



Robot-based Intervention for Autism Community in Hong Kong

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Why social robots?



Challenges the effectiveness of traditional, human-based interventions for individuals with Autism Spectrum Disorder (ASD).



Social Motivation Theory of Autism (Chevallier et al.; 2012): individuals with ASD show deficits in communications with humans.



Intense World Theory (Markram and Markram; 2010): individuals with ASD have excessive reactivity due to a particular form of brain hypertrophy.



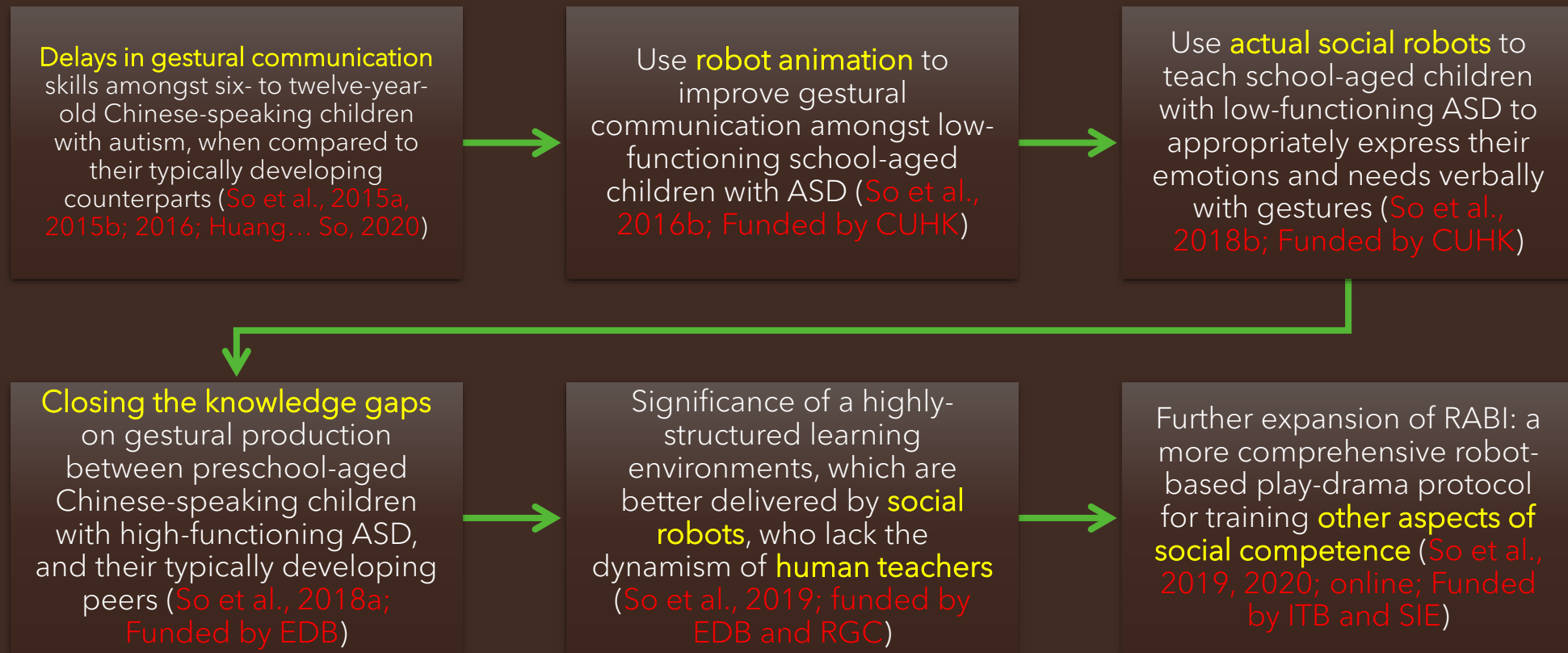
Application of social robots

- Programmable
- Predictable
- Repeatable
- Not affected by children's emotions

Previous research on the application of social robots

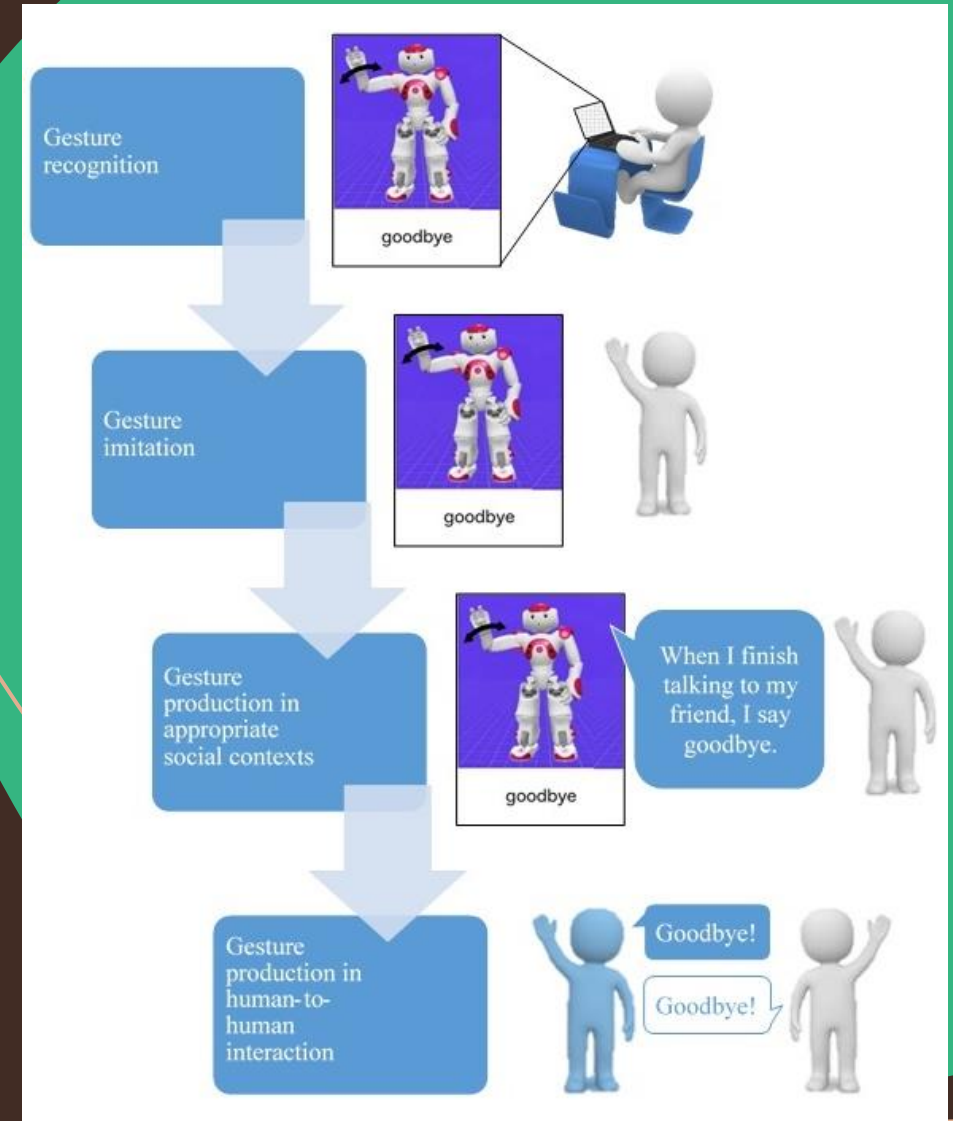
- Social robots have been widely used in therapy for individuals with ASD in the past decade (Cabibihan, Javed, Ang, & Aljunied, 2013; Fong, Nourbakhsh, & Dautenhahn, 2003; Li, Cabibihan, & Tan, 2011).
 - **Attract children's attention**
 - Kozima, Michalowski, & Nakagawa, 2009; Miyamoto, Lee, Fujii, & Okada, 2005
 - **Elicit positive and productive responses from them**
 - Scassellati et al., 2012
 - **Develop joint attention behaviors, self-initiated interactions, non-verbal communication skills, and the ability to make eye contact**
 - e.g., Ricks & Colton, 2010; Warren, Zheng, Swanson et al., 2015; Werry, Dautenhahn, Ogden, & Harwin, 2001; see reviews in Pennisi et al., 2016

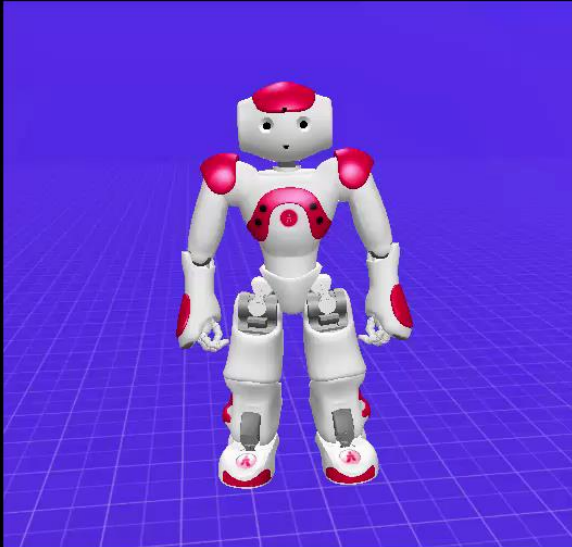
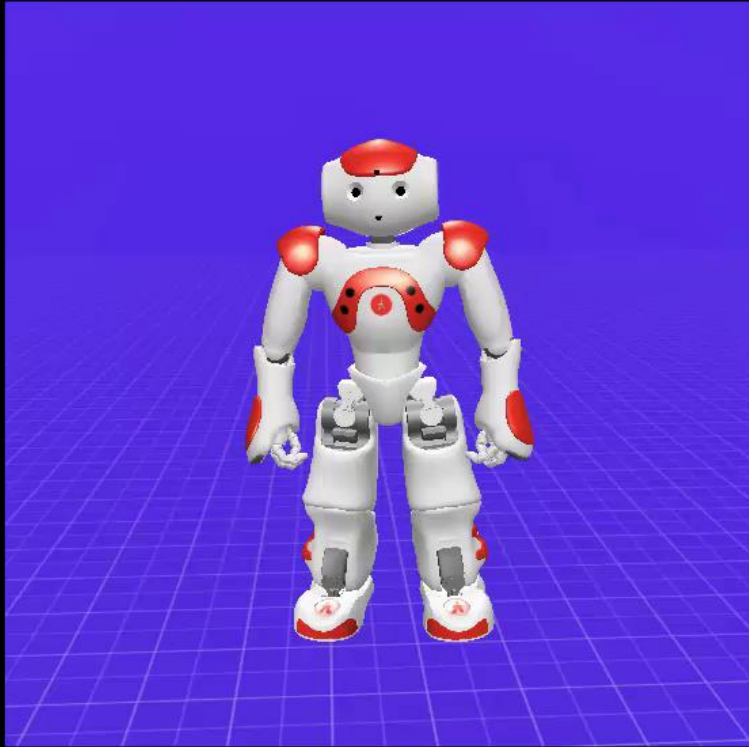
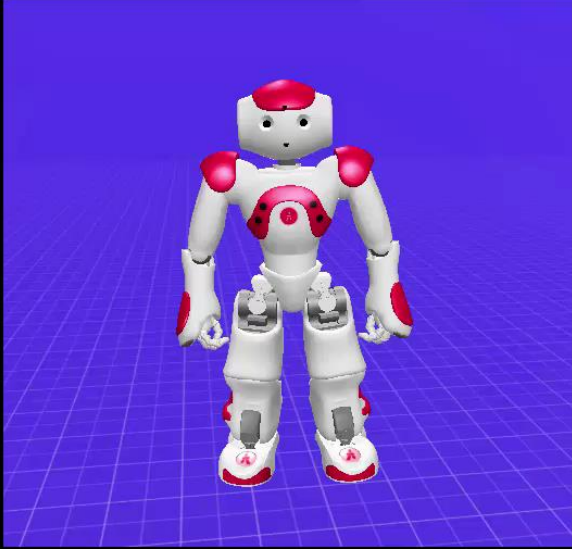
EMPIRICALLY SUPPORTED ROBOT-BASED INTERVENTIONS



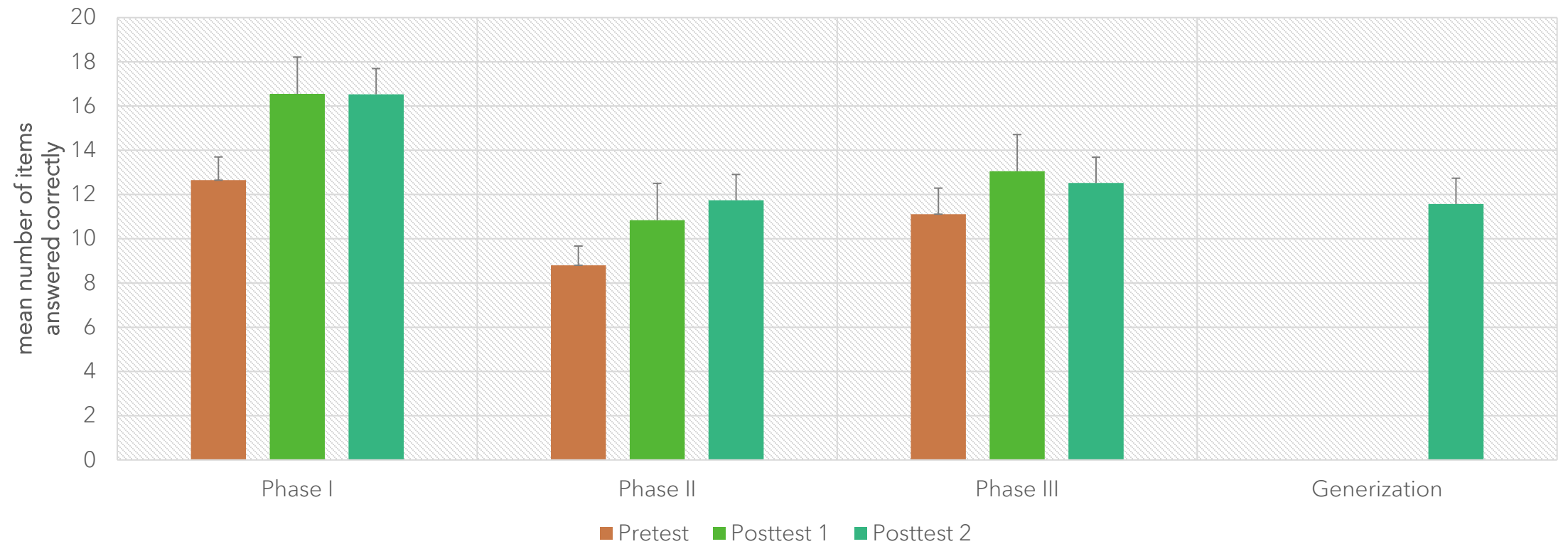
Three-phase intervention on recognition and production

- So, Wong, Cabibihan, Chan, & Qian (2016). Journal of Computer Assisted Learning

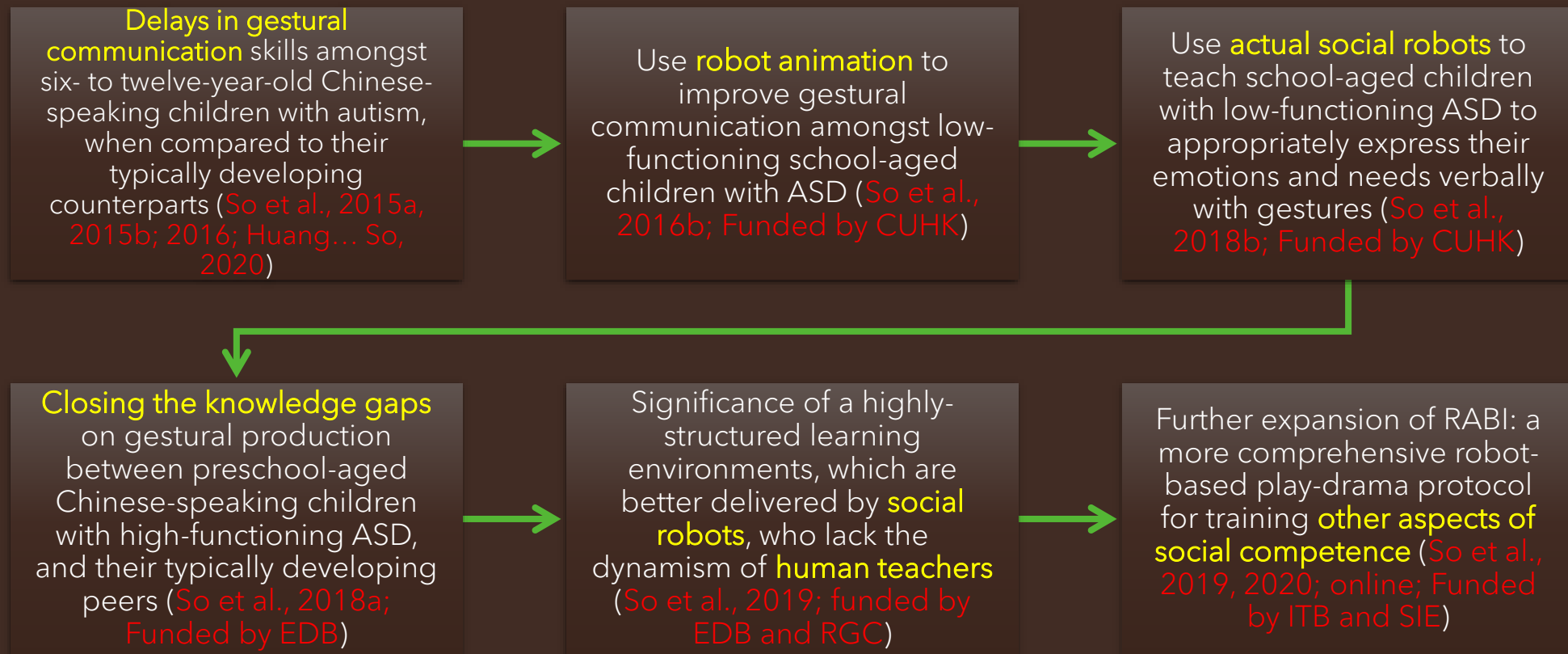




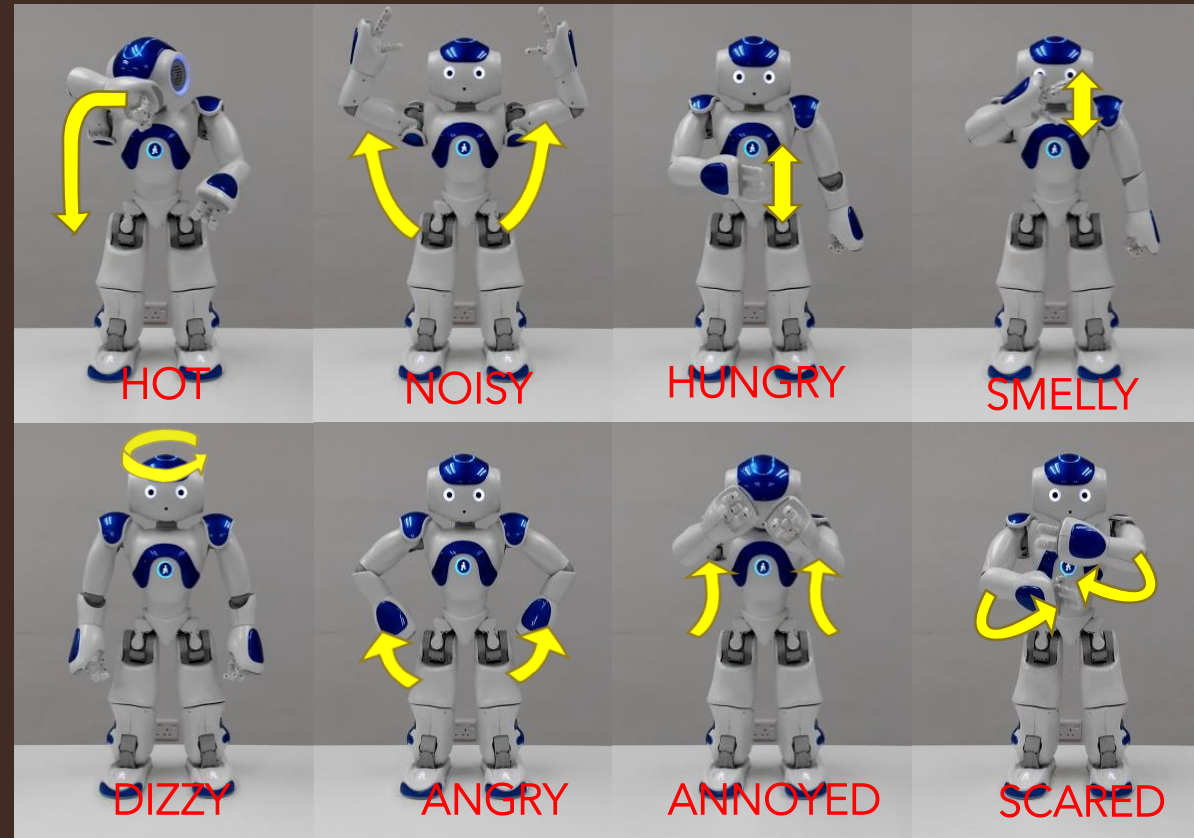
Learning outcomes in three phases



EMPIRICALLY SUPPORTED ROBOT-BASED INTERVENTIONS



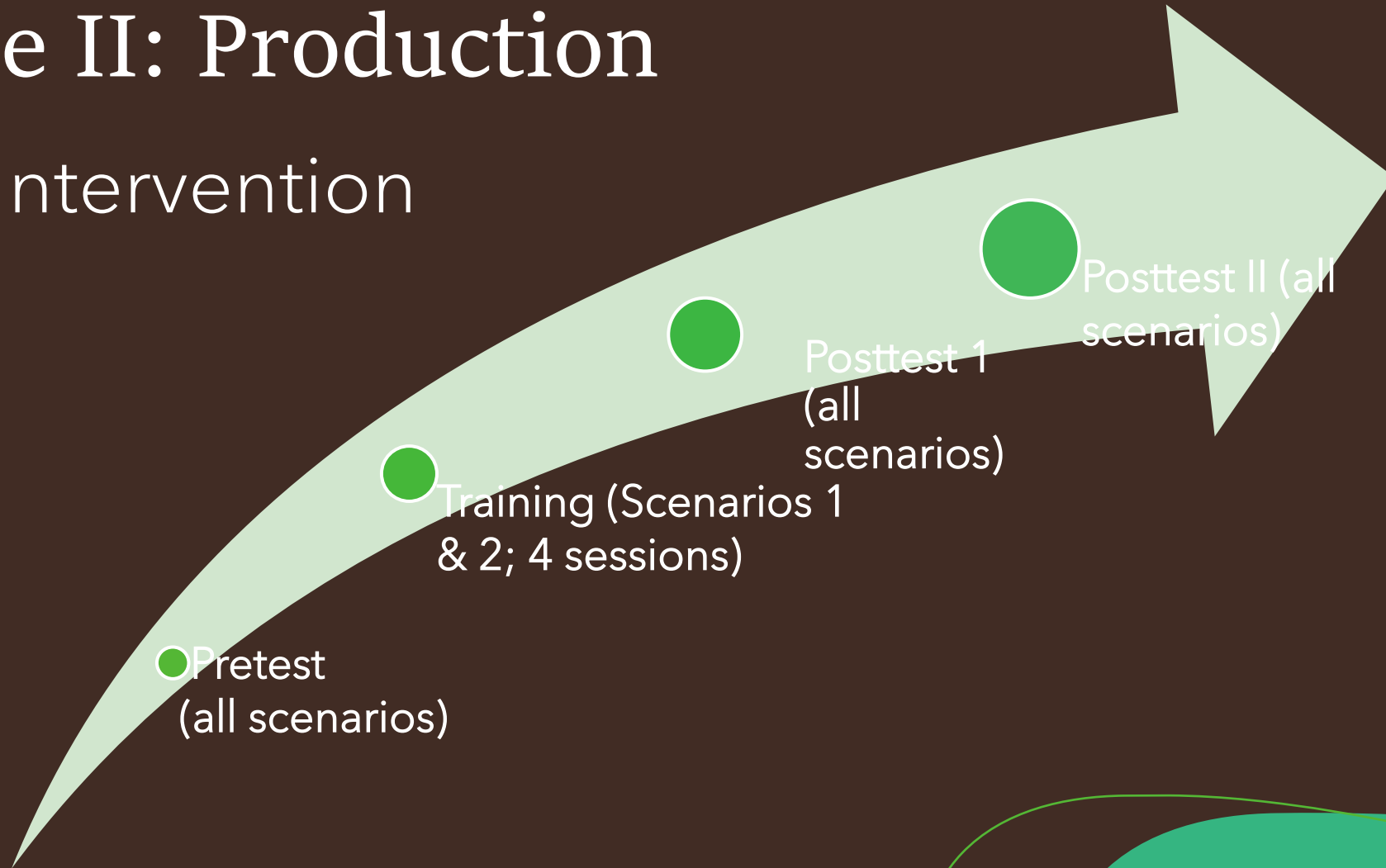
Gestures that express feelings and needs



Phase I: Recognition

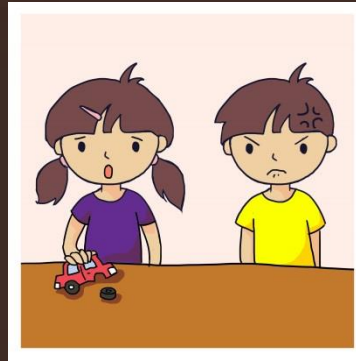
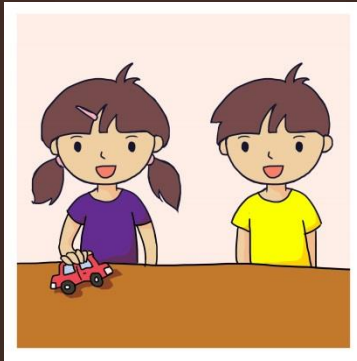
Phase II: Production

Intervention



Scenarios for Training

Scenario 1 (presented by social robot)

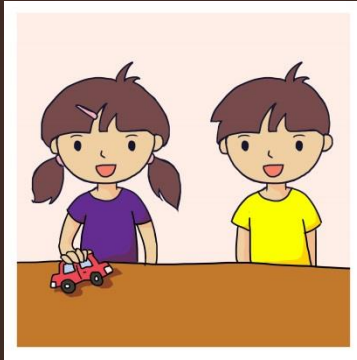


Scenario 2 (presented by social robot)

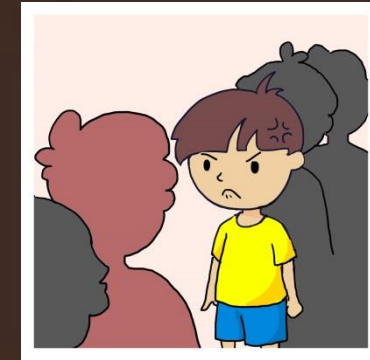


Scenarios for Training

Scenario 1 (presented by social robot)

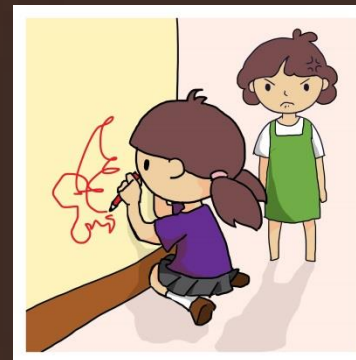


Scenario 2 (presented by social robot)

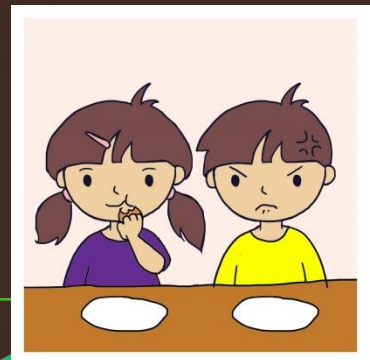
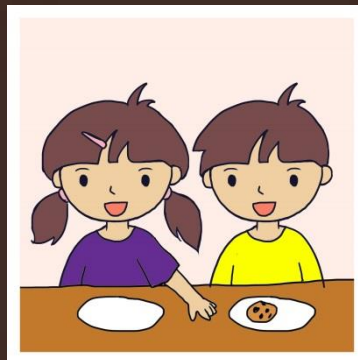


Scenarios for Testing

Scenario 3 (presented by social robot)



Scenario 4 (presented by human teacher)



Phase I: Recognition

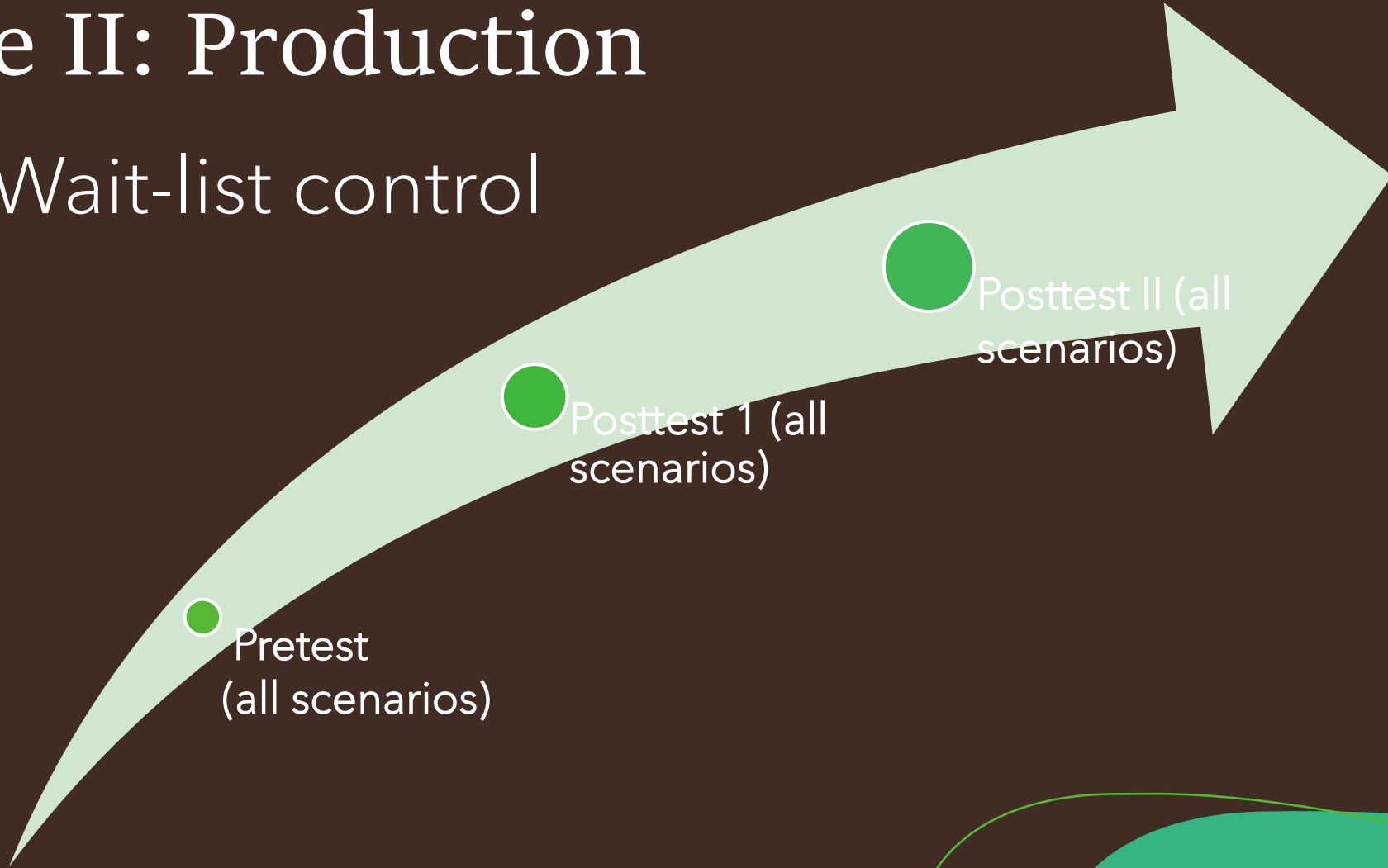
Phase II: Production

Wait-list control

Pretest
(all scenarios)

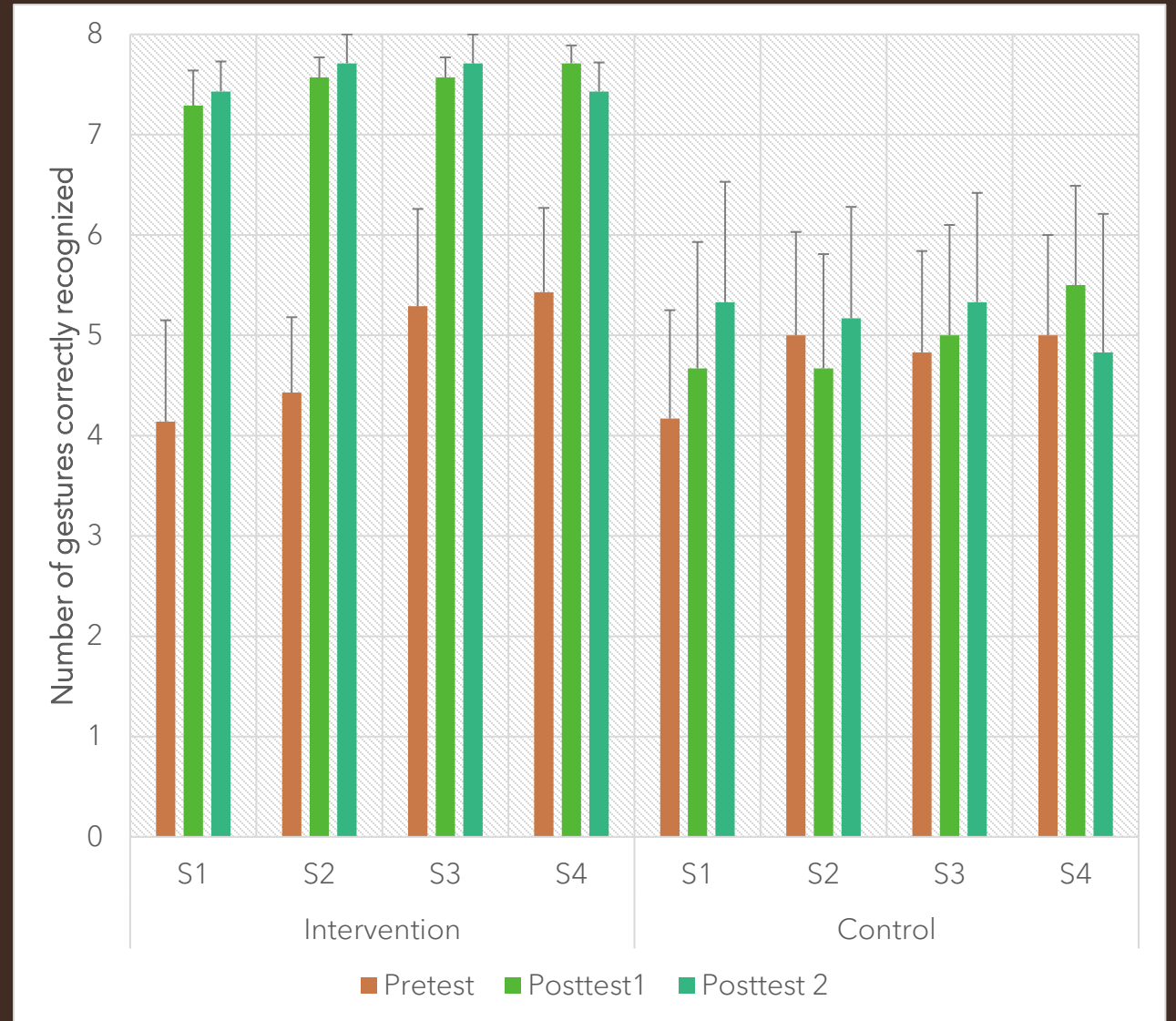
Posttest 1 (all
scenarios)

Posttest II (all
scenarios)



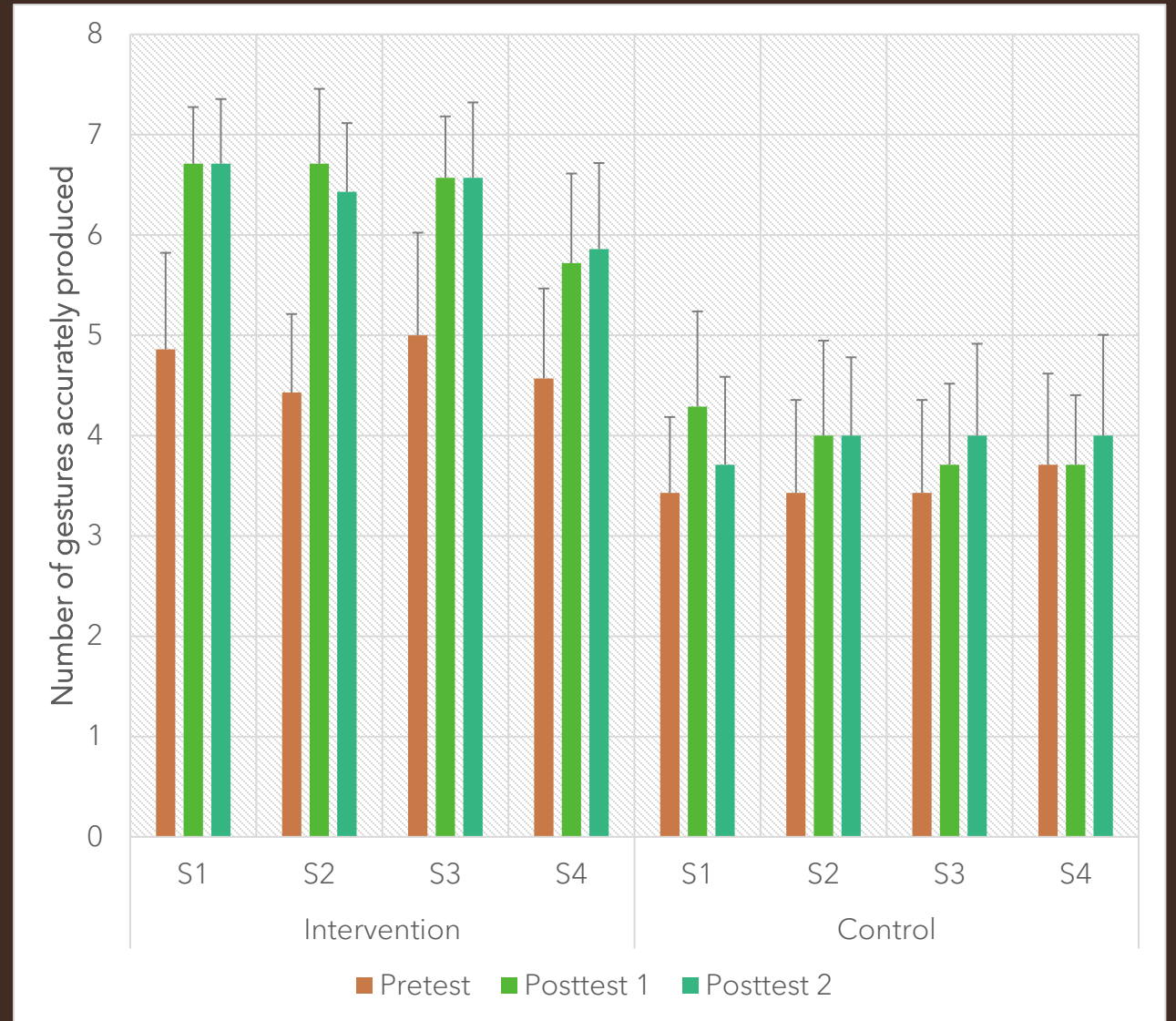
Phase I: Gestural Recognition

- Improvement in gestural recognition in the training scenarios delivered by the robot (S1, S2)
- Improvement in gestural recognition in the testing scenario delivered by the robot (S3)
- Improvement in the gestural recognition in the testing scenario delivered by the human (S4)
- All the improvements were maintained

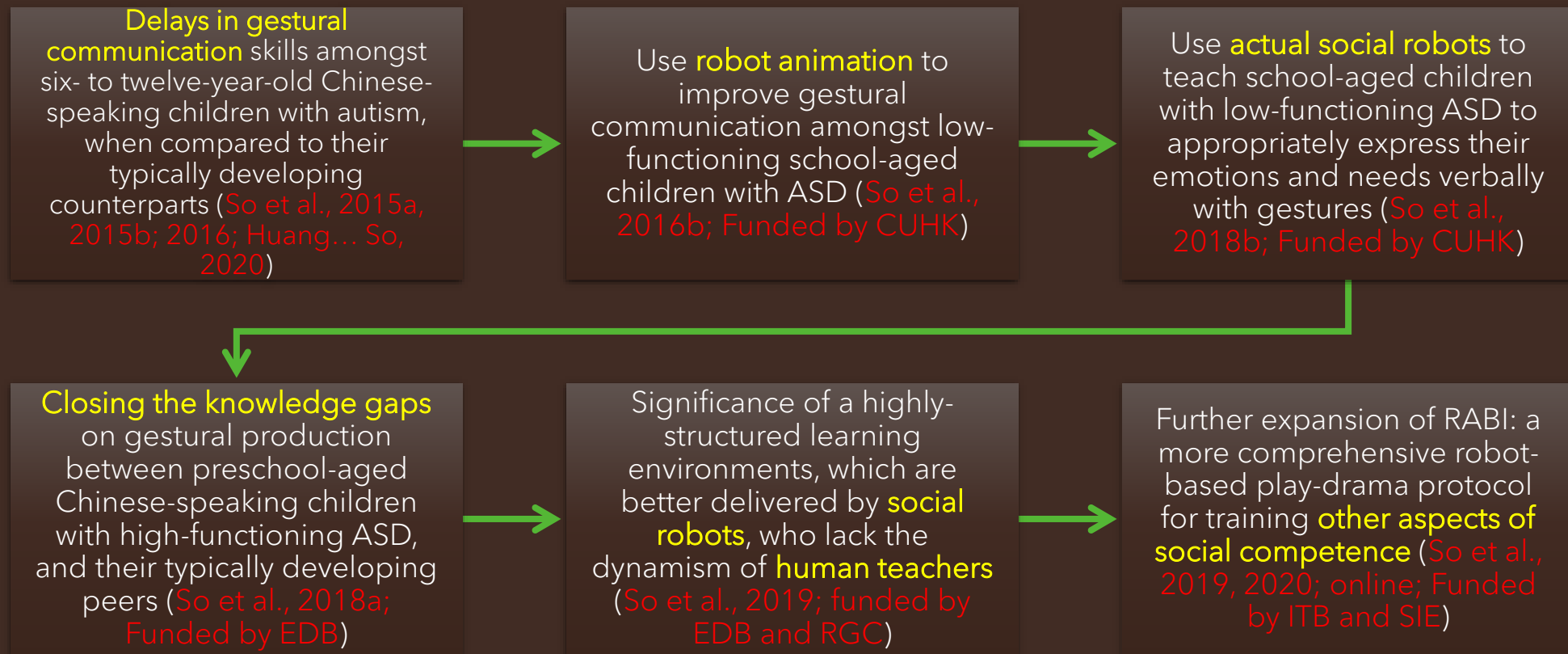


Phase II: Gestural Production

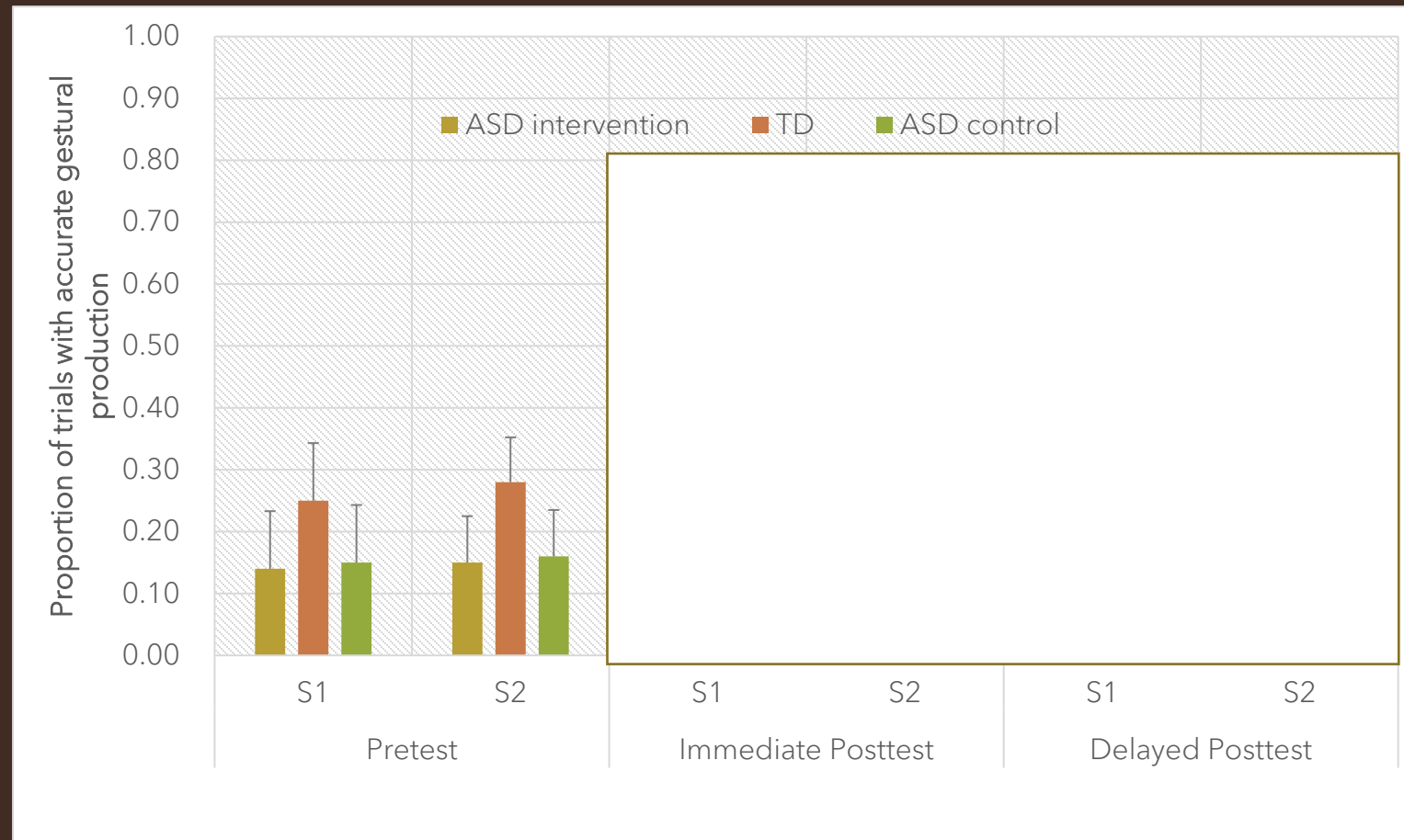
- Improvement in gestural production in the training scenarios delivered by the robot (S1, S2)
- Improvement in gestural production in the testing scenario delivered by the robot (S3)
- All the improvements were maintained



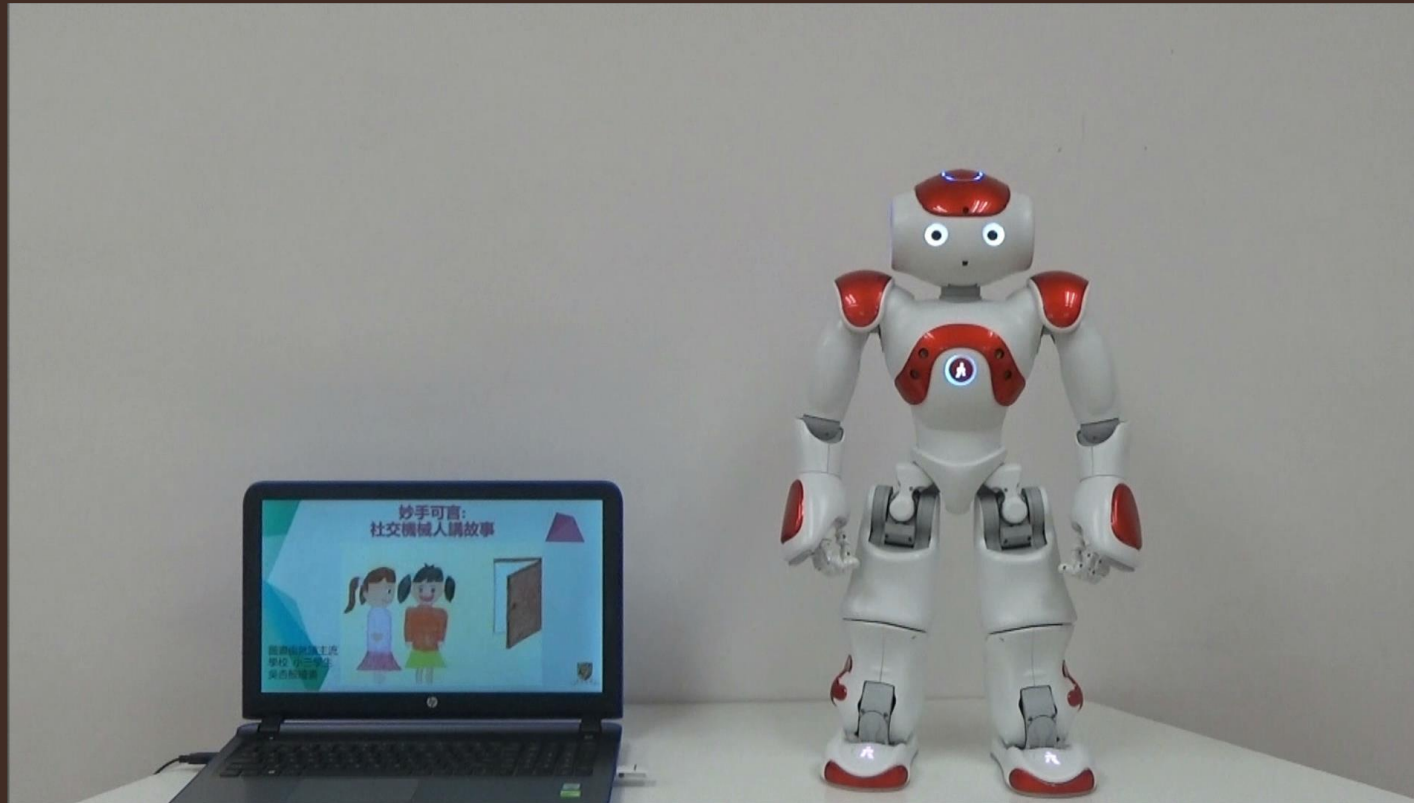
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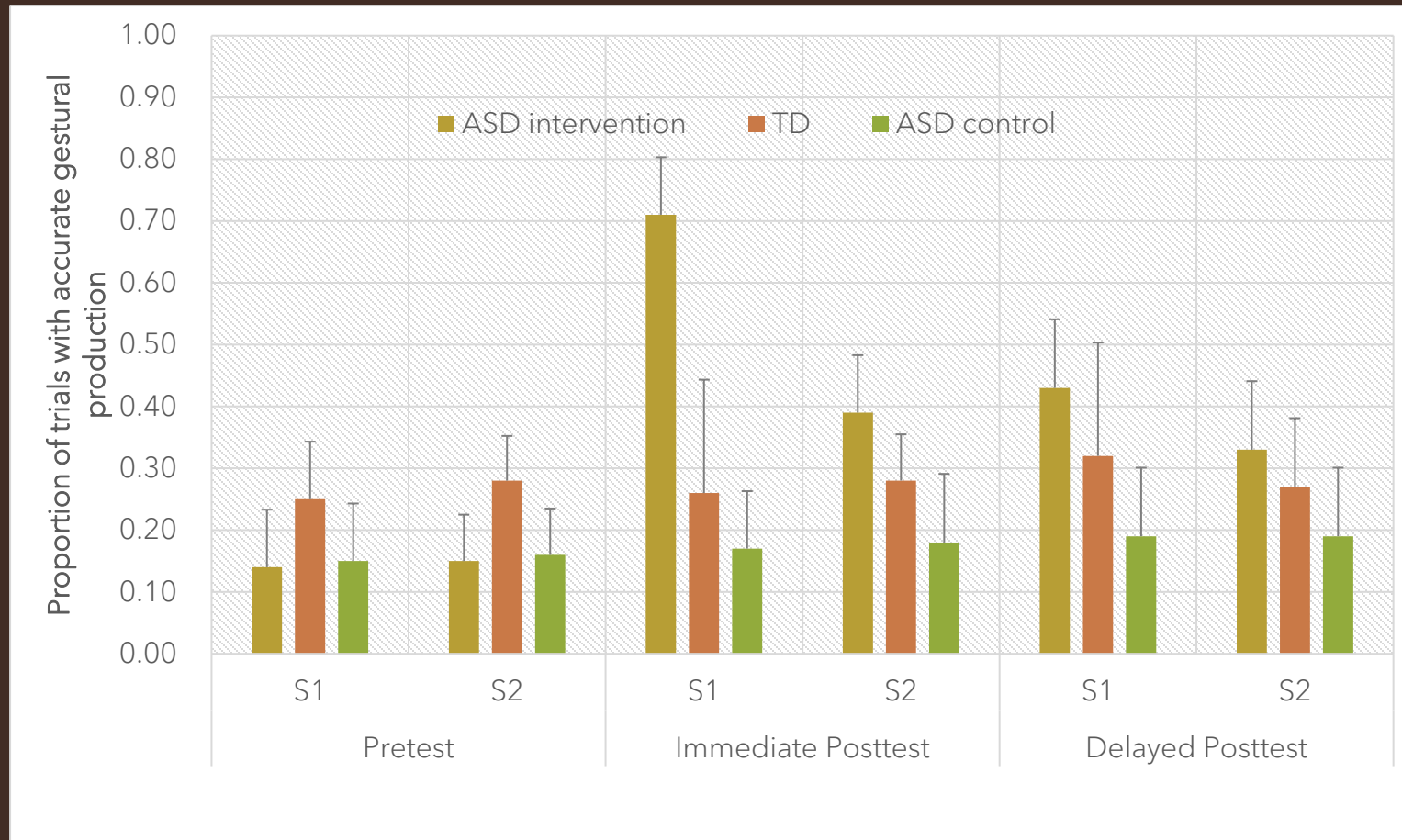
Gestures produced when narrating stories



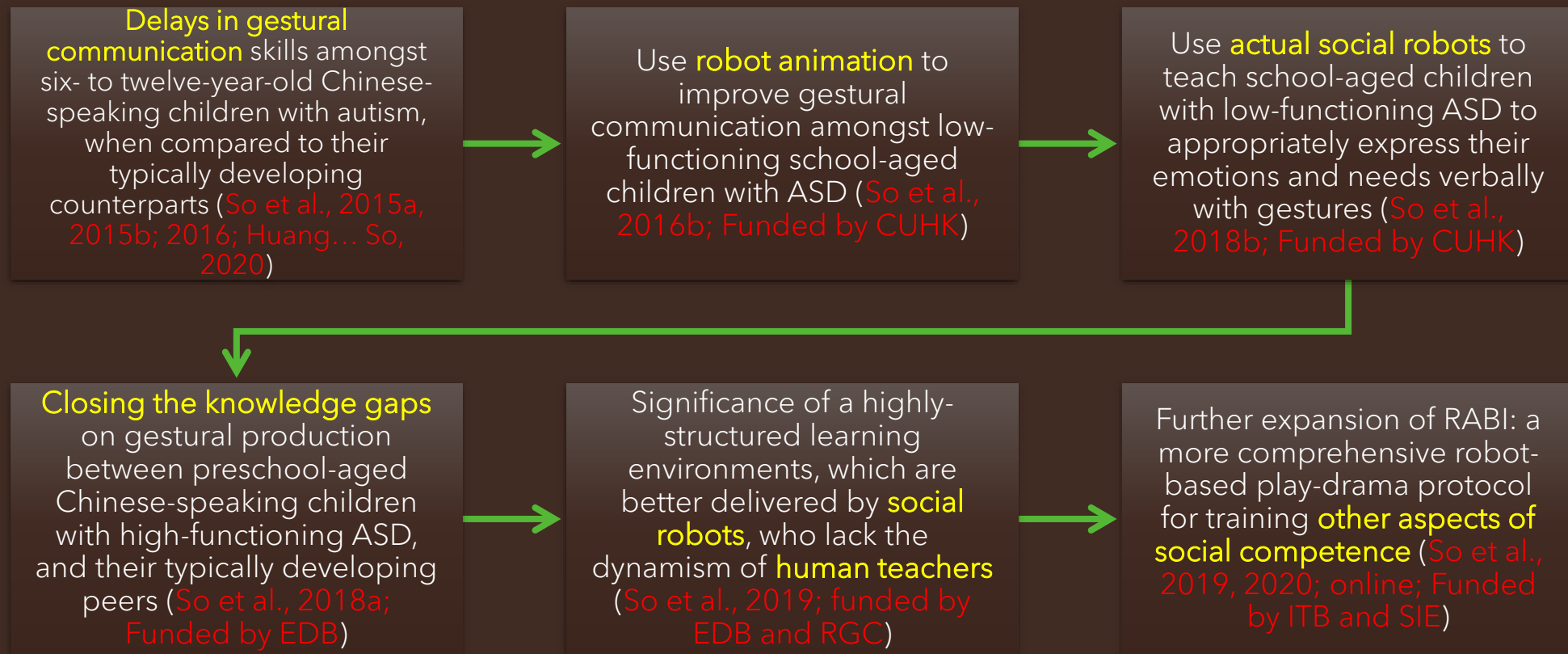
Gestures in narratives



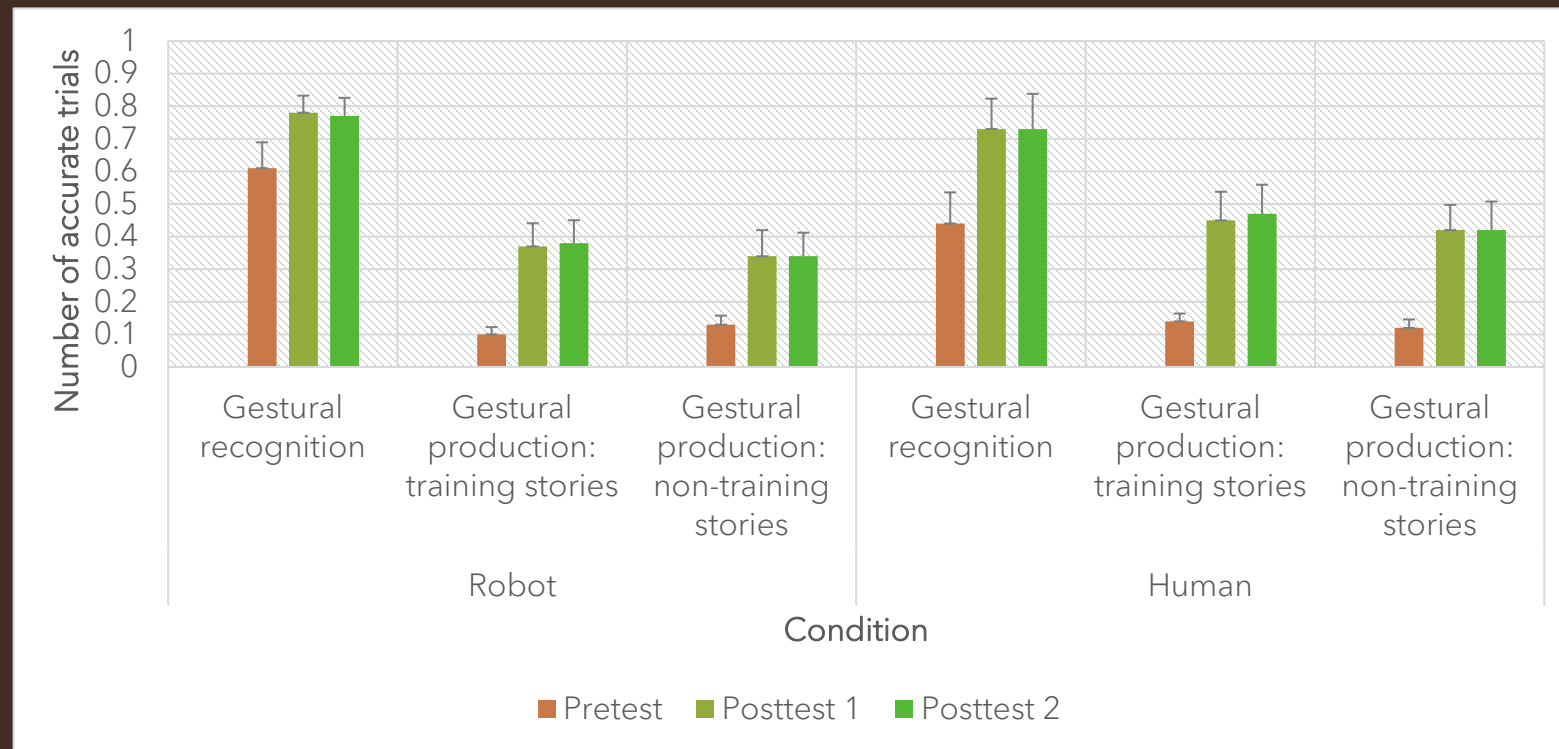
Gestures produced when narrating stories



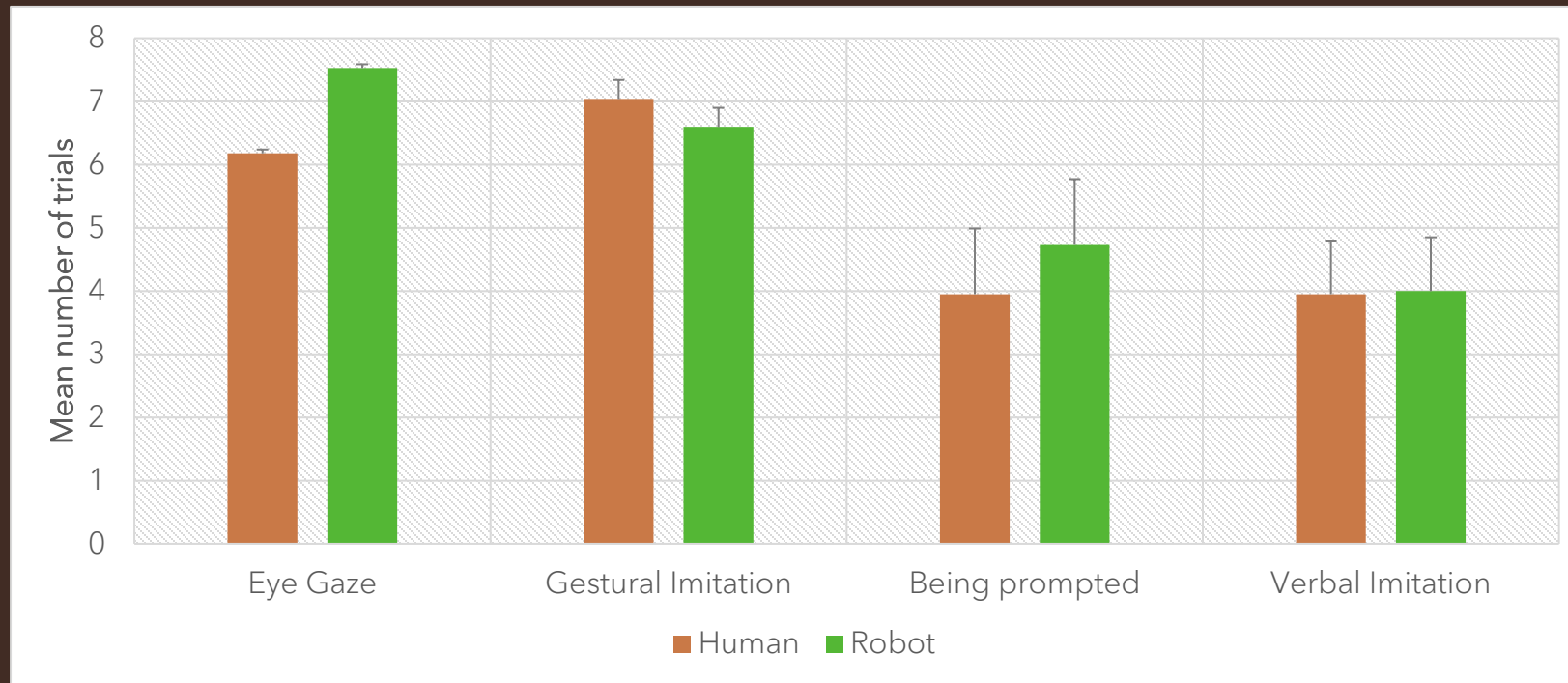
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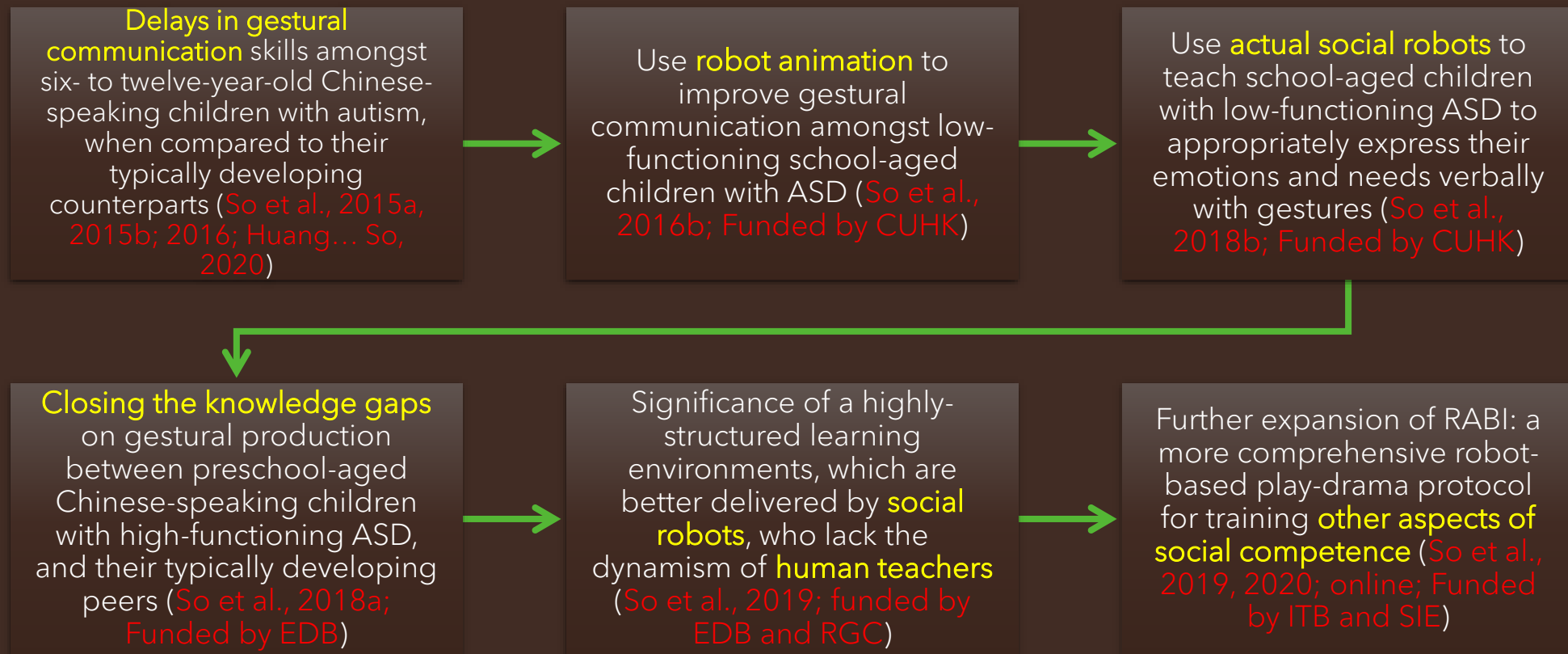
Gestures produced in conversation

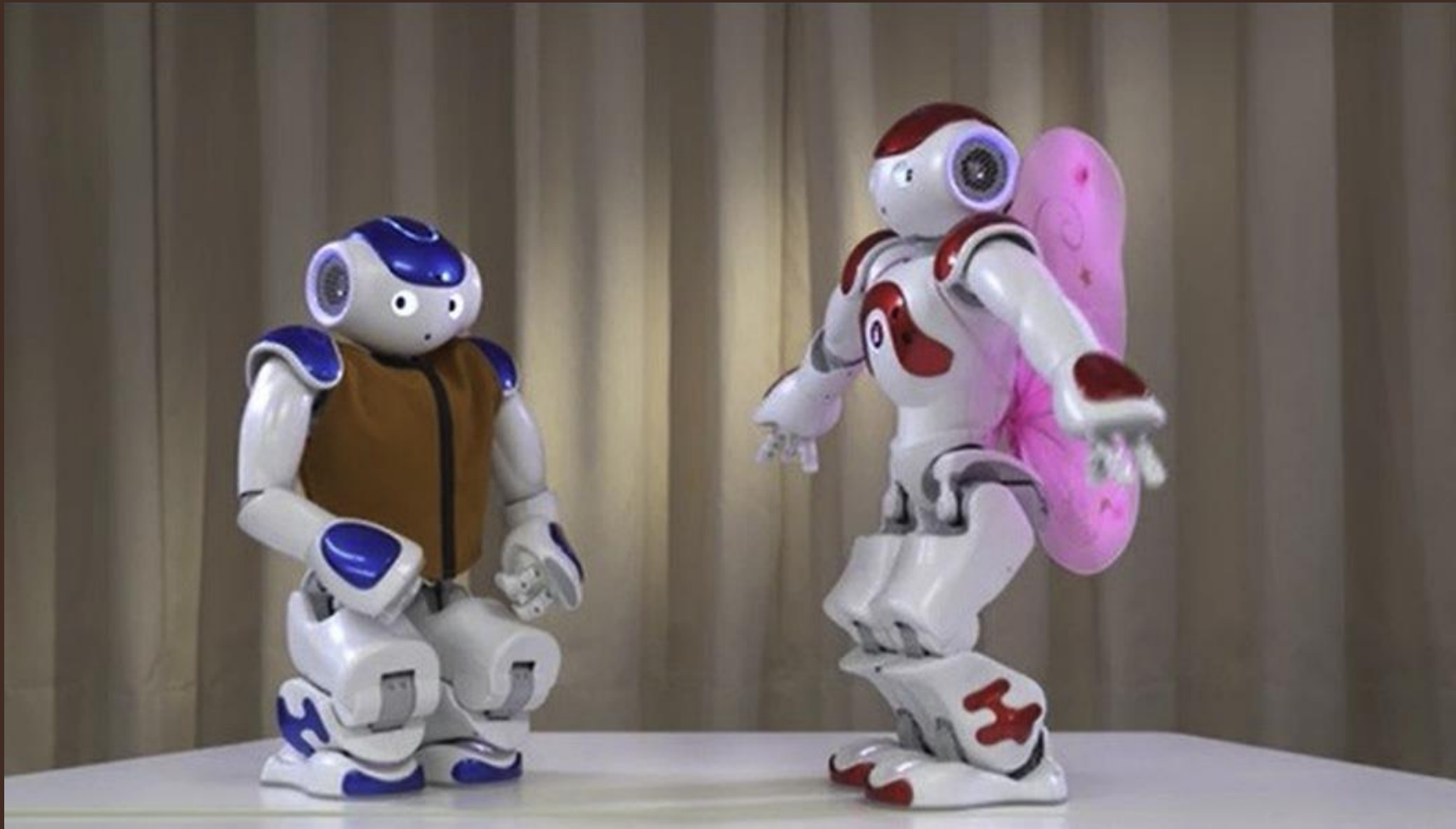


Learning behaviors during training



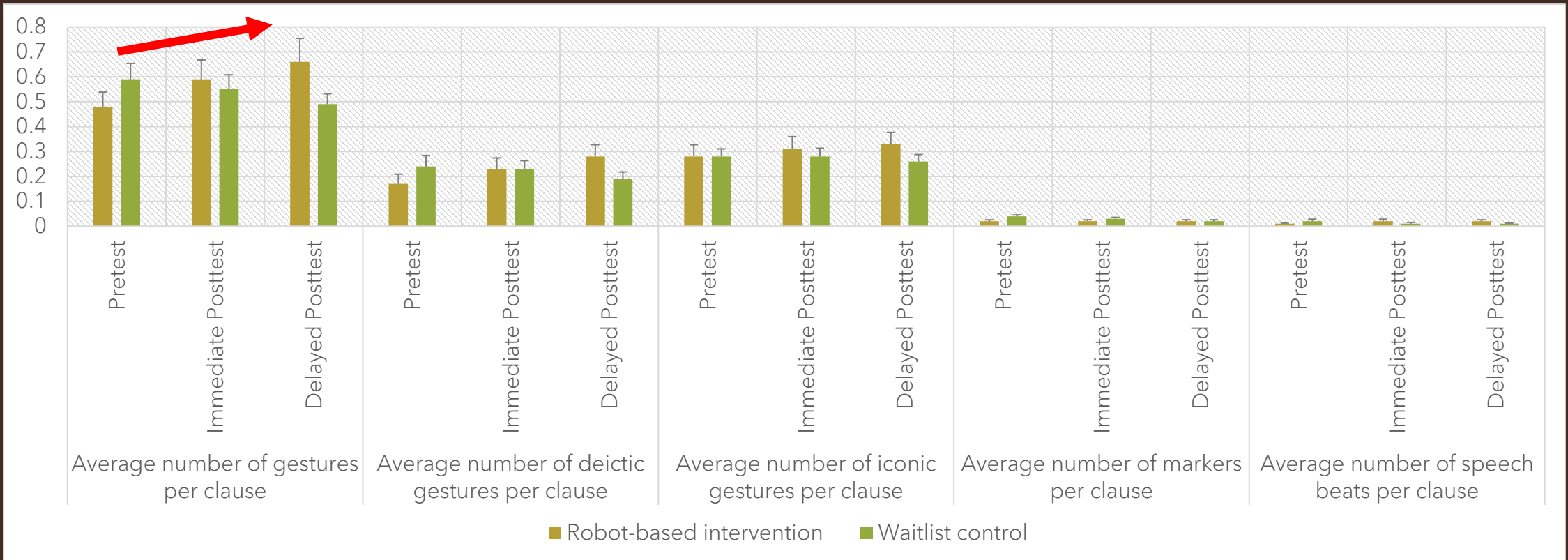
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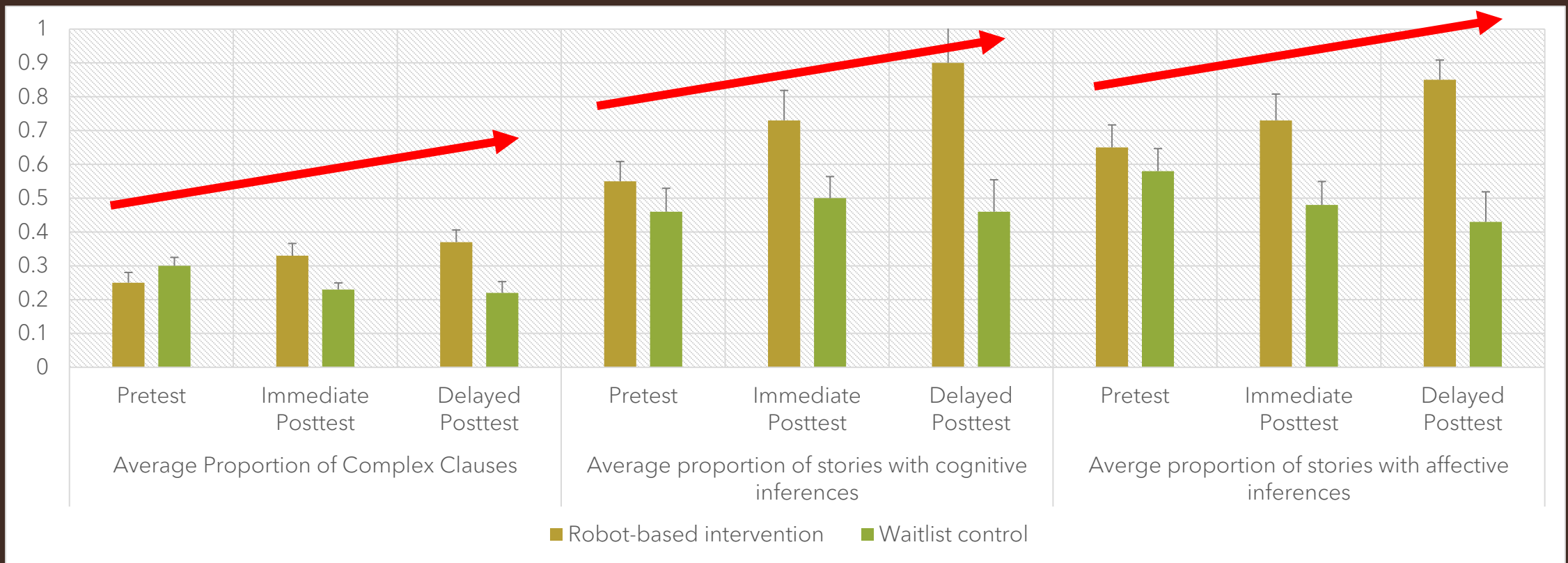




Gestures in narratives



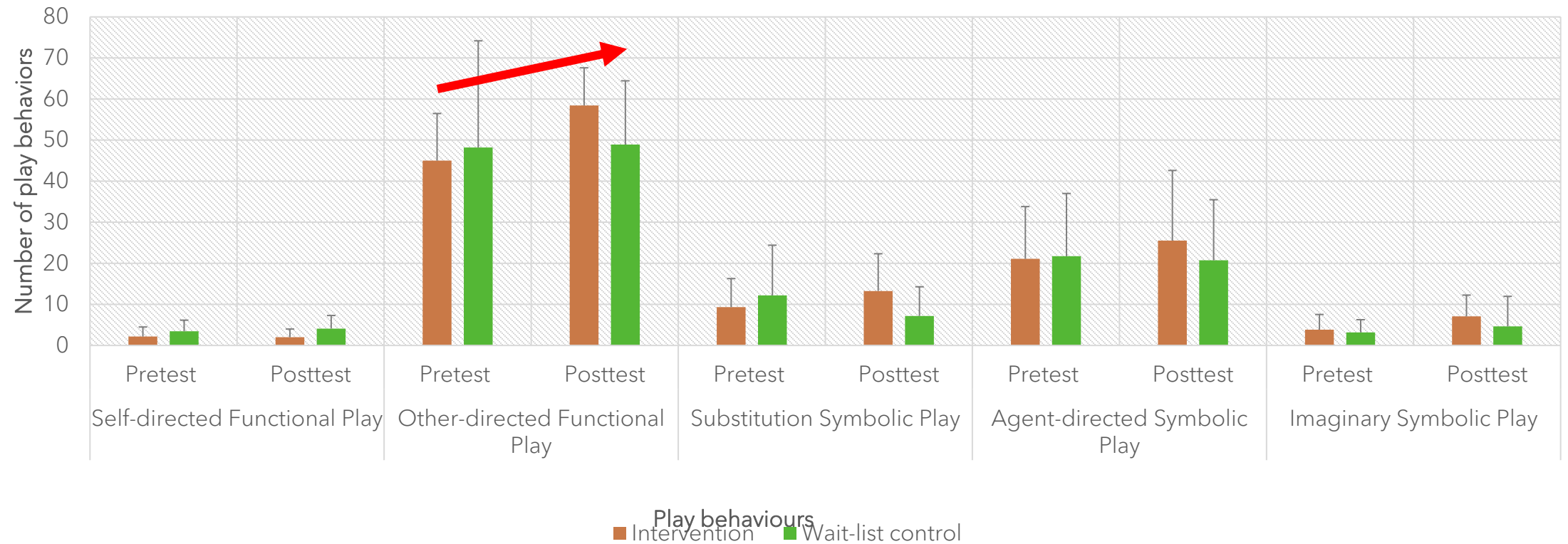
Narrative measures



Initiation of joint attention



Symbolic play behaviors



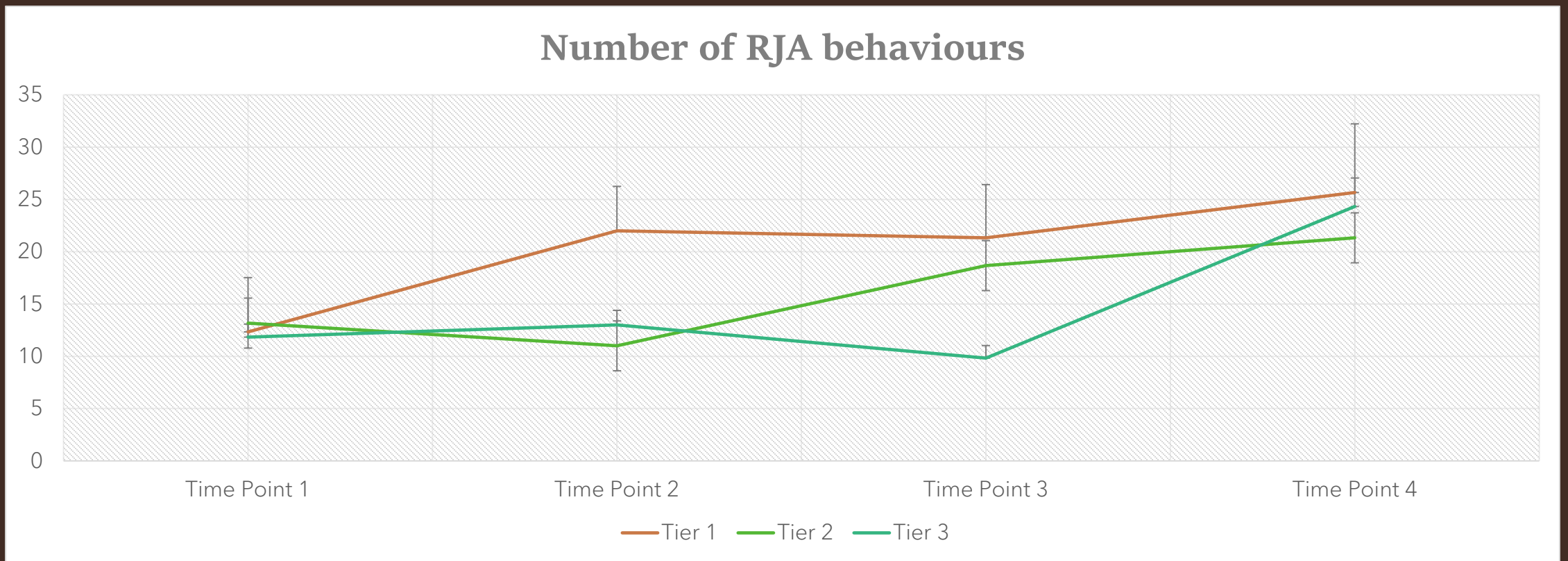


So et al., (online), Disabilities and
Rehabilitation: Assistive technology

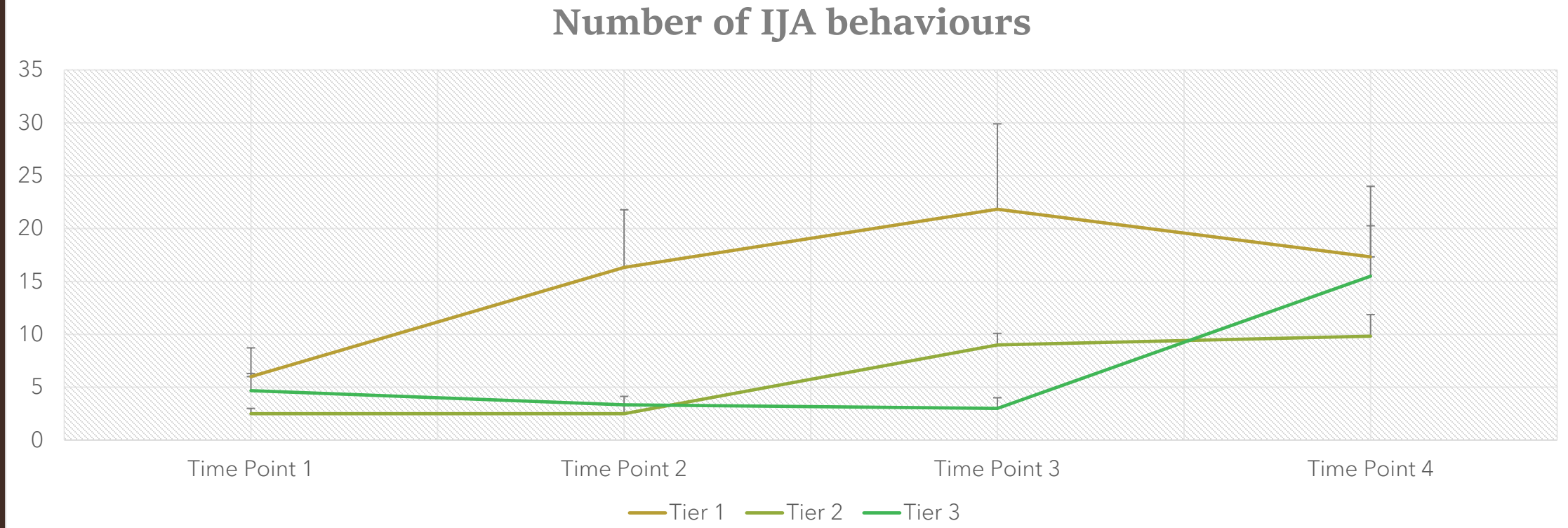
Stepped Wedge Trials

Tier	Time Point							
	1		2		3		4	
	Treatment	Assessment	Treatment	Assessment	Treatment	Assessment	Treatment	Assessment
Tier 1 (N = 6)		Pretest	Robot-based drama intervention	Posttest 1		Posttest 2		Posttest 3
Tier 2 (N = 6)		Pretest		Pretest	Robot- based drama intervention	Posttest 1		Posttest 2
Tier 3 (N = 6)		Pretest		Pretest		Pretest	Robot-based drama intervention	Posttest 1

Response to joint attention



Initiation of joint attention



Robot for Autism Behavioral Intervention (RABI) (機哥伴小星)



Fundamental

- Self-care
- Make request



Elementary

- Prosocial behaviors
- Daily-life Vocabularies (nouns, adjectives, verbs)



Medium

- Emotional understanding and expression



High

- Conversation
- Narration



Specific

- Sexual education
- Issues on social isolation and bullying

Learning through role-plays in robot dramas

Bad demonstration



Good demonstration





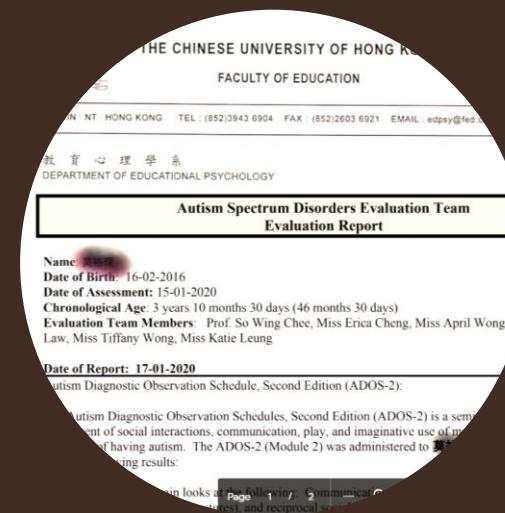
13 Mainstream primary and secondary schools



6 Non-government organizations



~1000 Individuals aged from 3 to 18 with ASD



200 Assessment reports



智趣伴星途有限公司

Science and Technology for Autism Remediation (STAR) Limited

f 登記服務

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A background image showing several colorful, stylized robots with large eyes and friendly expressions. The robots are white with various colored accents like blue, red, yellow, and green. They are arranged in a group, some looking towards the camera.

我們的RABI課程是全港首創，
經過多年的研究成果，
致力為改善自閉症學童的社交能力。

Next steps



Work towards heterogeneity of verbal and nonverbal impairments of autism



Build up language corpus for individuals with ASD aged 3 to 18 with wide ranges of autism severity and intellectual abilities



Detect contributing factors to the heterogeneity



Develop personalized robot-based intervention

Thanks to our STAR Team



Erica Cheng
導師
中大心理學碩士

我是怡儀姐，我一直致力為有特殊教育需要的兒童提供訓練，至今已逾七年經驗。我很高興能與孩子一同成長，一同面對各種困難與挑戰。



Tiffany Wong
導師
范德堡大學 (Vanderbilt University) 人力資源發展科 及 心理學碩士，哥倫比亞大學師範學院 (Teachers College, Columbia University) 發展心理學碩士

我是Tiffany姐，在美國留學的時期開始參與與自閉症兒童有關的研究項目，至今已逾六年經驗。我興趣透過研究創新的方式來發掘自閉症兒童的潛質。



Vanessa Law
導師
中大心理學碩士

我是小雲姐，我為自閉症兒童提供服務已有兩年的經驗。我很高興能與孩子們共同融入生活，仍期望未來能發掘更多孩子的特點。



Katie Leung
導師
維多利亞大學 (University of Surrey) 心理學碩士

我是Kate姐，我一直致力為有特殊教育需要的兒童提供正面的學習經驗，至今已逾三年經驗。我期望能與孩子一起愉快地學習，共同度過難關。



Samson Lam
導師
中大教育碩士 (遠東師範系碩士)

我是Sam哥哥，我很喜歡和小朋友相處。與特殊兒童學生亦有超過五年的教學經驗，現正就讀中文大學教育系 PhD，致力研究自閉症學童。



Cayleb Lee
導師
現主修中大心理學

我是Ho哥哥，有三年與特殊教育需要學生相處的經驗。現正就讀中文大學心理學碩士課程。我很喜歡小朋友，也對了解不同兒童的需要很有興趣。



Goddie Kwok
導師
現主修中大心理學

我是GOOD哥哥，家裡有很多表姊妹，經常跟他們玩耍，所以很懂得你喜歡與小朋友打成一片。現在是中文大學心理學本科三年級生，有的一年與特殊學童相處及教學經驗。



Sarah Ng
導師
中大心理學碩士

我是沙少姐，我剛畢業於中文大學心理學系。我有兩年獨自與兒童相處和教學經驗，我期望他們可以在日常生活當中運用上課學習到的知識。



April Huang
研究員
中大教育心理學系碩士

我是April姐，曾任特殊教育教師五年，過去四年我參與了自閉症兒童的評估和訓練。從事自閉症兒童語言發展及學習特點的研究，期望能與小朋友一起學習和進步。



Evelyn Lau
項目經理
中大課程學士，中大心理學碩士

我是曉姐，現正修讀性別研究碩士。過往兩年曾參與自閉症兒童的中文寫作訓練和研究。我期望自己能做好同行者角色，與孩子一起成長。



Tina So
項目主任
中大計算機科學碩士

我是Tina姐，家中有一小朋友有自閉症，明白自閉症兒童同小朋友面對社會和學習上的種種不同困難和挑戰。我期望透過HA的課程向大家一齊進步。



Cassandra Lee
工程師
中大計算機科學碩士

孩子叫我彤彤姐，負責教學、程式和技術支援，能名正言順以「玩」機械人為工作（為樂）的彤彤。平日教職中指導過特殊需要學生，也樂意協助教學活動。