ASC control, and Typical control over Time 1 and Time 2.](image)

- ASC intervention: Red line with diamonds
- ASC control: Green line with triangles
- Typical control: Yellow line with squares

Significant difference at p < 0.01:

* p < 0.01
Sally's clamp fell off and she might fall.
Level 2: Familiar scenes and faces

* p<.01
Jennie is stuck in the middle of a busy road. She might be hit by someone.
Level 3: novel scenes & faces from series

![Graph showing the comparison of ASC intervention, ASC control, and Typical control across Time 1 and Time 2. The x-axis represents Time 1 and Time 2, and the y-axis represents a scale from 8 to 14. The graph indicates a significant difference at p<.01.](image)
The neighbour’s dog has bitten people before. He is barking at Louise.
Level 4: novel scenes & faces not from series

* p<.01
• Intervention group improved on emotion recognition and emotional vocabulary over 4 levels of generalization. (Golan et al. 2010).

• Better effect than Thomas (Young & Posselt, 2012)

• Improvement greater than control animation series, maintained on 3m follow-up (Gev, Rosenan & Golan, in preparation).
An internet-based virtual world, teaching children with ASD to recognise, understand and express emotions through **facial expressions, voice and body language**
Project Main Objectives

1. Create an internet-based service that will assist children with ASD and their carers to improve their socio-emotional communication skills.
2. Attend both to the recognition and to the expression of socio-emotional cues.
3. Attend to individual sensory channels (facial expressions, prosody, body language) separately, and to their integration in context.
4. Provide carers with professional information, principles to enhance generalization, and tools to assign tasks and monitor child’s progress.

www.asc-inclusion.eu
Evaluation

- Four countries: UK, Sweden, Israel, Poland.
- Emotion recognition tasks pre+post intervention.
- SRS and VABS–Socialization scales for generalization assessment.

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**a: Facial Expression Task**
Please select the label which best describes what this person is expressing?

- a. Happy
- b. Sad
- c. Afraid
- d. Angry

**b: Body Gesture Task**
Please select the label which best describes what this person is expressing?

- a. Happy
- b. Worried
- c. Disappointed
- d. Angry

**c: Integration Task**
At the end of the scene, what is the young man in the purple hoodie expressing?

- a. Disappointed
- b. Interested
- c. Proud
- d. Joking
Distribution of VE use

- Lessons: 41%
- Curricular Games: 7%
- Non-Curricular Games: 23%
- Avatar Related Activities: 29%
### Preliminary findings: UK

<table>
<thead>
<tr>
<th>TASK</th>
<th>Mean PRE (SE)</th>
<th>Mean POST (SE)</th>
<th>t value (DF)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body</strong></td>
<td>14.33 (1.34)</td>
<td>18.73 (.61)</td>
<td>5.14 (14)</td>
<td>&lt;.01**</td>
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<td><strong>Integration</strong></td>
<td>11.13 (1.03)</td>
<td>13.47 (.72)</td>
<td>2.79 (14)</td>
<td>.02*</td>
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<td><strong>Questionnaire</strong></td>
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<td>SRS N=14</td>
<td>114.78 (7.27)</td>
<td>110.43 (8.25)</td>
<td>1.24</td>
<td>.24</td>
</tr>
<tr>
<td>Vineland Social N=11</td>
<td>67.63 (3.91)</td>
<td>71.45 (3.92)</td>
<td>2.99</td>
<td>.01*</td>
</tr>
</tbody>
</table>

Using the VE had a significant effect on both close generalization tasks, as well as the distant generalization measure of socialization.
Preliminary findings: Israel

Face task

Voice Task

Body task

SRS – Autism Symptoms

*Significant improvement of the intervention group, compared to controls, on voice and body tasks. Face task and SRS effects are nearing significance.
12 Children tested the system’s expression recognition with their parents.
The system correctly recognized 80% of the children's expressions on valid trials.
Parent–computer agreement was 61.1%. 
Conclusions

• Relying on systemizing strengths, favourable multimedia environment, and intrinsic interests could be used effectively to teach individuals with ASD about emotions.

• Successful generalization and integration with other social skills may require further support.

• Need for application for lower functioning users.
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