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Behavioural changes in the interaction between child with autism spectrum disorder and mother through the Comprehensive Care Humanity™ intervention

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Abstract

The number of children with autistic spectrum disorder (ASD) has increased. ASD children are characterised by their refusal to change and difficulty in changing their responses to different social situations, which make it difficult for them to communicate with others, including their parents. We applied the comprehensive care technique Humanity™ to mothers of children with ASD to support them from a multimodal communication perspective. Changes in mother-child communication were analysed in terms of mother-child gaze and the time the mother-child spent playing together. The results indicate that after the intervention with Humanity™, there were significant differences in eye contact, mothers looking at their children, and children looking at their mothers. There was also a decrease in the amount of time children spent playing alone was found. There was a high correlation between pre and post-Humanity™ intervention in the amount of time both mothers and children spent looking at each other, which suggests that incorporating multimodal communication can affect communication between parents and children.

Keywords: Humanity™; Developmental Disorder; eye contact; Autism Spectrum Disorder (ASD); mother-child interaction; multimodal communication

Introduction

Autism Spectrum Disorder (ASD) describes deficits in social communication and interpersonal interactions and limited, repetitive modes of behaviour, interest, or activity that are present from early development (Edition et al., 2013). The prevalence of ASD has been on the increase since the 1990s, and in the last decades, a large increase in the prevalence of Autism Spectrum Disorder (ASD) (Fombonne, 2020, 2001). A survey conducted in the United States reported 20 times increase in 2020s (Brugha et al., 2011; Mottron & Bzdok, 2020) and increasing social concern (Davidson et al., 2015; Follan et al., 2011; Gargaro, Rinehart, Bradshaw, Tonge, & Sheppard, 2011; Sadiq et al., 2012). The symptoms of ASD are on a continuum (spectrum) and various comorbidities are known, including intellectual disability and other neurodevelopmental disorders (Hepburn, Stern, Blakeley-Smith, Kimel, & Reaven, 2014; Hofvander et al., 2009; Maddox & White,

2015; Croen et al., 2015; Lever & Geurts, 2016). Therefore, it is essential to provide individualized support in clinical practice (Council et al., 2001). This is also emphasized in family support for ASD children.

Many children with ASD are less likely to initiate and maintain interpersonal interactions on their own to establish social bonds from early development, and such ASD characteristics have been reported to be related to caregiver stress (Abbeduto et al., 2004; Dumas, Wolf, Fisman, & Culligan, 1991; Smith et al., 2010; Baker-Ericzén, Brookman-Frazee, & Stahmer, 2005). Rivard & et al. reported that children's age, the severity of ASD symptoms, and adaptive capacity are related to parental stress. They also reported that parental stress affects both parents and children (Rivard, Terroux, Parent-Boursier, & Mercier, 2014). In other words, carrying out interventions that focus on the parent-child relationship by not only intervening with children with ASD but also with their parents. Parent-child communication is especially important during early childhood when play between parents and children is the best way to provide a foundation for communication, as children with ASD are not able to verbalize well. However, because children with ASD tend to pay more attention to objects than to people during play, it is not uncommon for caregivers to struggle with interpersonal interactions with these children (Dawson et al., 2004).

We investigated supporting mother-child interaction from the perspective of multimodal communication regarding free play, in which interpersonal responses and interactions based on internal triggers are considered more likely to occur. Multimodal communication has been shown to promote interpersonal communication in early childhood and may promote interpersonal responses and be effective in mother-child interactions in children with ASD (Gogate, Bahrick, & Watson, 2000). Therefore, we tested whether teaching Humanity™ to mothers of preschool children with ASD would lead to changes in mother-child interaction during free play.

Humanitude™

Humanitude™ is a comprehensive perceptual, emotional, and verbal care technique based on the philosophy of ‘what is a carer’ and ‘what is a person’ proposed by Gineste and Marescotti and practiced using a single sequence consisting of four concrete basic actions and five steps. Specifically, it focuses working on the human characteristics of eye contact, speaking, touching, and standing, and continuously communicating these as verbal and non-verbal messages, always using multiple technologies (Gineste & Pellissier, 2007; M. R. Honda M. & Gineste, 2014; M. Honda, Ito, Ishikawa, Takebayashi, & Tierney, 2016; Ito & Honda, 2015). This can help build positive relationships with people who have difficulty communicating verbally.

Materials and Methods

For ASD children and their parents, we tested whether there was a change in parent-child communication before and after the intervention of teaching the technique of Humanitude™ to them. Then ASD children attending a child development support center and their parents were recruited. The ASD children participants were 6 boys and 4 girls ranging from 3 to 7 years old. As for the parents, all of the participants in this experiment were mothers.

Measure

All mother participants filled out and submitted the SRS-2 questionnaire included in the tool Vineland (Tests to assess adaptive behaviour at 0 years 0 months to 92 years 11 months). SRS-2 is used to objectively quantify the level of adaptive behaviour of people with developmental, intellectual, or mental disabilities on the basis of the adaptive behaviour of the general population of the same age (Roopesh, 2019). A 4-point Likert scale was used for the SRS-2, and the responses were collected before the experiment.

To measure the physical behaviour of the mothers and children. We then retrieved face-to-face distance, the occurrence of eye contact between parent and child, the amount of time both parties looked at the other, and the amount of time they spent playing together was obtained from videos recording during the experiment.

Apparatus

To reduce the psychological burden on the children (Wing, 2002), we conducted the experiment in a classroom at a child development support center attended by children with ASD. To record the mothers and children playing, four RICO THETA cameras were set up in the experimental room (Figure 1), which are capable of capturing full-dome video to record children moving around when they play. The four cameras were mounted as shown in Figure 1, with two hanging from the ceiling on the east and west sides of the room and the other two on the floor on the north and south sides. This was to ensure that the line of sight can be seen by either camera, whether the mother-child is playing seated or standing.

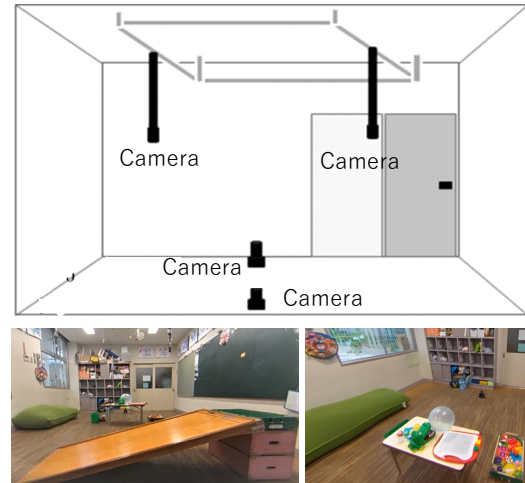


Figure 1: Experimental setup (playroom)

Toys for the mothers and children to play with were set up in the room for use during the experiment. Nine types of toys were used, including balloons, crocodile toys, play sets, and Lego (Figure 1).

Procedure

Figure 2 shows an overview of the experiment. In the beginning, the participants answered the SRS-2 questionnaire. A pre-experiment was then conducted to understand the relationship between the mothers and children before the intervention with Humanitude™. Humanitude™ lectures were then given to the mothers. Three weeks later, feedback was given by the Humanitude™ instructor on the mother-child situation in the pre-experiment. This is hereinafter referred to as interim feedback. The mother-child play session was then filmed in the same setting as the pre-experiment. Six weeks after the second experiment, feedback was given on the mother-child situation in the second experiment. This is hereinafter referred to as the final feedback. The mother-child play session was then filmed in the same setting as a post-intervention evaluation of the Humanitude™ intervention. Between the pre-experiment and the post-experiment, parents were asked to communicate with their children at home, keeping Humanitude™ in mind.

The room's 360-degree video camera and toys were arranged the same way. We conducted a 3-hour lecture on Humanitude™ (M. R. Honda M. & Gineste, 2014) for the parents after pre-experiment, and on the four pillars of Humanitude™, “seeing”, “speaking”, “touching” and “standing assistance”, we particularly focused on “seeing”, “speaking” and “touching”, which are considered important for multimodal communication in children with ASD.

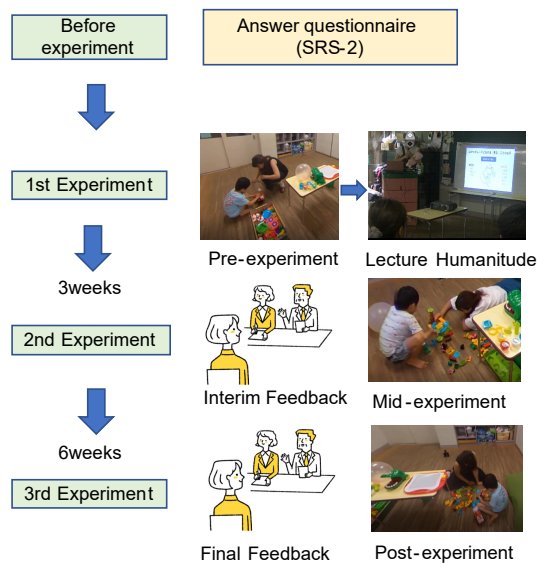


Figure 2: Overview of experiment

Analysis

The free-play videos of mother-child taken before and after intervention with Humanitude™ were included in the analysis. The analysis period was 15 minutes from the time the mother-child entered the room and the start of play until the end of play. To examine whether mothers and children were playing together, we annotated the mother's gaze (hereafter, parental gaze), the child's gaze, and whether the child was playing with the parent, using ELAN(Sloetjes & Wittenburg, 2008). The annotated items, their annotations, and explanations of the annotations are as follows.

- Parental Gaze
 1. Part: the part of the person you are looking at.
 2. Eyes: When it can be determined that the mother is looking into the child's eyes. when it is difficult to tell that a mother is looking at the child, but it is possible to determine that she would be looking into the child's eyes.
 3. Body: When the mother looks at the child's body. When she is looking at the child's face but cannot be determined that she is looking into the child's eyes.
- Distance (from children)
 1. 50cm: When the distance from the child is within 50cm.
 2. Over 50cm: When the distance from the child is over 50 cm.
- Child's gaze
 1. Part (the part of the person you are looking at)
 2. Eyes: When it can be determined that the child is looking into the mother's eyes. when it is difficult to tell that a child is looking at the mother, but it is possible that he/she may be looking into the mother's eyes.

3. Body: When the child looks at the mother's body. When he/she is looking at the mother's face but cannot determine that he/she is looking into her eyes.

- Distance (from parent)
 1. 50cm: When the distance from the mother is within 50cm.
 2. Over 50cm: When the distance from the mother is over 50 cm.
- Are children playing with their mothers or not?

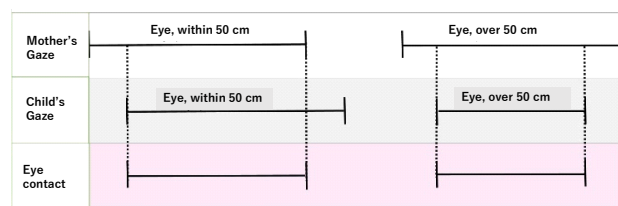


Figure 3: Eye contact determined with system

From the annotation data, we determined the total time of mother-child eye contact and the total time that parents and children played together. Using ELAN, we extracted the start time, end time, interval between annotations, and content of each annotation from the annotation data attached to the videos and calculated the time of eye contact and the time the mothers and children played together. The mother-child gaze was categorized by distance, and the times during which the parent and child looked into the other's eyes overlapped were determined, as shown in Figure 3. We also classified the data into two categories in accordance with the annotation of playing with mothers and playing alone and divided the time for each. The eye distance between the mother-child was annotated within or over 50 cm with reference to the width of the table because the width of the table shown in the video is 50 cm.

Results

Changes in gaze time before and after the intervention with Humanitude™ are shown.

Figures 4 and 5 show the variation in eye contact time within 50 cm and at all distances between mother-child eye contact. The average duration of eye contact between all mothers and children increased significantly. Significant differences were found both within 50 cm (Pre: 17.88, Post: 61.79, $p=0.0068$) and at all distances (Pre: 25.22, Post: 86.09, $p=0.0072$).

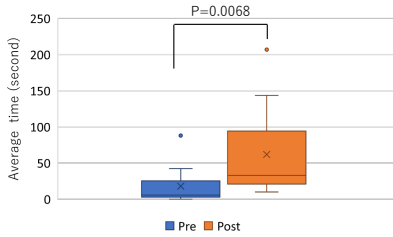


Figure 4: Total changes in eye contact (distance <50cm)

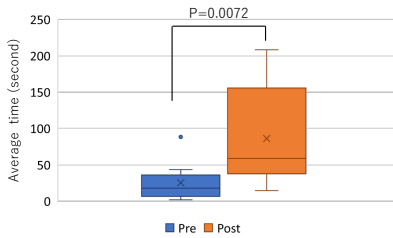


Figure 5: Total changes in eye contact (all distances)

Figures 6 and 7 also show changes in the time that the mother looks at the child at an eye distance of less than 50 cm and at all distances, respectively. For all mothers and children, the amount of time mothers watched their children increased significantly. Significant differences were found both within 50 cm (Pre: 17.88, Post: 61.79, $p=0.0068$) and at all distances (Pre: 17.88, Post: 61.79, $p=0.0068$).

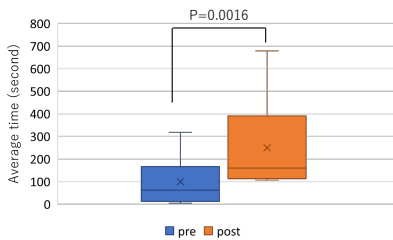


Figure 6: Total changes in parental gaze (distance <50cm)

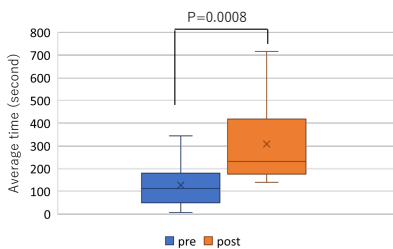


Figure 7: Total changes in parental gaze (all distance)

Figures 8 and 9 also show changes in the time that the child looked at the mother at an eye distance of less than 50 cm and

at all distances, respectively. For all mothers and children, the amount of time children looked at their mothers increased significantly. Significant differences were found both within 50 cm (Pre: 32.15, Post: 68.93, $p=0.005$) and at all distances (Pre: 49.77, Post: 94.27, $p=0.004$).

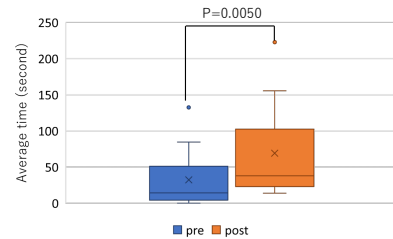


Figure 8: Total changes in child's gaze (distance <50cm)

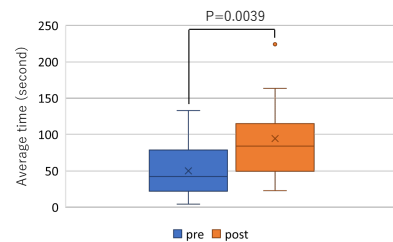


Figure 9: Total changes in child's gaze (all distance)

Figure 10 shows the change in the time mothers and children played together. There were no significant changes.

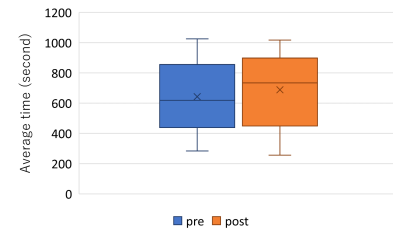


Figure 10: Total changes in child's gaze (all distances)

Figure 11 shows the change in the amount of time children played alone. Although no significant differences were found, the time spent playing alone decreased in the post-experiment.

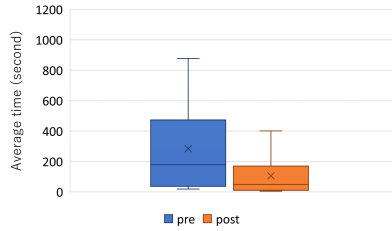


Figure 11: Total changes in child’s gaze (all distances)

There were large individual differences in the amount of time mothers and children spent watching each other. To investigate the factors behind this, the scatter plots in Figures 12, 13, 14 and 15, 16 and 17 show the pre (first session) and post (third session)-experiments for the time spent looking at each parent and child.

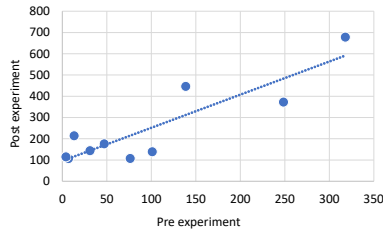


Figure 12: Correction coefficients between pre and post-experiment of parental gaze (distance <50 cm)

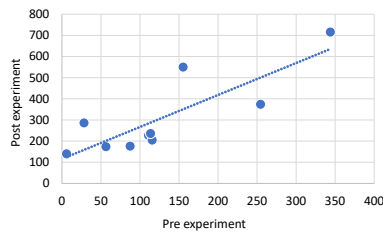


Figure 13: Correction coefficients between pre and post-experiment of parental gaze (all distances)

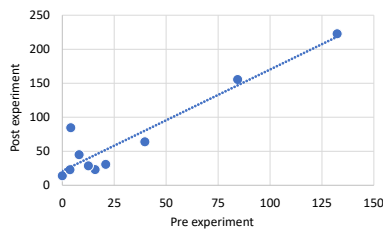


Figure 14: Correction coefficients between pre and post-experiment of child’s gaze (distance <50 cm)

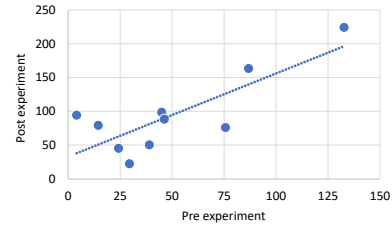


Figure 15: Correction coefficients between pre and post-experiment of child’s gaze (all distances)

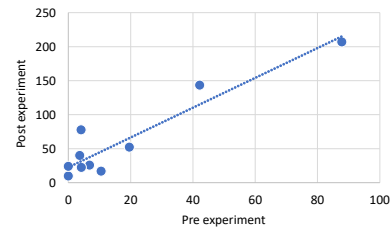


Figure 16: Correction coefficients between pre and post-experiment on eye contact (distance <50 cm)

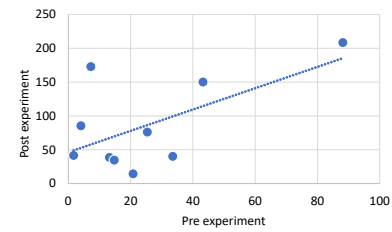


Figure 17: Correction coefficients between pre and post-experiment on eye contact (all distances)

Correlation coefficients were also obtained to examine the relationship between the pre and post-experiment. The correlation coefficients were 0.864 in Figure 12, 0.800 in Figure 13, 0.940 in Figure 14, 0.801 in Figure 15, 0.938 in Figure 16, and 0.603 in Figure 17, there are correlated all gazes. However, eye contact (all distances) had low correlations. To investigate the cause of this high correlation, Table 1 lists the results of determining the correlation coefficients between changes in parental gaze, child’s gaze, and eye contact, and changes in frequency and average time.

Table 1: Correlation coefficients between changes in parental gaze, child gaze, and eye contact and changes in frequency and mean time

	Eye Contact 50 cm	Eye Contact All	Parental gaze 50 cm	Parental gaze All	Child’s gaze 50 cm	Child’s gaze All
Count	-0.1556	0.687	0.309	0.217	-0.076	0.466
Ave Time	0.4134	0.407	0.44	0.446	0.412	0.451

However, we could not identify any high correlation between the difference between pre and post-experiment of eye contact, parental gaze, and child's gaze, and the frequency and average time.

Table 2 summarizes the correlation coefficients with the SRS-2.

Table 2: Correlation between gaze change and SRS-2

	Total Score	SCIT	Awareness	Cognition	Communication	Motivation	RRB
Eye Contact (50 cm)	0.471	0.45	0.423	0.533	0.289	0.313	0.633
Eye Contact (All distances)	0.139	-0.073	0.721	-0.166	0.489	-0.254	-0.022
Parental gaze (50 cm)	0.068	0.068	0.067	-0.206	0.269	-0.052	0.258
Parental gaze (All distances)	0.139	-0.073	-0.022	-0.166	0.489	-0.254	-0.022
Child's gaze (50 cm)	0.519	0.519	0.268	0.588	0.344	0.329	0.708
Child's gaze (All distances)	-0.019	0.003	0.387	-0.169	0.391	-0.366	-0.111

The results indicate a high correlation between eye contact (all distances) and social awareness.

A correlation was also found between child's gaze within 50 cm, the localization of interest, called RRB, and the addictive behaviour. Scatter plots of these two correlations are shown in Figures 18 and 19.

The greater the social awareness, the more time there is for eye contact. Figure 19 also shows that the more time the child spends looking at the parent, the greater the localization of interest and the more constant the behaviour.

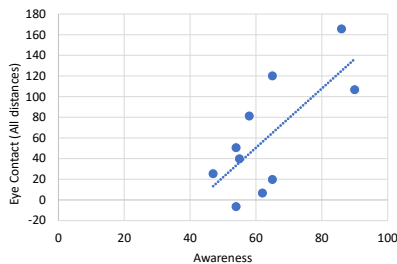


Figure 18: Correlation between eye contact (all distances) and social awareness

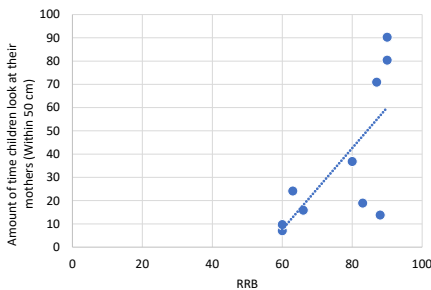


Figure 19: Correlation between child's gaze and RRB

Conclusion

We investigated whether there was a change in mother-child communication before and after the intervention with Humanitude™ to mothers of children with ASD. The mothers were taught Humanitude™, and we determined whether there were changes in mother-child communication before and after the intervention with Humanitude™ examined.

From the video clips, it was clear that in the pre-experiment, the mothers were often next to or behind their children and had few opportunities to positively engage with their children, so the eye contact time was extremely short, but in the post-experiment, after learning Humanitude™, the mothers were in front of their children and lowered their posture to their children's eye level, and attempted to make eye contact. This may have led to children picking up on their mothers' gaze and turning their gaze toward them more often and may have increased the amount of time spent looking at their mothers. The children spontaneously made eye contact with their mothers more often; thus, there were occasions when the mothers made eye contact with their children, following their gaze. It is thought that the duration of eye contact increased due to these factors. When correlations were determined with the SRS.2, a test measuring symptoms associated with ASD investigated in Vineland, a high correlation was found between eye contact (all distances) and social awareness. The correlation between child's gaze (within 50 cm) and RRB, and their addictive behaviour showed that the less socially aware children were, the more difficult it was for them to relate to others. We also found that children with a stronger commitment to a particular behaviour tended to continue the same behaviour alone (Dawson et al., 2004) and were extremely unlikely to make eye contact with their mothers. However, when mothers communicated with their children using the multimodal communication method of Humanitude™, the children began to pay more attention to their mothers, and in the post-experiment, they made eye contact more often and the eye contact time may have increased significantly. This suggests that the intervention with Humanitude™ with the mothers may have changed their reactions to their children and elicited interpersonal interactions based on the children's internal triggers.

Future Work

Behavioural changes between mothers and children were analysed in terms of eye contact, but when the videos of mothers and children playing were observed, it was confirmed that parental behaviour changed in terms of speech and touch as well as in terms of eye contact before and after the Humanitude™ training. Therefore, we plan to conduct an analysis with regard to speech and touch and examine the influence and correlations that mothers have on their children. Furthermore, since all applicants in this experiment were mothers, analysis by fathers was not conducted. It is necessary to verify whether the same results can be obtained for fathers and children in the future.

Acknowledgments

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