

# Hug Therapy: The Use of a Hugging Robot Moffuly in Therapeutic Counseling for ASD

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**Abstract**—Individuals with Autism Spectrum Disorder (ASD) are predisposed to co-occurring mental health conditions issues such as depression and anxiety symptoms, necessitating more frequent counseling compared to the general people. However, receiving counseling can itself induce anxiety, often making participation in therapy challenging. On the other hand, touch interactions such as hugging may enhance comfort during communication. This study evaluated the impact of introducing the hugging robot Moffuly into counseling sessions, aiming to create a more supportive therapeutic environment for individuals with ASD. In the experiment, the counselor remotely operated Moffuly and conducted the sessions by talking to the individuals with ASD. As a result, engaging in hugs with Moffuly was found to inhibit the increase in anxiety levels among participants, enabling them to converse calmly during the counseling sessions.

## I. INTRODUCTION

Individuals with Autism Spectrum Disorder (ASD) are predisposed to co-occurring mental health conditions issues such as depression and anxiety symptoms [1-3]. These psychological problems, combined with the difficulties with communication and social interaction associated with ASD, often exacerbate distress and mental burdens. Therefore, individuals with ASD require counseling more frequently than the general people to maintain mental health and address social challenges [4]. However, receiving counseling can itself induce anxiety [5], and it is often difficult to participate in therapy. Anxiety and tension during counseling sessions can reduce the effectiveness of the treatment, necessitating approaches that mitigate these factors.

Previous studies suggested touch interactions can enhance comfort during communication [6-9]. For example, receiving a hug provides a sense of familiarity and reassurance [1,10]. However, employing physical touch during therapy makes psychological issues more complicated. One solution to this dilemma is the incorporation of social robots capable of touch

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interaction into counseling. We developed a robot Moffuly which can actively hug participants during counseling sessions [11, 12]. Moffuly is huggable robot designed with a soft texture and is sizable enough to embrace an adult male. Moffuly's responses and actions remain consistent, regardless of the participant's stress level, providing a stable and calming hug. The purpose of this study is to introduce Moffuly into counseling sessions for individuals with ASD, providing a tactilely supported and reassuring therapeutic environment.

## II. MATERIALS AND METHODS

### A. Huggable Device

Based on previous study [11], We introduced Moffuly into counseling sessions for individuals with ASD. This robot is designed for comfortable full-body interaction and is made from soft materials appropriate for adult-size engagements. Each arm is equipped with one degree of freedom at the elbow and wrist, which allows for arms of sufficient length to replicate the sensation of a natural hug. The physical structure features a metal frame for safety and a skin made of cotton and fabric to prioritize tactile sensation. Internally, the robot incorporates a Raspberry Pi 4, and two Dynamixel MX-106R motors in each arm providing smooth movements with a torque of 8.4Nm each. In addition, built-in microphones and speakers facilitate communication with participants. Moffuly's functions include arm opening and closing behaviors, as well as a patting gesture, which is performed by slowly moving the left hand horizontally for three seconds. Operationally, Moffuly is equipped with a remote-control system allowing the operator (who is the counselor) to directly interact with the participant. This system uses a webcam installed in the experimental room, through which the remote operator can view video to hugs and control gestures, thereby enhancing the effectiveness of counseling sessions.

### B. Experimental procedure

In the experiment, we introduced into counseling sessions for individuals with ASD by incorporating Moffuly. During these sessions, Moffuly sat on the floor, and the ASD participants sat with their backs to it, as if leaning into a chair (Fig 1). The counselor remotely operated Moffuly and conducted the sessions by talking to the participants. The purpose of the experiment was to assess the extent to which Moffuly's hugs could alleviate anxiety during the counseling sessions. We compared with being hugged condition and without being hugged condition. In the with being hugged condition, Moffuly gently hugged the participants from behind and performed a patting behavior every 30 seconds. These hugging and patting behaviors were designed to provide comfort to the participants and reduce psychological stress during the sessions.



(a) With being hug condition



(b) Without being hug condition

Fig 1. Snapshot of the experiment.

Counseling session lasted eight minutes and progressed using a pre-prepared conversation script. The script began with small talk which was light topics such as weather and hobbies, and transitioned to more private topics which was potentially induce greater social stress. This staged conversational flow was designed to create an environment to observe the comfort of individual participants with ASD regarding private topics that cause stress. The study involved thirty male participants with ASD, and their reactions and emotional changes during the sessions were observed.

### III. RESULTS

All participants completed the counseling sessions without interruption, demonstrating focus during the experiments and expressing a favorable impression of Moffuly. More than half of the participants agreed that Moffuly was easy to talk with. Our careful observation during the experiments revealed that participants were more calmed at with being hugged condition than without being hugged condition. This calming effect was also corroborated by the anxiety levels. Our experiment deliberately designed the counseling sessions to increase social stress more significantly during the second half (private topics) than during the first half (small talk). In without being hugged condition, we observed that the anxiety levels were substantial increase. Conversely, this increase was not observed in with being hugged condition, suggesting that robotic hugs can mitigate social anxiety in individuals with ASD, thereby enhancing their response to social stressors [13].

### IV. CONCLUSION

This study introduced Moffuly into counseling sessions for individuals with ASD. Our results showed the potential of robotic hugging to alleviate the heightened anxiety that often accompanies counseling for individuals with ASD. We observed that participants were more calmed at with being hugged by Moffuly during counselling. In particular, the usual increase in anxiety levels was absent during the more stress-inducing segments of counseling that involved private topics. This suggests that the physical reassurance provided by Moffuly is effective in creating a supportive environment that counteracts the typical stress responses.

This study supports the Moffuly's consistent and calming presence through physical touch not only mitigates the immediate symptoms of anxiety but also contributes to a more effective counseling outcome.

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