THE EFFECTS OF THE MIRROR PROTOCOL ON GENERALISED MOTOR IMITATION AND EARLY OBSERVING RESPONSES

Aisling Collins, Samantha Parker, Jo Thorne, and Emily Peak - Jigsaw CABAS® School & Nicholls State University

jigsaw INSPIRED BY AUTISM

Generalised motor imitation (GMI) is a fundamental developmental cusp. It has a significant impact on an individual's ability to learn without direct teaching and it develops an individual's repertoire of habilitative responses. Studies suggest, however, that children diagnosed with autism often have difficulties acquiring GMI. This study extends previous research by investigating the effects of the Mirror Protocol (Du & Greer, 2014) on the inducement of GMI and on other early observing responses in a 14-year-old male diagnosed with autism. The participant was described as an early listener and early speaker. The research was conducted at an independent CABAS® day school for children diagnosed with autism. Results showed the successful acquisition of GMI following the Mirror Protocol, with rates of acquisition increasing as he worked through the Mirror Protocol phases. The protocol also had significant effects on the participant's early observing responses. The necessity to adjust future curricula for this participant was discussed.

Generalised Motor Imitation (GMI)

Imitation as a skill refers to the ability to copy a model with 1:1 correspondence and an identical result is achieved (Garcia & Byrnes, 2013). Once basic imitation skills are mastered they can then be developed so that the individual is able to imitate an array of complex human behaviour (Soorya, Gillis & Romanczyk, 2003). Generalised motor imitation is recognised as both a critical behavioural developmental cusp and one of the three verbal developmental capabilities that facilitate learning in new ways (Greer & Ross, 2008).

Mirror Protocol

One tactic that was developed in order to help individuals acquire GMI is the Mirror Protocol (Du & Greer, 2014). The mirror procedure requires both the teacher and the child to sit in front of a standing mirror with the teacher delivering instruction on sets of actions.

Literature review

Individuals diagnosed with autism are often found to have difficulties with imitating the actions of others (Smith & Bryson, 1994). However, many children diagnosed with autism do not acquire generalised motor imitation without direct instruction and without the use of additional tactics to the learn unit (Du, Nuzzolo, & Alonso-Álvarez, 2016). The establishment of generalised motor imitation (GMI) is a critical developmental milestone as it facilitates the acquisition of untaught behaviours (Du et al., 2016).

- Pereira Delgado, Speckman and Greer (2009) used a mirror procedure to develop GMI on the basis that the mirror provides direct feedback on the individuals own responses. In the study all six participants were successful in acquiring GMI after the use of a mirror was implemented.
- Du and Greer (2014) compared the effectiveness of imitative instruction carried out face to face versus in front of a mirror for teaching GMI to children with autism. The number of trials were yoked in each condition and the participants were matched based on their development level. Results demonstrated that only participants in the mirror condition acquired GMI.
- Another study by Miller, Rodriguez, and Rourke (2015) used a multiple baseline design across imitative behaviours to examine the effectiveness of teaching imitative behaviours in front of a mirror. Results demonstrated that the participants, children with a diagnosis of autism, acquired the responses taught in front of the mirror quicker.

Method

Participant and setting

- Participant: A 14-year-old male diagnosed with autism.
- He communicated using gestural behaviour, vocal approximations, and Proloquo2Go technology on an iPad.
- Setting: Independent CABAS® day school in the South of England for children and young adults diagnosed with autism.
- The participant worked in a classroom with six other male pupils who all received instruction on a 1:1 basis.

Definition of behaviour

The main dependent variable in this study was the number of correct responses to learn units. There were several other dependent variables related to the participant's observing responses including various scenarios, attendance to faces, and looking at 2D/3D stimuli. The independent variable used was the Mirror Protocol which targeted imitative responses through learn unit presentations.

Data collection

Across phases data were collected in terms of the number of correct and incorrect responses to learn units, or trials in the case of pre- and post-probes. Each session was run in a block of 20 learn units with data graphed as the number correct. A correct response was defined as the participant imitating the teacher's behaviour with point-to-point correspondence or with a pre-determined approximation. An incorrect response was defined as one that did not meet the criteria or a non-response within 5 seconds of the antecedent being presented.

Design

The design used was a multiple probe design.

Procedure

Pre-probes. The pre-probe trials were conducted with the participant sitting across from the experimenter in a quiet area of the classroom. A set of twenty actions was presented to the participant. The antecedent was the model presented by the teacher alongside the vocal antecedent of, "Do this." No programmed consequences followed responding during these baseline probes but the participant was reinforced for appropriate behaviour. Further baseline probes related to observing responses were conducted across various settings including during group work, during 1:1 instruction at the table, or in a quiet area of the school.

Intervention. Intervention sessions were run in blocks of 20 learn units, with each response in the target set presented 5 times in random order. The participant was sat on the floor facing the mirror with the experimenter sat slightly behind to ensure attendance to the model in the mirror. A second teacher was positioned behind the participant. The antecedent consisted of the teacher ensuring the participant was attending to the mirror before presenting a model of the action to be imitated alongside the vocal antecedent of, "Do this." If the participant responded correctly then vocal praise was delivered as well as token reinforcement on a VR3 schedule for correct responses, or an FR1 schedule during some phases. If the participant did not respond or responded incorrectly then the antecedent was re-presented. If following this first correction the participant did not respond correctly then the antecedent was presented again with the second teacher physically prompting the participant do to the correct response. Following this the antecedent was re-presented again to allow the participant an opportunity to independently respond. If the participant did not respond correctly at this time the physical prompt and opportunity to respond independently was repeated once more before moving on to the next target response. No reinforcement was provided for correct responses during the correction. In two phases a verbally mediated decision was made to adapt, or replace certain target responses as the participant could not physically produce a response with point to point correspondence to the model's behaviour. Once criterion was achieved on one set, instruction began on the next set, with five sets targeted in total. In each set one target response that was already in the participant's repertoire was included as per existing procedures.

Post-probes. The post-probes were conducted in an identical fashion to the pre-probes.

Results

- The results of this study in terms of the acquisition of imitative responses during the Mirror Protocol are displayed graphically in Figure 1 as well as the pre- and post-probes of a generalised motor imitation repertoire in Figure 2.
- In baseline the participant performed 35% of the imitative responses correctly, with this increasing to 80% during the post-probe session as seen in Figure 2.
- Furthermore the rate of acquisition of responses, as measured by the number of learn units to criterion in Figure 1, improved across training phases.
- The most significant increase in observing responses was seen towards the face of a speaker, which evidenced a 65% increase, and towards non-preferred 3D stimuli which evidenced a 40% increase as demonstrated in Figure 3.

Discussion

- The present study extended existing literature on the inducement of GMI in populations who typically show deficits in this area by investigating the effectiveness of the Mirror Protocol. The results support the use of the Mirror Protocol for the inducement of a GMI repertoire, as following the protocol the participant could imitate significantly more novel responses compared to baseline.
- Following the protocol there were other significant changes in the participant's early observing responses, especially in orienting towards the face of a speaker and attending to non-preferred 3D stimuli. These collateral effects on early observing responses further support the idea that GMI represents a cusp.
- Now that GMI is in the participant's repertoire their curriculum should be modified in order to reflect this. For instance previous prompting strategies that relied on more intrusive physical prompts can be replaced by a teacher model.
- A limitation of the study is that while it demonstrated that GMI is now shown to be in the participants repertoire, it may be limited to a certain set of actions. It would have been interesting to include an assessment of object use imitation in the analysis and whether the current results extend to different contexts such as doing stretches in physical education.
- The core limitation of the present study was the lack of interobserver agreement and treatment fidelity measures in place during the pre- and post-probes, which significantly limits the conclusions that can be made from the current results. In future the use of video-technology could circumvent the need for an in-vivo second observer, though the ability to provide immediate feedback would be sacrificed.
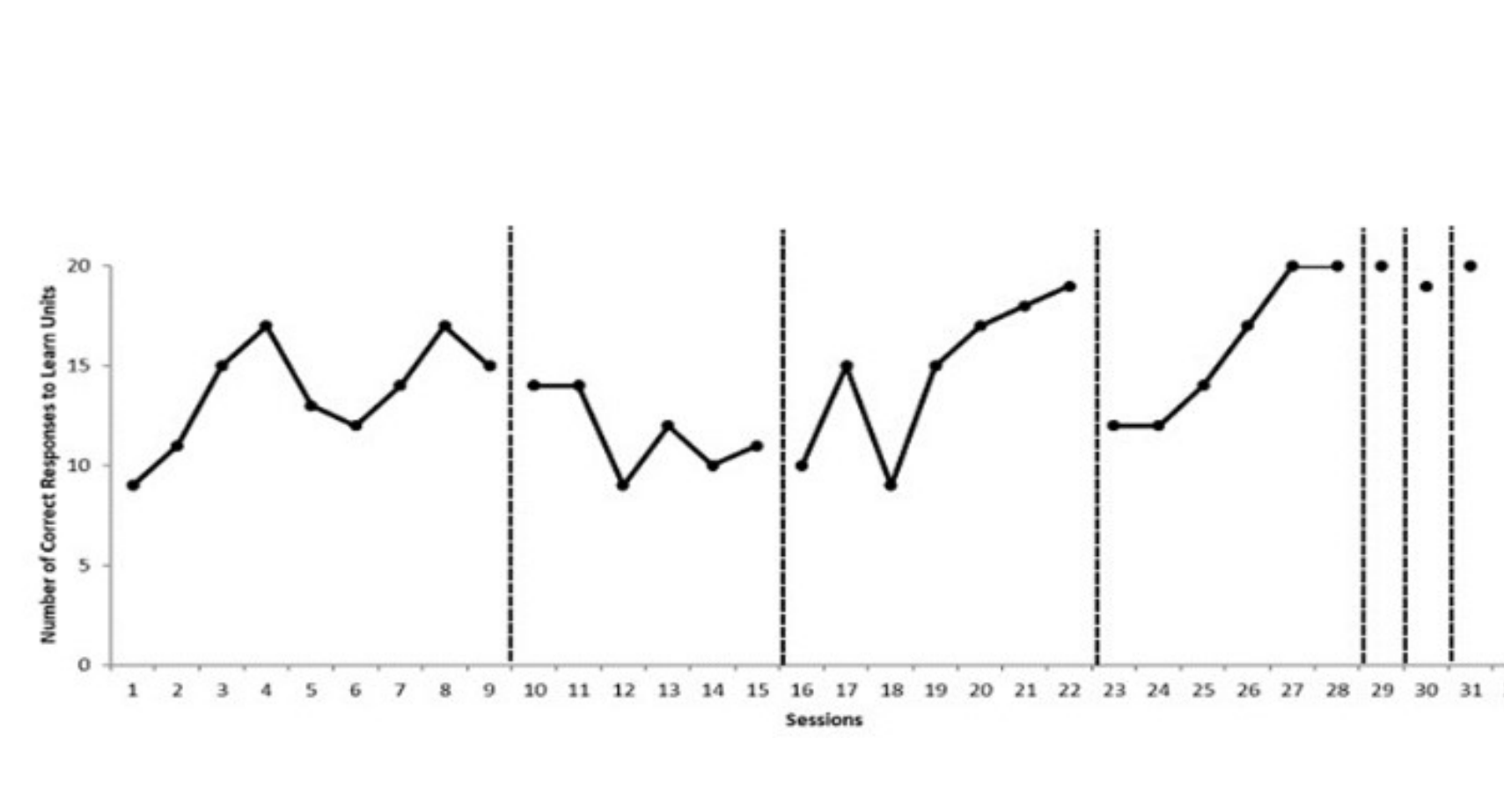

Figure 1: Number of correct responses to trials and learn ulnits across phases
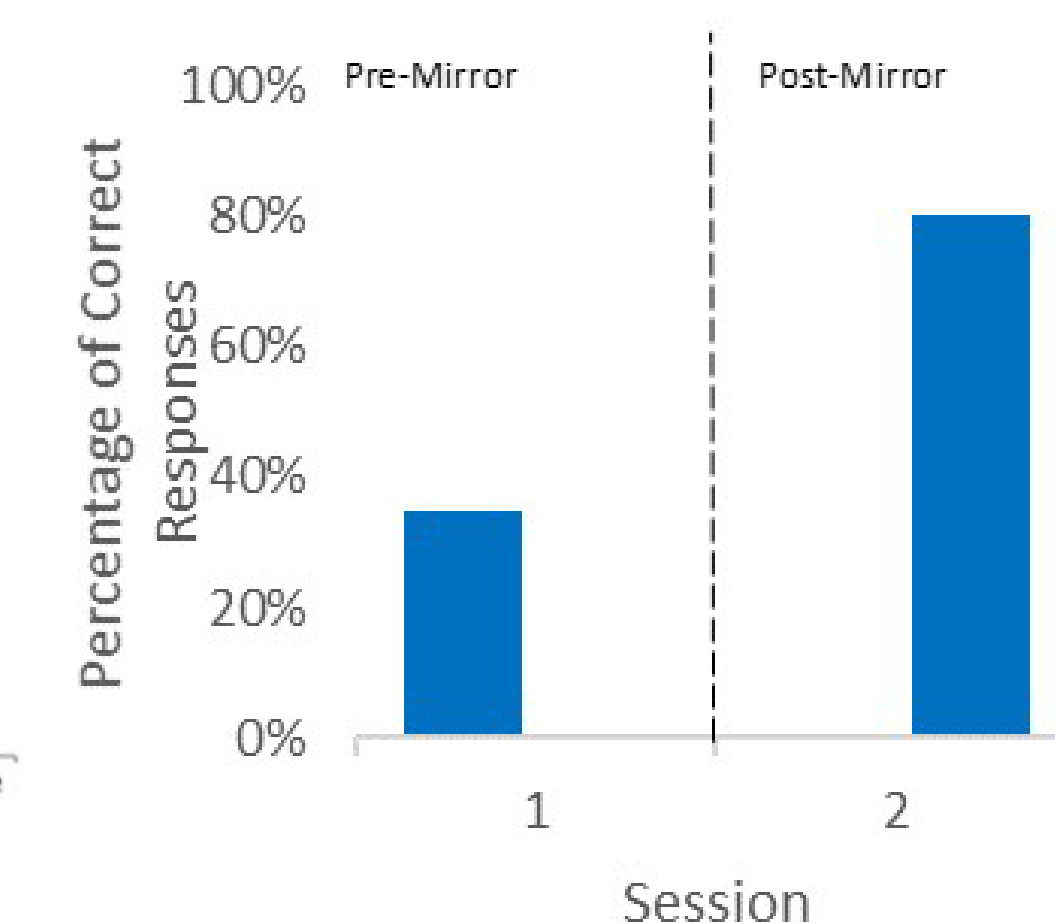

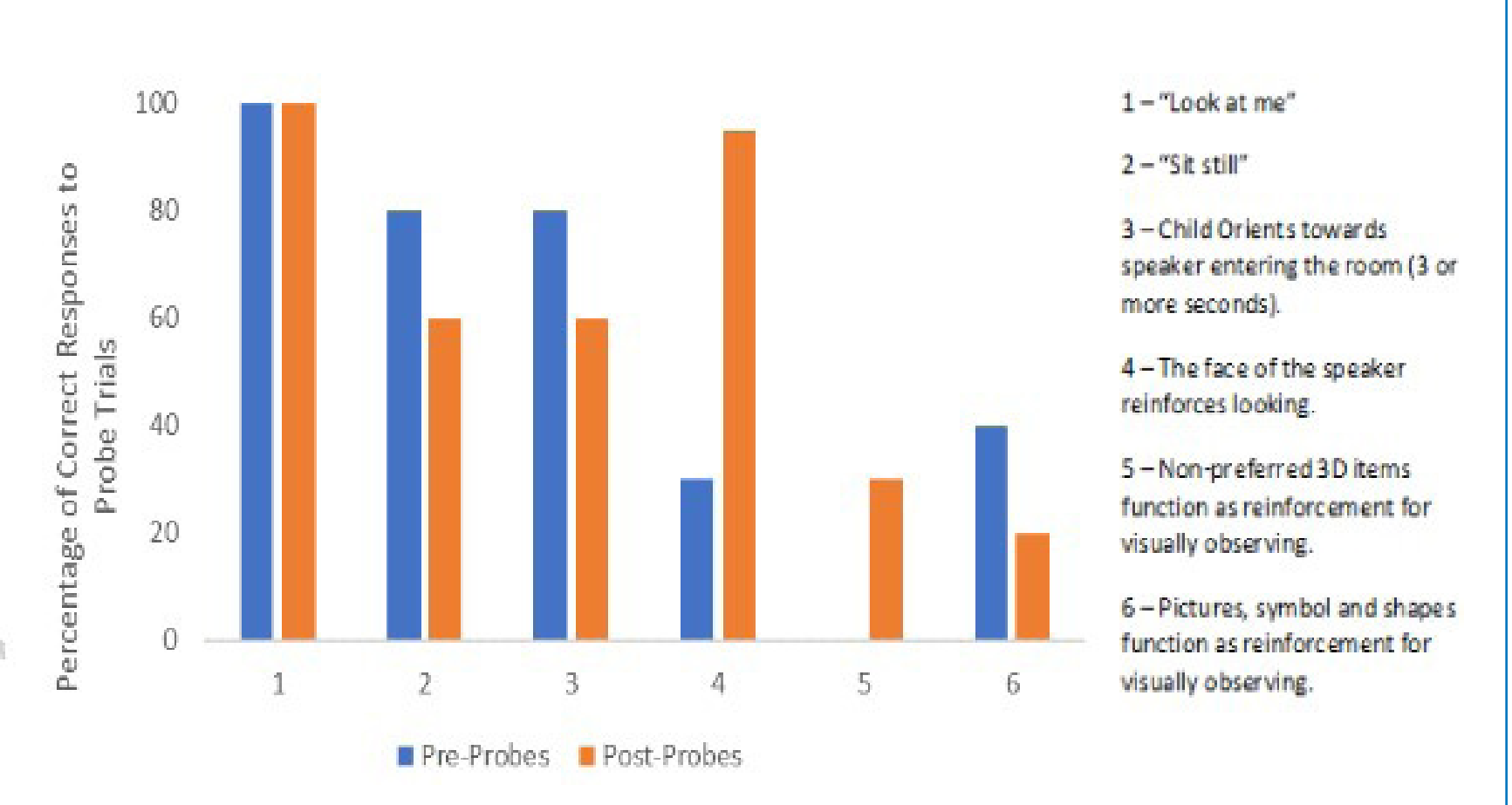*Figure 2:* Percentage of correct responses to imitation responses in the pre- and post- probe conditions

Figure 3: Percentage of correct responses to trials on observing responses in the pre- and post- probe trials

References

Du, L., & Greer, R. D. (2014). Validation of adult generalized imitation topographies and the emergence of generalized imitation in young children with autism as a function of mirror training. *Psychological Record, 64,* 161–177.

Du, L., Nuzzolo, R., & Alonso-Alvarez, B. (2016). Potential benefits of video training on fidelity of staff protocol intervention. *Behavioural Development Bulletin, 21(1),* 110 – 121.

Garcia, E., Guess, D., & Byrnes, J. (1973). Development of syntax in a retarded girl using procedures of imitation, reinforcement and modelling. *Journal of Applied Behavior Analysis 6 (2),* 299-310.

Greer, R. D., & Ross, D. E. (2008). Verbal Behavior Analysis: Inducing and Expanding New Verbal Capabilities in Children with Language Delays. *New York, NY: Allyn and Bacon.*

Miller, S. A., Rodriguez, N. M., & Rourke, A. J. (2015). Do mirrors facilitate acquisition of motor imitation in children diagnosed with autism? *Journal of Applied Behavior Analysis, 48,* 194–198.

Pereira Delgado, J. A. Speckman, J., & Greer, R. D. (2009). The emergence of generalized imitation in two to four-year-olds with developmental delays as a function of teaching imitation in a mirror. In J., Dudek (Chair), From Learning to Observe Through Learning From Observation. *Symposium conducted at the meeting of the Comprehensive Application of Behavior Analysis 3rd International Conference, Cobham, UK.*

Smith, I., & Bryson, S. (1994). Imitation and action in autism: A critical review. *Psychological Bulletin, 116,* 259–273.

Soorya, L.V., Arnstein, L.M., Gillis, J., and Romanczyk, R.G. (2003). An Overview Of Imitation Skills in Autism: Implications For Practice. *The Behavior Analyst Today, 4(2),* 114-123.