

Differences in Psychological and Physiological Stress Reduction Effects of Different Canine Characteristics in Animal Assisted Intervention

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The purpose of this study is to examine the characteristic elements of canines that influence psychological and physiological stress reduction and how to interact with them from the perspective of animal-mediated intervention. The subjects were 25 university students. Nine groups (physical group (image observation, warmth touch, breathing movement observation, and heartbeat hearing), a psychological group, an integrated group that combined physical and psychological interventions, and a control group) were set up and given 5 minutes to interact with canine elements after performing a calculation task. An analysis of variance for the two factors of group \times time was conducted for the physiological and psychological indices, and no significant differences were found in any of the dependent variables. However, two qualitative data, the observation records during the experiment and the post-event questionnaires of the participants, suggested that there might be an effect between the factors. The results indicated that the participants subjectively felt calmer and more secure, that the way they interacted with the animals changed over time, and that the impression of “being alive” may have influenced the change in impression.

Key Words: animal assisted intervention, psychological and physical stress

Introduction

It is not clear from the whether the effects of Animal Assisted Intervention (AAI) are derived from direct contact with animals or from the development of trust, familiarity, and bonding. Therefore, it can be said that research on specific models of interaction has not progressed.

In this study, direct contact using the five senses is classified as “Physical Contact” while contact focusing on “mental connections” called “trust” or “kizuna” is classified as “Psychological Contact”. The purpose of this study is to examine which type of interaction is more effective in reducing stress by measuring the psychological and physiological responses of the animals when they interact with each type of interaction. In this study, we limited the target animals to dogs, which are the most active animals in the actual AAI and used stuffed animals for safety and hygiene reasons. The “Physical

Contact” is classified into “Warmth Touch,” “Breathing Movement Observation”, “Heartbeat Hearing”, and “Image Observation,” and the method of contact that is most effective is also examined. In addition to the above, an “Integrated” condition that combines the “Psychological Contact” presentation condition and the “Physical Contact” presentation condition (excluding Image) is also provided. The purpose is to make the combination of physical and psychological factors more canine-like.

There are three hypotheses in this study. First, the “Physical Contact” component is more effective in reducing stress than the “Psychological Contact” component in terms of “Physical Contact Image Observation,” “Physical Contact Warmth Touch,” “Physical Contact Breathing Movement Observation,” “Physical Contact Heartbeat Hearing,” and “Psychological Contact.” Second, among the various elements of “Physical Contact,” the most effective in reducing stress is Physical Involvement Warmth Touch. Third, the stress reduction effects of “physical involvement” and “psychological involvement” were

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non-inferior to those of “Integrate,” and the stress reduction effects of “physical involvement” were also non-inferior to those of “Integrate”.

Methods

Experimental Participants

Participants were university students. There were 7 males (mean age: 21.29 ± 1.38 years) and 18 females (mean age: $21.00 \pm .87$ years), for a total of 25 (mean age: 21.08 ± 1.02 years).

Experimental Materials

(1) Physiological indexes

Maximal blood pressure, minimal blood pressure, heart rate, and salivary amylase were measured.

(2) Psychological index

The Japanese abbreviated version of POMS2 (Yokoyama, 2015) was used.

POMS2 consists of the following seven scales: Anger-Hostility, Confusion-Bewilderment, Depression-Dejection, Vigor-Activity, Tension-Anxiety, Fatigue-Inertia, and Friendliness. The responses were: “1: not at all,” “2: a little,” “3: a little,” “4: a great deal,” and “5: a great deal.”

(3) Stress task

25 two-digit multiplication questions. The participants were instructed to solve the problems within 5 minutes without using any computing devices.

(4) Canine elements

A photograph of a dog from the neck up was presented for all groups.

The details of each group are described below, along with the procedures.

Procedure

Experiments were conducted individually according to the following procedures. The participants were informed of the nature of the experiment, that participation in the research/experiment was voluntary, and that they could cancel their participation at any time.

Participants were divided into 9 groups that were involved with the canine element during the experiment and a control group that was not involved with the canine element during the experiment. Each participant participated in two

conditions. The experimenter told the participants, The purpose of this study is to examine the differences in stress reduction after a task from two aspects, physiological and psychological stress, between the groups that interacted with the canine element and those that did not.

1. Psychological Contact Group: PC
2. Physical Contact Image Observation Group: IO
3. Physical Contact Warmth Touch Group: WT
4. Physical Contact Breathing Movement Observation Group: BMO
5. Physical Contact Heartbeat Hearing Group: HH
6. Integrated Group1 (Psychological Contact + Warmth Contact): Integrate 1
7. Integrated Group2 (Psychological Contact + Breathing Movement Observation): Integrate 2
8. Integrated Group3 (Psychological Contact + Heartbeat Hearing): Integrate 3
9. Control Group

List below materials and methods for each group without control group (Table 1).

In all groups, the experimenter kept a distance from the participants and observed them while they were engaging with the elements, taking care to stay out of their line of sight.

The control group was measured in a resting state 10 minutes after completing the stress task. Figure 1 shows the protocol of the experiment.

Analysis Method

In order to examine the effect of the contact with canine elements on the reduction of psychological and physiological stress, we used the group and period as independent variables and the physiological and psychological indices as dependent variables, and calculated the following 9 groups (control group, PC, IO, WT, BMO, HH, Integrate 1, Integrate 2, Integrate 3) \times 3 (period: resting period, task period, and recovery resting period). Statistical analysis software R version 4.1.2 “Bird Hippie” was used. The analysis of physiological indices included maximum blood pressure (systolic blood pressure: SBP), minimum blood pressure (diastolic blood pressure: DBP), heart rate (heart rate: HR), salivary amylase activity (saliva amylase (SAL) data were included in the analysis. The psychological indices were added to each factor

of POMS2. For both physiological and psychological indices, the following subjects were analyzed: 6 in the control group, 5 in PC, 5 in IO, 6 in WT, 5 in BMO, 5 in HH, 6 in Integrate 1, 6 in Integrate 2, and 6 in Integrate 3.

Voluntary questionnaire after participation in the experiment

A post-event questionnaire was administered to the participants of the experiment. The answers were optional.

Table 1 *Materials and method for each group without control group*

Group	PC	IO	WT	BMO	HH	Integrate1	Integrate2	Integrate3
Materials	Video	Picture	stuffed animal electric warmer	stuffed animal inflater silicon tube	stuffed animal sound source speaker	video WT materials	video BMO materials	video HH materials
Method	Say the command to the count-down which in the video.	watch. Can be talked to and petted.	Touch. Pay attention to the warmth. Can change the direction of the body and were instructed to interact with it using their own senses.	Touch and observe. Pay attention to this movement and were instructed to relate to the movement with their own senses.	Hear the sound. Pay attention to the heartbeat and were instructed to interact with the animal using their own senses.	Watch short ver. PC video(2;30). After that same as WT(2;30).	Watch short ver. PC video(2;30). After that same as BMO(2;31).	Watch short ver. PC video(2;30). After that same as HH(2;32).

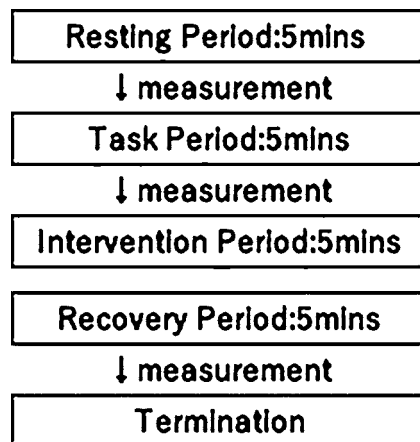


Figure 1. Protocol

Results

(1) Psychological index

There were no significant differences in all subscales of the POMS2.

(2) Physiological index

There were no significant differences in SBP, DBP, HR, or SAL.

(3) At the time of observation

The following is what each group looked like at the time of observation (Table 2).

Table 2 Each group looked like at the time of observation

PC	JO	WT	BMO	HH	Integrate 1	Integrate 2	Integrate 3
"Chobi" was seen to tilt her head when she lay down./Chobi" responded to "Come here" and laughed when she came towards him or her./He or she became louder and louder./"Chobi" was seen laughing as she approached the camera."	"He or she made a gesture of stroking the photo with his or her finger./He or she stroked the photo with one hand, but gradually he or she held the photo down with one hand and stroked it with the other hand./When I said 'goodbye' to him or her at the end, he or she made a gesture of waving her hand."	He or she looked into the stuffed animal's face and made a gesture of trying to make eye contact./Stroked it from the top of its head to its back./He or she stroked it by wrapping his hands around its back./Continuous stroking.	He or she was softly wrapping and holding a stuffed animal./Occasionally him or her fingertips were seen stroking the tips of fur.	She or he had her or his eyes closed./Occasional stroking gestures were seen.	Appeared restless, with hands going to knees or to chair./Was vocalizing with raised endings./Stroked slowly over the warm area./After 30 seconds, he or she was seen supporting him or herself with one hand and stroking with the other.	He or she spoke in a clear, crisp voice./Was seen approaching the screen when calling out./He or she was softly wrapping and holding a stuffed animal.	He or she were seen to talk to "Chobi" in a crisp, clear voice with a lengthening of the end of words./Commands were given clearly, while "come" was given in a softer tone of voice./He or she moved their hands in response to "Down"/Eyes closed throughout. Occasionally stroked "Chobi".
Lean forward and watch the video./Produces a bouncy voice./When "Chobi" moved, he or she was seen to laugh. Stretched the end of the word and called out to "Chobi"/Move their bodies in time with the movements of "Chobi".	Called "Chobi" by name, said "cute" and "good boy"/Was seen asking questions of "Chobi"/Lifted the photo to his or her own eye level./Was observed placing the photo on the desk and making a gesture of petting it.	Not only stroked in one direction, but was also stroked rhythmically with a tapping motion and with both hands wrapped around "Chobi's" back./"Chobi" was seen to be stroked with his face towards him or her.	Occasional stroking of hair ends with fingertips was observed./Seen to be concerned about "Chobi's" tail.	She or he had her or his eyes closed./Occasional stroking gestures were seen.	He or she was seen to lean forward when calling out to "Chobi"/When praising her for being a good girl, his or her tone of voice was softer than other words./When I handed him or her a stuffed animal, he or she showed no hesitation in trying to hold it in him or her arms./Gazed at "Chobi's" face and slowly stroked the warm parts.	He or she raised his or hers end and called out in a raised voice./He or she watched the video with a correct posture./Seemed to be reading the dialogue rather than saying the words./Occasionally moved his or hers fingers./He or she kept his or hers eyes on the stuffed animal throughout.	When he or she couldn't see Chobi's face, he or she looked at her as if she was peeping at them./There was a difference in the way he or she spoke to her each time. He or she moved their face in response to "Chobi's" facial movements./He or she closed own eyes./He or she had both hands on the stuffed animal.
When the video started, said to "Chobi", "You're so cute". He or she stretched the end of the word and called "Chobi's" name in a quieter voice./When "Chobi" approached him or her, they occasionally blurted out "cute" and sometimes laughed./When "Chobi" responded to "Good boy", he or she said "Cute".	voice was heard saying "cute". Fingertip stroking was observed./At first only stroked with right hand, but gradually used left hand as well./As the second half he or she was seen to sit in the chair in a relaxed manner.	Turned the stuffed animal's face towards him or her and stroked it from the chest to the back./Stroked repeatedly on the back./Stroked the stuffed animal with one hand while holding it with the other./Observed stroking the part of the body that felt warm, especially slowly.	Stared at the stuffed animal throughout./Occasional facial peering movements were observed.	She or he had her or his eyes closed./Occasional stroking gestures were seen.	Was seen smiling and watching the video./Was seen stroking slowly./Occasionally kept placing his or her hand on one spot.	He or she was seen clapping their hands and speaking out. Was seen speaking to "Chobi" in a crisp, cheerful voice./He or she was seen speaking to "Chobi" in a gentle tone of voice, with a lengthening of the end of words./Was observed occasionally stroking "Chobi's" fur with his or hers fingertips.	"Chobi" was seen laughing when she responded to commands./Seen smiling when "Chobi" approached. He or she also said, "Oh, here it comes."/He or she spent more time meditating compared to the time he or she was free.
He or she called out "Chobi's" name as if to call out to her, stretching the end of the word./Gradually the tone of his or her voice became softer./Looked into "Chobi's" face and saw his or her head tilt down as if to make eye contact with her.	He or she kept staring at the picture.	Stroked the stuffed animal's back while turning its face towards him or her./He or she was seen stroking it while turning his or her eyes to the photograph.	A few occasions were observed where the hand was moved slightly to the ventral side	She or he had her or his eyes closed./Occasional stroking gestures were seen.	Tilting their heads to look into the eyes of "Chobi"/Saying "cute" and other comments that were not part of the dialogue./Observed stroking slowly from the top of the head to the back./Observed stroking slowly while looking into the face.	Commands had a clear tone of voice./Appeared to call "Chobi's" name with an elongated ending./Movement of hands within the range of respiratory movement was observed./Was observed sitting deeply in a chair.	He or she called out "Chobi's" name and smiled when "Chobi" approached them./He or she could be seen talking to the stuffed animal as if he or she was talking to it./At first he or she only put his head on the stuffed animal, but after 30 seconds he or she was seen to hold the stuffed animal in both hands.
At first the voice was quiet, but after a minute or so it became louder./It was observed that the end of the word was splashed up as if to say 'come'.	He or she kept staring at the picture.	Was observed stroking the tips of "Chobi's" fur while placing his or her hand on the warmest part of her back./Seen stroking feet and tail.	He or she was softly wrapping and holding a stuffed animal./Occasionally, he or she was seen stroking the tips of "Chobi's" fur with his or her fingertips.	She or he had her or his eyes closed./Occasional stroking gestures were seen.	Seen to lean forward and look at the video./Seen to compare praise with other words and talk to each other when praising./He or she was observed stroking "Chobi's" back slowly in one direction./Was observed occasionally stroking "Chobi's" face as if looking into it.	Initially, the voice was quiet, but gradually became louder./Voice tone was different when calling names and on command (softer in the former)/Seen holding it more enveloping compared to the first designated place.	Calls "Chobi's" name clearly. When "Chobi" moves, say something like, "That's great"/When Chobi complied with commands, he or she would say "good job", "good boy", "good boy" etc./There were moments when he or she would let out a "oooh" or similar./He or she closed own eyes and held the stuffed animal with both hands.
—	—	He or she was observed placing his or her hand on the area where he or she felt warmth./The right hand was seen supporting "Chobi's" chest and stroking with the left hand./He or she was observed occasionally stroking with the back of his hand./Turned around and was observed stroking from the back side.	—	—	Creaked "Oh, come here, come here, come here."/Clapping hands when saying "come here"/Can be seen turning "Chobi's" face towards him or her and stroking while calling out./Was seen cupping "Chobi's" face in his or her hands and making eye contact. Smiling too.	He or she was seen leaning forward when calling out to "Chobi"/Was seen calling out to "Chobi's" name in a soft tone of voice./He or she did not move their hand from the first designated place to the last./Was seen stroking fur with fingertips.	Seen raising the end of the word "come" and calling out to the camera in a cheerful voice./"Chobi" was seen to laugh when she approached the camera./Can be seen watching the video with a smile on his face./When giving compliments, he or she were observed to speak in a higher voice and with a gentler tone of voice.

(4) Post-event questionnaire

The results of the post-event questionnaire for each group are shown below (Table 3).

Table 3 *Post-event questionnaire for each group*

Group	What did you feel during your contact with the elements?	Which was the more positive emotion before and after contact with the elements	Did your impression of "Chobi" change before and after your contact?	Only those who responded "Changed." Please describe how it has changed	Impressions on the experiment
PC	I was embarrassed to speak up. It was difficult to speak up. I thought it was cute when I saw the video. I was a bit embarrassed because only my voice reverberated in the room. But Chobi in the video was very cute and by the end I really wanted to meet him in person. It was soothing.	Before contact ... 3 After contact ... 1	Changed... 2 Did not change ... 2	After the involvement, I wanted to see Chobi in person. It was cute because it was footage of a real dog in action.	I thought the process of reacting to the voice through the screen was like Nintendo, I think animals are cute when I see them, but through the experiment I realised how little I had been involved and wished I liked animals more./At first, I was conscious of the fact that the experimenter was watching me from behind and I was very nervous and was much more reluctant to speak out, but by the end I got used to it and felt less reluctant to speak out. I also thought that Chobi looked cuter in the video than in the photos or the stuffed animals./I was watching him thinking how cute he was; it was like watching a video of a dog on YouTube.
JO	I got a warm feeling. I was a bit confused, but I also felt soothed by the images I just felt like I was looking at images of dogs. Confused.	Before contact ... 1 After contact ... 3	Changed... 2 Did not change ... 2	I've come to think she's a lovely doggy.	I was able to relax through being in a resting state and interacting with the creatures./I didn't feel like anything had clearly changed, but I think there was a part of me that was soothed by Chobi's appearance. For dog lovers, I wondered if their reactions would change even if it wasn't a pet dog./There was a slight resistance to talking to images of dogs.
WT	The entire time, I recognised it as a 'stuffed dog' and did not think of it as a living creature. I liked the warm stuffed animal because it was like a hot water bottle./It was warm, but I was not sure how strong to touch it, as I am not good with animals and have rarely touched them before. I didn't know how to talk to them./It was so warm, it was like touching a real live animal. I felt warm and relieved./It felt good to feel the warmth. I felt warm and relaxed, too./I felt relaxed.	Before contact ... 2 After contact ... 3	Changed... 3 Did not change ... 2	I felt prettier than before I got involved I felt safer than before I got involved. I felt closer to you than before I got involved (like a sense of security)	I was a little embarrassed. It was the first time I had such firm contact with an animal, and I thought I still needed more practice to get in touch with real animals. At first I was nervous because it was an experiment, but the feeling of warmth put me at ease and eased my nerves. I also became attached to Chobi, as if I had bought him myself.
BMO	I felt alive. It felt like I was really alive. The breathing motion made me feel warmer and healed. It felt like the puppy was alive.	Before contact ... 1 After contact ... 3	Changed... 4 Did not change ... 0	I felt more attached than before I got involved. I wanted to. I felt pretty. I felt more relaxed after involvement I felt more adorable	I was amazed at how much could be done by hand. It was interesting to feel the chobi more alive by adding warmth as well as air puffiness, which represents the heartbeat./I felt a little more healed after the involvement./The breathing sounds made it feel like it was alive from inanimate objects.
HH	Felt the warmth. Felt like I could really hear the heartbeat. I was just listening to the heartbeat.	Before contact ... 0 After contact ... 3	Changed... 2 Did not change ... 1	It felt real. Felt closer to Chobi.	I was Healing./I was surprised that my heart rate changed a bit./I thought it was amazing to hear the heartbeat from the stuffed animal and at the same time I imagined I was putting my ear to my dog.
Integrate 1	I felt my hands gradually getting warmer and warmer to the touch Made me feel more attached than watching video. I felt the warmth. It felt good to feel my hands getting warmer and warmer.	Before contact ... 3 After contact ... 5	Changed... 1 Did not change ... 7	None stated	None stated
Integrate 2	I felt a sense of familiarity. I put my hand on the stuffed animal and concentrated mindlessly on the movement of her breathing. It was adorable./I was confused, but found Chobi cute./While Chobi was cute and soothing, I couldn't get over my nervousness about participating in the experiment./I felt a little confused because it felt alive./I was happy to feel that Chobi was responding to my voice when I watched the video. In the breathing exercise, I was a little confused by the feeling of being 'alive'.	Before contact ... 1 After contact ... 5	Changed... 4 Did not change ... 2	I felt prettier than before I got involved. I felt closer to them. I felt more attached to them after I got involved I began to think of Chobi as my pet. After getting involved, I became attached to Chobi as if I had bought it myself	It was a nice change of pace as I don't normally have access to animals. It was very therapeutic. Stress reduction. Chobi was just so cute. Even though he was a stuffed animal, he actually seemed to have a heartbeat, and I felt like I was holding a real dog. Communicating with Chobi, even indirectly, gave me a soothing feeling.
Integrate 3	I felt like a real live animal. The video made me feel more involved with Chobi and I enjoyed it. I was a little embarrassed, but I was healed. I was comforted by a dog that came to me when I called it. I felt more familiar with the dog, which made me feel at ease.	Before contact ... 0 After contact ... 5	Changed... 5 Did not change ... 0	I felt more alive than before the involvement./I felt more attached to Chobi after the involvement. I felt somewhat closer to him./I felt relieved because the calculation task had cleared up the blurred feelings I had./Felt closer to Chobi after the involvement.	I felt more deeply connected to Chobi when I actually called out to him through the video and he responded to that, and I was healed. I had no experience of interacting with animals, but I enjoyed it. I would like to have contact with a real dog. I became fond of Chobi. I feel more interested in owning a dog. It was easy to feel familiar with dogs and imagine what they are like.

Discussion

The purpose of this study was to examine which elements of canine contact had an effect on psychological and physiological stress reduction, focusing on canines, which are frequently used in AAI. Therefore, we used group and period as independent variables and physiological and psychological indices as dependent variables and calculated the variance of 2 factors of 9 (group: control group, PC, IO, WT, BMO, HH, Integrate 1, Integrate 2, Integrate 3) \times 3 (resting period, task period, recovery resting period), and an analysis of variance of two factors was conducted.

In this study, there were no significant differences between groups in either psychological or physiological indices, and no interaction effects were observed. This suggests that there is no difference in the stress reduction effect among the elements of canine contact. Two possible reasons for this result are listed below.

First, the effect obtained in the current AAI is that animals are “alive,” i.e., they have the potential to move. In this study, except for the images used in PC, photographs and stuffed animals were used, so it was difficult to see animal-like movements. The only movement that could be seen was in BMO, but it was manipulated by the experimenter and was not a communicative movement toward the participants. According to Aoyama and Shiizuka (2010), robot therapy is attracting attention as an alternative therapy to animal therapy, and various demonstration experiments are being conducted. One of the advantages of robot therapy is that it avoids hygiene problems and pet loss syndrome. One well-known example is “Paro,” a seal-shaped therapy robot that went into production in 2005. According to Shibata and the Human Life Technology Research Division of the National Institute of Advanced Industrial Science and Technology (AIST), “Paro” can use multiple digitally sampled baby seal cries and recognize its own name and greetings at the word level (2012). Through numerous sensors and AI movements, it can cry, open and close its eyes, and recognize and respond to human faces (Mirai

Kotohajime, 2020). According to Shibata et al, “Paro” can stimulate language, connect people, decrease anxiety, provide safety and comfort, stimulate activity, interest, happiness, and attention, and join in social interactions in groups for the elderly (2012). YUKAI Kogaku also developed “Qoobo”, a round cushion with a tail, although it does not resemble a specific animal. According to YUKAI Kogaku and Hakuhodo, a POMS2-based evaluation of the stress reduction effect of a resting state with and without “Qoobo” showed that holding “Qoobo” significantly reduced stress (2018). According to the product description of “Qoobo” on the online store of YUKAI Kogaku, “Qoobo” responds to strokes by fluffing when stroked gently, by wagging when stroked a lot, and sometimes by wagging its tail whimsically (as of November 21, 2022), which indicates that both “Paro” and “Qoobo” have communication through movement. These results suggest that some kind of active movement from the animal side may have an influence on the effect obtained by AAI.

Second were the limitations of the experimental design and the measurement of physiological stress indices. Blood pressure and heart rate were measured using a sphygmomanometer after the resting, task, and recovery resting periods, and saliva was then collected to measure salivary amylase activity levels. According to Asami Tsuchida, hormones in saliva quickly decrease with small changes. In this study, stress indices were measured after a 5-minute recovery rest period following engagement with the elements. She said that salivary amylase may have dropped during that time, which is why no significant differences were found (2022). When salivary amylase activity levels are increased by direct neural action, the response time takes 1 to several minutes (Yamaguchi, 2007). The shorter the span, the less visible the physiological and psychological changes are, and the more likely it is that no differences occur. In this study, since the same participants were asked to participate in two groups in a single experiment, it was necessary to minimize the time required to reduce the burden on the participants as much as possible. According to Mizuno et al., the time from the start of stress

application to the maximum salivary amylase activity was within 10 minutes, and the time required for recovery was about 20 minutes, indicating a relatively fast response to the stress load (2002). According to Tsuchida, the 25 two-digit multiplication questions set as the stress task may not have functioned well as a stress load. Considering Tsuchida's point and Mizuno's (2002), it is necessary to raise the stress level to the maximum value and then lower it from the maximum value within a sufficient time period. In this study, blood pressure was also measured at a point, but it is more effective to measure blood pressure over time (Tsuchida, 2022). Measurement using a continuous sphygmomanometer is considered to be preferable and will be a point of improvement in the future.

Although quantitative data showed no differences between the groups, two qualitative data, a record of observations during the experiment and a post-experiment questionnaire of the participants, suggested differences in the way the elements interacted and subjective feelings among them.

In PC, the participants were observed to leak voices other than commands, and those who at first merely uttered words gradually changed their tone of voice to one of talking to each other. Some participants also moved their bodies in response to the canine's movements. These behaviors indicated a growing affinity for the canine. In the post-event questionnaire, some participants responded that "the canine in the video was the cutest," suggesting that the experiment induced favorable feelings toward the canine in motion. On the other hand, many participants felt embarrassed and perplexed by the fact that they had to speak in the presence of the experimenter, even though they could not see him or her. One participant said, "I was a little embarrassed because only my voice reverberated in the room," suggesting that their attention was focused on themselves and not on the canine. Another respondent said, "It was difficult to call out to them." This suggests that they may have concentrated on vocalizing to the countdown and paying attention to what the next command was. In actual AAI situations, vocalization is basically the participant's

free will and is not forced. The act of vocalization in AAI is not limited to talking to the animal but may also include communication with the handler. In this study, this point was not taken into consideration because the study was conducted to examine the effect of the interaction with the canine itself. However, in this study, the experimenter played the role of a handler in an actual AAI situation, and instead of a countdown, the experimenter called out "Let's call your dog's name" or "Sit, and it will sit." We would like to consider future experiments using a method in which the experimenter calls or says instead of counting down.

In IO, more participants answered in the post-event questionnaire that they were more positive before and after the interaction than after, but in fact, many of them felt puzzled. According to Nagasawa et al., gazing behavior from dogs, but not wolves, increased urinary oxytocin concentrations in owners, which consequently facilitated owners' affiliation and increased oxytocin concentration in dogs (2015). Gaze behavior refers to gazing at each other. The canines used in this study were photographed looking at the camera and were made to feel as if they were making eye contact. However, we can say that this effect was not observed. Although we told the participants that they could hold the camera in their hands or talk to it during the teaching, only a few experimental participants actually observed these behaviors, and only for a short period of time. In real dogs, eye contact is near zero, and even when eye contact occurs, it is accompanied by other movements. Kaminski et al said in only 33,000 years, domestication transformed the facial muscle anatomy of dogs specifically for facial communication with humans (2019). In particular, the muscles around the eye, called the levator anguli oculi medialis muscle (LAOM) and the retractor anguli oculi lateralis muscle (RAOL) muscles, are well developed, allowing them to raise and lower their eyebrows and change facial expressions (Kaminski et al, 2019). In addition to facial expressions around the eyes, other movements can occur in real canines, such as ear movements in response to subtle sounds and nose twitching when

sensing a scent. Improvements could be made by showing the canine from the neck up and using video that basically looks at the camera, but also captures small changes in facial expressions and movements.

In WT, all experimental participants showed a change in the way they touched. They stroked the stuffed animals slowly from head to back or supported the stuffed animals with one hand and stroked them, indicating that they felt they had to treat them gently and that they recognized that the stuffed animals were weaker than themselves. They also looked into the stuffed animal's face and tried to make eye contact with it, and turned its face toward them, indicating that they wanted to communicate with it through eye contact. All participants kept their hands constantly moving for most of the time, although they also placed their hands on the warm part for a short time. From this, it can be inferred that the therapy participants were seeking soft touch and warmth from the canine's coat rather than physical warmth from body heat. In a study examining the difference in stress-relieving effects when touching a soft-touch robot and a hard-touch robot (Hayashi and Kato, 2018), all psychological and physiological stress-relieving effects were significantly higher for the soft-touch robot, except for the beta-wave decreasing effect. On the other hand, some responses referred to physical warmth. One respondent said, "It was so warm, it was like really touching a live animal," suggesting that warmth is an element that makes people feel as if they are "something alive." Many respondents mentioned a sense of security and familiarity as changes in their impressions before and after the interaction. It was suggested that these feelings may be maintained or enhanced by prolonged contact with the animals and may also have an effect on stress reduction. The juxtaposition of "didn't feel like a living thing" with, also suggested that an individual's affinity for animals and imagination may have played a significant role in this study.

There seemed to be some similarities between BMO and HH. In BMO, participants were instructed to wrap their hands around a stuffed animal that resembled a dog and to focus their attention on the

movement of breathing. However, according to the observation recordings, many of the participants occasionally stroked the tips of the animal's fur with their fingers, paid attention to its tail, or made gestures as if they were looking into its face. In HH, the participants were instructed to put their ears on the belly of the stuffed animal to focus their attention on the heartbeat, but according to the recordings, all the experimental participants closed their eyes and occasionally stroked. In addition, looking at the responses of these groups in the post-event questionnaire, many of them mentioned the sensation of "alive" and "realism," such as "It was interesting that it felt alive," "It felt alive," "It felt real," "I imagined I was putting my ear to my canine," and "It felt like it was actually beating." Many of the participants mentioned "the feeling of being alive" and "the realism of the image." No such descriptions were found in the PC or IO. In the post-observation questionnaires, some respondents stated that "the addition of warmth in addition to the air puffiness that represents the heartbeat made Chobi seem more alive" (BMO) and "I felt the warmth" (HH). The only thing that these groups had in common was that they were using stuffed toys and were touching them, and they did not use warmth derived from the sense of temperature, as was used in WT. However, these responses suggest that people may perceive "warmth" not only from the sense of temperature, but also from the texture of the fur, which may be related to the behavior observed in WT, that is, touching other parts of the body besides warm areas. This may also be a common finding in Harlow's (1958) surrogate mother experiment, in which the comfort of contact is important for attachment. From the post-event questionnaire, it was inferred that the breathing movements and heartbeats were factors that made the animal feel "alive" keenly, and that these factors left a lasting impression on the participants. This suggests the need for further study of the effects on humans of making animals feel "alive."

In Integrate, all 3 groups exhibited behaviors similar to those observed in the PC and in each of the Physical contact groups. The difference was that

many participants answered that they felt more positive before and after the physical involvement in the post-event questionnaire. The 3 groups were also more likely to say that they felt “more attached” and “more familiar” to the animals. It is possible that the participants were able to visualize the canine more concretely because they interacted with each element after watching the video, or that they were able to grasp the warmth, breathing motion, and heartbeat of the canine in their memories by interacting with the stuffed animals after understanding the canine’s personality through the video. It is possible that the participants were able to capture the canine more three-dimensionally.

Since no significant differences were found in the quantitative data, it is highly likely that the current effects of AAI are influenced by the fact that AAI is an “alive animal”. However, the qualitative data from this study suggest that the impression of “being like a living animal” may be influencing the impression change, such as subjective feelings of calmness and security, and changes in the way of touching with the passage of time. This suggests that there were signs of differences in the effects of the different elements, as well as the necessity of continuous and long-term involvement and the importance of a sense of realism. As for future prospects, the first step is to conduct a follow-up study of this research based on what has just been described. We believe that it is appropriate to keep the procedures the same, but to use a different experimental design. For example, they may relate to all elements, relate to the same element multiple times, or use elements that are more realistic. The second is a follow-up study using actual animals. Since it is difficult to categorize elements in real animals, it is desirable to differentiate the way they interact with each other. For example, it would be desirable to categorize the animals into groups that look at the animals from a distance, stroke them from head to back, place their ears on their stomachs, etc.

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