A Friendly Article:

The Qualitative Investigation of Anthropomorphism in Autistic and Non-autistic Adults

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Authorship Confirmation Statement

Dr Anna Remington and Dr Rebekah C White developed the study concept, and all authors contributed to the study design.

Participant recruitment, data collection and analysis were performed by Orli Negri.

Orli Negri drafted the manuscript, and Dr Anna Remington and Dr Rebekah C White provided critical revisions.

All co-authors have reviewed and approved of the manuscript prior to submission.

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Lay-language summary

Why was this study done? 'Anthropomorphism' is when you feel that non-human items have human characteristics, for example if you experience plants, animals, or household objects as having thoughts or feelings. Anthropomorphism is experienced by many people in many different ways. Researchers think it might happen when people have a strong desire for social connection. This has led some to suggest that autistic people will be less likely to anthropomorphise due to difficulties in social understanding and motivation. However, researchers have not examined this directly, and our prior research, together with comments in online forums and autobiographical accounts, indicated that autistic individuals may experience a special relationship with non-human items.

What was the purpose of this study? The purpose of the study was to speak directly to people who anthropomorphise and hear about their experiences. We could then compare patterns of anthropomorphism between autistic and non-autistic adults.

What did the researchers do? We interviewed 16 adults (8 autistic and 8 non-autistic) who told us they anthropomorphised, and asked about their personal experiences of anthropomorphism.

What were the results of the study? Autistic and non-autistic adults described very similar experiences of anthropomorphism. People in both groups described anthropomorphism as comforting, and said that it gave them a sense of safety and friendship. They also cared for, and experienced feelings of empathy toward, anthropomorphised items. Individuals in both groups worried about anthropomorphised items' feelings and well-being and this caused some people considerable distress. Autistic individuals stressed the important role anthropomorphised items

played in their life, particularly when growing up: reducing loneliness and helping them develop an understanding of emotions and relationships.

What do these findings add to what was already known? Our findings show that there are many similarities in the experiences of anthropomorphism in autistic and non-autistic adults. The findings also show how, for some autistic adults, anthropomorphism was a helpful in developing relationships with other people.

What are potential weaknesses in the study? The small number of participants means that we do not know whether the findings would apply to all people who experience anthropomorphism.

How will these findings help autistic adults now or in the future? By showing the various ways in which autistic individuals attach social meanings (such as feelings of caring or friendship) to anthropomorphised items, our findings add to a growing number of studies which challenge the commonly-held assumption that autistic individuals are less motivated to make social connections. Our work shows that autistic individuals may be highly motivated to connect socially, and that meaningful social connections and expressions of empathy need not be limited to human beings.

Abstract

Background: Anthropomorphism is the attribution of human characteristics to non-human agents. This common tendency is thought to be driven by a heightened motivation for social connection, and may therefore be expected to be reduced in autistic individuals given that this group has been claimed to demonstrate reduced social motivation in some settings. However, the subject of anthropomorphism in autism has not been studied extensively, and online forums, autobiographical accounts and recent research on the topic suggest that, contrary to this expectation, anthropomorphism is commonly experienced by autistic individuals.

Methods: We conducted semi-structured interviews with eight autistic and eight non-autistic adults, all who reported a tendency to anthropomorphise. We recorded, transcribed and analysed the interviews according to the thematic analysis framework with the objective of identifying similarities and differences in the lived experiences of anthropomorphism in autistic and non-autistic individuals.

Results: Individuals in both groups described anthropomorphism as comforting, promoting a sense of safety and friendship with, and feelings of empathy and sympathy toward, non-human agents. Autistic individuals stressed the important role anthropomorphised agents played in their life, particularly when growing up: easing loneliness and helping develop an understanding of emotions and relationships. Participants also expressed negative aspects of the phenomenon, with both autistic and non-autistic individuals worrying about anthropomorphised agents' feelings and well-being. For some individuals, such thoughts and feelings caused distress, and were experienced as intrusive due to their involuntary nature.

Conclusions: Autistic and non-autistic adults showed very similar anthropomorphic patterns. Although preliminary in nature, our findings highlight characteristics of anthropomorphic experiences for autistic and non-autistic individuals, furthering our understanding of individual differences in social cognition. By illustrating the important role non-human agents may play in the lives of autistic individuals, our findings may also guide future research and practice.

Introduction

Anthropomorphism is defined as the attribution of human characteristics (including emotions, intentions and behaviour) to non-human subjects, such as animals, plants or inanimate household objects. Common examples of anthropomorphic experiences may be feeling that a certain tree is friendlier than another, or that a computer is malfunctioning intentionally. Although it is considered to be a common phenomenon with vast and various expressions throughout human culture, the tendency to anthropomorphise seems to vary considerably from one person to another.[1] Our recent research has suggested that one population who may experience increased anthropomorphism are those on the autistic spectrum. A survey of 87 autistic and 263 non-autistic adults in the UK revealed that anthropomorphism was reported more commonly among autistic individuals, and perhaps more often (and continuing later in life) than in the general population.[2] Further, various descriptions from autistic individuals on internet blogs and forums, as well as some autobiographical accounts, seem to elaborately describe the perceived mental states of non-human agents, and include detailed expressions of empathy toward the agents.[3–6] (Note: since anthropomorphism leads to perceiving non-human entities as having agency, anthropomorphised entities are referred to as "agents" within the literature.)

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These observations may be interesting, when considering the core characteristics of autism outlined by prevailing theoretical accounts. Autism is a neurodevelopmental condition characterised by differences in social communication, repetitive and restricted interests and behaviour, and a hyper or hyposensitive sensory profile.[7] Mentalising – the ability to understand and attribute mental states to others – is thought to be challenging for those on the autistic spectrum.[8–10] Recently, research has suggested that this difficulty stems from reduced social motivation, rather than an inability to make inferences about others.[11] Given that literature also proposed that anthropomorphism exemplifies an increased motivation for reasoning about the minds of others,[12,13] the observation of increased rates of anthropomorphism for autistic people initially appears counterintuitive.

However, a closer investigation highlights a number of factors that may underpin anthropomorphism in autistic individuals. For example, increased levels of loneliness have been reported by individuals on the autistic spectrum, compared to non-autistic individuals,[14–16] and intolerance of uncertainty has been suggested as a significant construct in autism.[17–19] Both these issues have been linked to the attribution of human characteristics to non-human agents: research by Epley and colleagues[12] suggests that in non-autistic adults there is an increased tendency to anthropomorphise among those who feel socially isolated, or experience a desire for control and predictability. Furthermore, a recent review suggested anthropomorphic tendencies among autistic individuals may be motivated by the considerable difference in the complexity of interaction with humans compared to non-human agents.[20]

An alternative account is that, for autistic people, anthropomorphism may be linked to synaesthesia (a condition in which certain stimuli trigger unusual, automatic and involuntary sensations). Recently, subtypes of social synaesthesia have been identified, in which individuals

attribute gender, feelings, and personality traits to graphemes and/or inanimate objects, in a manner that is consistent over time.[21–23] Anthropomorphism and the various subtypes of social synaesthesia are thought to activate brain regions that are linked to the mentalising network.[24,25] The observation of higher levels of anthropomorphism in autistic compared to non-autistic individuals,[2] indicates value in revisiting the nature of the mentalising difficulties within the condition, and makes the association of autism and anthropomorphism even more intriguing. Importantly however, although rates of synaesthesia are higher in the autistic community compared to the general population,[26,27] this is true only of autistic individuals with prodigious talent,[28] which renders an explanation for high rates of anthropomorphism in autism as being tied to synaesthesia less probable.

The potential links between autism and anthropomorphism, discussed above, raise the question as to whether the phenomenon plays a different role, or is different in nature, for autistic people compared to non-autistic people. One way to explore this question is by examining the lived experiences of autistic and non-autistic individuals who anthropomorphise. To date, there has been minimal research on this topic, and indeed even the literature on anthropomorphism in the general population has yet to explore the first-hand experiences of individuals who report increased anthropomorphic tendencies. The current study provides, to our knowledge, the first qualitative investigation of individual experiences of anthropomorphism in autistic and non-autistic adults, so as to illustrate and compare their personal experiences and provide insight into this interesting mechanism of social cognition.

The importance of this is underlined by the fact that, in online forums, many first-hand accounts by autistic individuals highlight the involuntary nature of anthropomorphism, and include negative sentiments, such as feeling guilty about selling an old car that might feel

abandoned.[6] As such, it is necessary to establish whether anthropomorphism plays a different role for autistic and non-autistic individuals, and how best to support those who experience distressing aspects of the phenomenon. Due to limited research on the subject, we chose to use a qualitative approach. First-person perspectives will facilitate a deeper understanding of anthropomorphism, highlighting differences and similarities in the two groups.

Methods

Participants

16 participants took part: eight adults with a self-reported formal diagnosis of autism (4 females and 4 males, ages 21-58, $M = 35$), and eight non-autistic adults (4 females and 4 males, ages 24-70, $M = 40$). To maintain anonymity, participants in the autistic and non-autistic groups will be referred to as A1-A8 and N9-N16, respectively. Participants in both groups were recruited from a previous study on anthropomorphism,[2] online blogs, or a research recruiting website, and all self-reported a regular tendency to anthropomorphise various types of non-human agents from a range of categories (e.g., plants, animals, electrical devices, household objects). Two participants (non-autistic group) were from the United States. All other participants were from various locations across the United Kingdom. English was confirmed to be the first language of all participants, thereby reducing the likelihood of linguistic factors, such as gendered nouns, affecting anthropomorphic tendencies. Three participants (A3, A8 and N11) reported a diagnosis of Obsessive Compulsive Disorder (OCD) or anxiety in childhood and/or adulthood; one of whom (A8) also reported a diagnosis of depression. In addition, two participants in the non-autistic group (N9 and N16) reported grapheme-colour synaesthesia.

Participants in both groups had various educational backgrounds, ranging from high school education to PhD.

Ethical approval for this study was obtained from the Department of Psychology and Human Development Ethics Committee at the University College London Institute of Education, as part of an MSc dissertation. All participants gave informed consent prior to the start of the interviews.

Procedure

We conducted semi-structured interviews with participants over the phone (n = 15) or in person (n = 1) as per the participant's preference. Interviews lasted 20-50 minutes, and were audio recorded by the researcher. At the beginning of the interview, the interviewer repeated a definition of anthropomorphism, which had been given to participants as part of the recruiting process. The interview schedule comprised open-ended questions about personal experiences of anthropomorphism, relating to childhood and adulthood. Some questions encouraged general reflection, such as "How do you feel about anthropomorphising?", while others aimed to elicit descriptions of experiences, such as "Can you describe a certain anthropomorphised agent from your personal experience?" Additional questions aimed to evaluate the stability and consistency of anthropomorphism, by assessing factors which may influence the tendency to anthropomorphise, such as "Do you find that anthropomorphising is related to your mood?" The interviewer asked all questions in their original phrasing, and rephrased with added explanation where participants expressed uncertainty with regards to what was being asked. Anecdotal observations suggested no systematic differences between the groups in requests for rephrasing.

The researcher later transcribed and analysed the recordings according to a thematic analysis framework, guided by the phases defined by Braun and Clarke:[29] (1) familiarisation with the data; (2) generation of initial codes; (3) search for themes; (4) review of themes; (5) definition and naming of themes; and (6) production of the report. The researcher applied an inductive coding approach to all interviews before collapsing together the emergent codes into themes and comparing across groups. Researcher ON first analysed the interview data, followed by AR. AR and ON conferred several times during the coding process to review areas of divergence and decide on final themes and subthemes. RW confirmed agreement with final set of quotes and themes. The researchers are non-autistic, and two have a tendency to anthropomorphise, therefore sharing participants' perspectives to a certain degree. Themes from the two groups (autistic and non-autistic) have been reported together due to the extent of overlap.

Results

Participants in both groups anthropomorphised animals, vehicles, soft toys, trees, technological devices, household objects, buildings, musical instruments, fruit and more. The types of attributions that participants mentioned included different emotions, gender, personality, free will and intentions, and the ability to understand speech. Researchers identified five main themes across both groups, with an additional theme exclusive to the autistic group (see Table 1 and Figure 1).

Table 1. Experiences of anthropomorphism

Themes identified both in autistic and non-autistic interviews are highlighted.

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Themes	Subthemes	Example Quotes	
		Autistic	Non-autistic
Overall feelings toward anthropomorphising		"It's just something I do, I don't attach a particular connotation to it." (1)	"I think it's just there, a part of how my brain sees things. I don't think it's a bad thing or a good thing". (14)
		Asking me that is like asking me what it's like to breathe - it's a part of my life, and an everyday part of it... I can say that some of it is definitely positive, because if my partner is away I can chat with my cat so I'm not lonely, so that's positive. I can't think of a negative experience. (A7)	I think it's something that I enjoy, I think it adds richness to my perception of the things I see and how I feel about them. The personification overall is pleasant for me, and I am grateful for it. (16)
		"I'd say it's more negative than positive, because it's as if in my mind I know that it's not rational and it's just not needed, but it's as if I just can't help it". (3)	"It normally manifest itself in terms of feeling guilty or bad about things maybe not being used or abandoned or lost, that kind of thing, so it would normally only affect me in a negative way". (12)
Anthropomorphism as a comforting experience		It could be a variety of things, it could be a very tactile object, like a pencil or a pen, just like a comforting companion, that's what they became. It's like I thought this pencil is my friend and I'm going to look after it. (1)	"the positive side to it is in circumstances in which you might feel a bit lonely, you feel you've got a bit of a comfort around you with these things which aren't really people". (9)
		"I still think he (teddy bear) makes me feel safe, and also I think it's like this consistency, there is something from home with me that I'm very attached to, that might make things better". (4)	"I had this really great tree, she had great hair - so that's foliage, it was comforting to sit by, and there was a very good associated feeling. I could lie there for hours and look up, I enjoyed reading and drawing by her, and playing with my dolls by her… I was just constantly fascinated by her, and so, as crazy as it sounds, I had a good relationship with her. I was quite happy to see her and she was quite happy to see me. She was like a guardian. I didn't mind being alone with her, I felt protected, safe and happy". (14)

Greater affinity for objects than people		"I just remember feeling more comfortable with objects than with people, like I could trust them more, as if they were more honest".(5)	"Sometimes maybe I feel more sorry for objects than I do about people. But I think that's because maybe I feel that people can stick up for themselves more, whereas objects are entirely dependent on me, and can't speak or move". (12)
Upsetting or distressing experiences	**Worrying about agents**	I was at secondary school, so it must have been around 14. I didn't like to throw things away unless I was at home, because I felt like the rubbish would be lonely, as if it had feelings, like it had to be thrown away at home. I liked to throw things away in pairs, again so it kind of wasn't on its own. (3) I almost feel sorry for objects I dislike, I feel guilty for that. Like I have this guitar that I can't really touch because I am hypersensitive to the material that it's made of, and I feel guilty for having had to hide it, because just thinking about its texture would make me shiver. And I always feel guilty when I remember it's hidden away, like I've locked it up. (5)	"Like even cutlery, just sort of thinking that you can't have one piece on their own because it could be lonely." (11) "Sometimes I feel guilty about complaining about inanimate objects because I feel like they can hear me. For instance, I was recently complaining that my pillow was uncomfortable, but I would kind of feel guilty if I would say that in the pillow's presence". (12)
	Deliberate Malfunction	"Sometimes at school I would think the computers would deliberately go off just too annoying me, to make me say 'oh why everyone else's is working but not mine?' a sort of sense of being picked on". (1)	"It's not that I believe the computer is capable of responding automatically, but sometimes that's where the thought would be triggered, that the computer has its own thoughts and feelings that might be deliberately getting in the way, or playing up". (14)
Supporting autistic challenges		"I think it's definitely a positive thing in my life, and we were able to use some of my toys to teach me more about being friends and caring and things like that, in a way I could understand and that was not threatening. I think	

that while we didn't know about the Asperger's, that's one of the things that my family got right, almost by accident. I think I's a really good thing. With my son, we use his toys to help him make sense of the world, and asking him 'how do you think that would make a certain toy feel?' and 'how a certain toy feels about this?' and getting him to think about feelings. Because they weren't people, I think it was easier for him and less difficult to deal with them first, and then start applying that to people". (7)

"I think it helped me feel safe, because I couldn't communicate properly with people and I would use my teddy to communicate, not with other people but I will tell him things that I couldn't tell other people, like when you're going to bed and you replaying your day, I will talk to him and get all of that out. (A4)

What other people may think	"I'm aware that I do it sometimes, but I'm not always aware of whether I do it or not, so sometimes it's when people are laughing at me that I realise that I've done it without meaning to". (4)	"If it's with animals I think it's different, because a lot of people do that. It's one thing to ask your cat how was his day in front of other people versus asking your cooking utensils are you ready to cook some amazing dinner with other people watching you and looking at you like you're absolutely insane". (10)

Figure 1. Thematic map
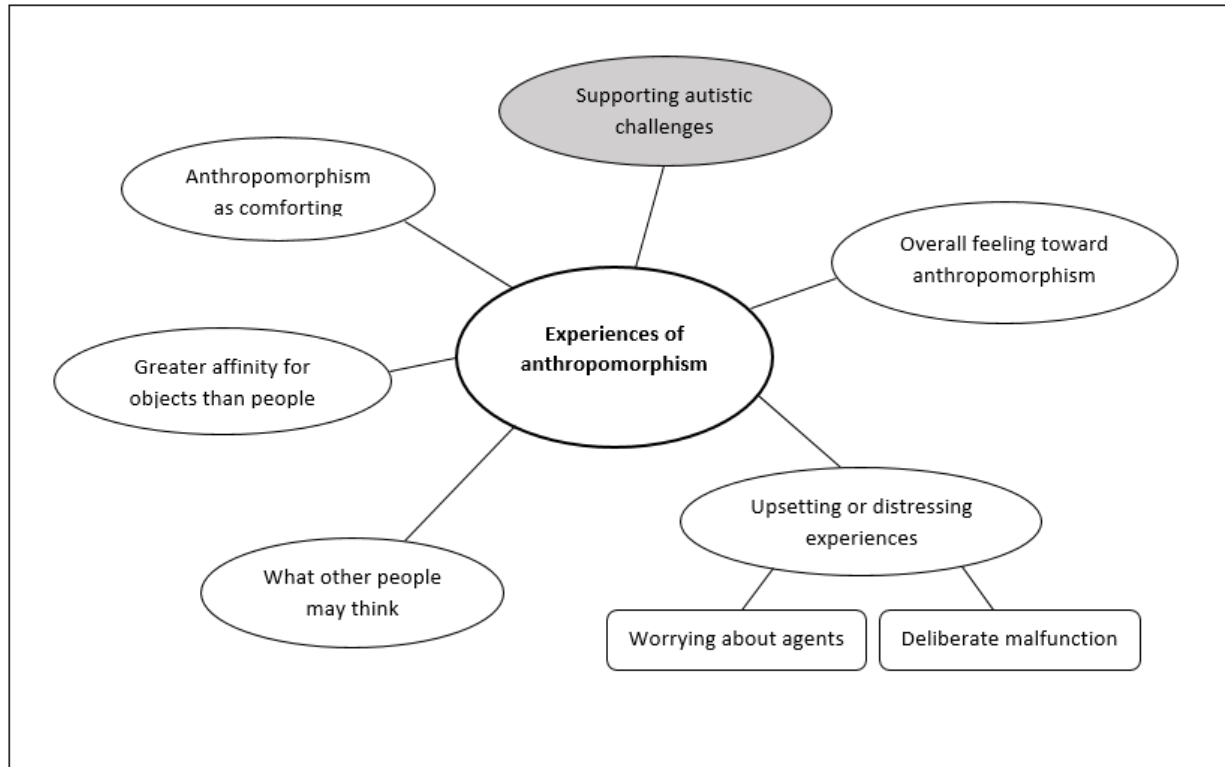
Participants in both groups spontaneously mentioned they were aware of the fact that, with the exception of animals/pets, the objects they anthropomorphised did not necessarily have the capacity to think or feel. As such, unlike for pathological symptoms (such as delusions),[30] anthropomorphic experiences described by participants in the current study were accompanied by insight that, in reality, anthropomorphised agents likely lack the capacity to think/feel.

Almost all participants experienced the tendency to anthropomorphise as mostly or entirely automatic. This was the case for both autistic ("*It just happens, it's not something I try to do or anything*" A3) and non-autistic ("*I think it happens automatically*" N9) individuals. Most participants mentioned anthropomorphism had become less frequent and less intense as they grew older ("*I think when I was younger it was more automatic, I applied it to a lot of things that*

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had sentimental value to me" N10), although some of their childhood anthropomorphic

tendencies persisted in adulthood ("*I think it's faded and became a lot less real. Although I would*

still struggle to destroy some objects" A5). Regarding a possible link between personal

experience and the content of anthropomorphic attributions, replies in both groups were mixed;

some participants stated they could clearly see a connection and thought of it as a form of

projection ("*I did kind of give feelings to the car, as if it would be sad I was getting rid of it, but I*

guess projecting my own feelings into the car" A3), while others felt it served an emotion-

regulation purpose ("*I actually think sometimes it was the opposite, if I was feeling*

sad attributing positive things to things would make me feel better, kind of like

therapeutic" N15), or that attributions depended on the characteristics of the agents ("*How I feel*

about an object will depend on the object and the context" A5). Similarly, some participants

indicated their anthropomorphic tendencies were stronger with personally-significant agents, and

others felt the tendencies did not depend on their personal preference. Several participants in

both groups indicated that pareidolia (the phenomenon in which one perceives a pattern

resembling a face in inanimate objects) [31] often induced anthropomorphism.

Overall feelings toward anthropomorphism

When asked about their overall feelings toward anthropomorphism, participants in each group

differed as to whether they described the overall experience as neutral, positive or negative. Some

participants (A1, A4, A5, N11, N13, N14) described their anthropomorphic experiences as neutral:

"*It's just something I do, I don't attach a particular connotation to it.*" (A1)

"*I think it's just there, a part of how my brain sees things. I don't think it's a bad thing or a good*

thing." (N14)

Other participants (A2, A6, A7, N9, N10, N15, N16) had positive views, and considered their anthropomorphism to be a beneficial addition to their life and perception:

"I think that it's amusing, it's fun. For example, if the teddy bear is in the room and I'm alone in my flat, I don't feel like I'm alone because the teddy bear is there." (A2)

"On the whole, it's a positive experience. It's something that gives me a feeling of purpose in life, of oneness. If I didn't feel this way about things, I think I would feel it's a loss, I would feel life had less point to it, less value." (N9)

Conversely, three participants (A3, A8, N12) viewed their overall experience as more negative, a view that seemed to strongly relate to the automatic and uncontrollable aspect of anthropomorphism:

It's mostly a negative thing. I think it's really tiring, because everything just seems to be sort of radiating with emotion - the light switch, or the tap, or water coming out of the tap - it's just literally everything. And I've been trying to get to the bottom of it for years, because I think it's something I was born with, and it's a really big part of my life, almost a disability in itself. It's not just a sort of quirky personality trait, it actually has some really detrimental effects on everyday living. (A8)

Anthropomorphism as comforting

The most prevalent theme in both groups (A1, A2, A3, A4, A5, A6, A7, N9, N10, N11, N13, N14, N15, N16) was that of anthropomorphism as promoting a sense of comfort and safety, during childhood and into adulthood. Examples of comforting anthropomorphic experiences were even mentioned by some of the participants who described their overall experience as neutral or more

negative. Participants described anthropomorphism as a pleasant experience that induced a sense of well-being:

"I definitely personify clothes, like I feel coats and stuff like that have a personality. I have a coat that I got a few years ago, and it's comforting, it makes me feel healthy when I'm unwell. I can't explain why, it's not rational, it just makes me feel that way." (A5)

Such experiences were often accompanied by a sense of social presence related to the character of the agents:

"I don't mind being by myself, but it is comforting to be around objects sometimes because they are imbued with the ability to be comforting in a way, because they have more personality." (N16)

These type of comforting experiences seemed to often be associated with a feeling of being protected:

"I think I was quite easily comforted by toys and familiar objects, so it was almost like they were protectors." (A6)

Participants frequently compared the presence of anthropomorphised agents to that of friends. As one participant explained:

"It's a similar feeling to having a sense of community, the feeling that you're living in a place where you know the locals and your neighbours look out for you and they're also your friends, it is as if the objects around you are your friends and you're looking out for them and they're somehow looking out for you." (N9)

Greater affinity for objects than people

Anthropomorphic experiences led some participants, both autistic and non-autistic (A5, A7, N9, N12), to report feeling more affinity for anthropomorphised agents than for people:

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"I just remember feeling more comfortable with objects than with people, like I could trust them more, as if they were more honest." (A5)

"The whole process sometimes puts me in the position where I feel I'm on the side of the objects against other people, like they're my gang or my friends, and someone else, a human being, is not, or vice versa. I feel like I have these objects and I'm protective of them against people." (N9)

Supporting autistic challenges

Nearly all autistic participants viewed their anthropomorphism as a way of supporting some of the challenges they encountered due to being on the autistic spectrum. Most participants in the autistic group (A1, A2, A4, A5, A6, A7) explained that sometimes, especially when they were growing up, anthropomorphism served as a safe and comforting alternative that allowed them to feel socially connected when human interaction felt inaccessible, or was unavailable:

"People can be a bit uncomfortable... and people are usually quite ambiguous, like with irony and stuff, they can say things which they don't mean...it is very confusing, but animals and trees, they don't do that." (A6)

Others felt that by allowing a more comfortable interaction, anthropomorphism supported their self-regulation, either emotional or sensory:

"It's definitely taught me how to comfort myself if I'm sad or alone." (A2)

I think I found people a lot harder for an awful lot of years. It wasn't until somewhere in my 30's that I really began to be comfortable with other humans, and to be able to do better. I had to cope with the fact that I take in for more detailed information than a lot of people do, so sometimes I would just get flooded and overwhelmed, there was just too much information, and I think that my

cat is really good at not bombarding me with massive information, and now with my partner we can just go someplace else that's quiet if there are just too many people and noise around. (A7)

Participants also described how anthropomorphising enabled them to further develop an understanding of their own emotions, and through that, allowed a safer path into learning and understanding social communications and relations:

"I know it made me anxious as a child, and I have learned some things about myself, but I suppose because I have issues with dealing with emotions anyway, and relationship stuff, that perhaps it's helped me to process those things." (A3)

Furthermore, reflecting on the role of anthropomorphism in their childhood, several participants in the autistic group (and one in the non-autistic group) mentioned time spent in solitude, loneliness, and social exclusion:

"School usually ended early, so I would be alone so long before my parents came home. And my friends all lived quite far away from me, I was alone." (A6)

"I think I was nurtured plenty, but I was lonely, definitely very lonely." (A2)

"I was very very lonely as a child, I didn't have many friends, between the lack of being able to do anything sport based because of the injuries, and the Asperger's that we didn't know anything about, I really didn't fit in." (A7)

Upsetting or distressing experiences

Two main themes emerged in which anthropomorphic tendencies were described in terms of a negative, upsetting or unpleasant experience to various degrees: worrying about

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anthropomorphised agents, and feeling an anthropomorphised agent may be malfunctioning intentionally.

Worrying about anthropomorphised agents

The experience of concern for anthropomorphised agents was highly prevalent among participants in both groups (A2, A3, A4, A5, A6, A7, A8, N9, N11, N12, N14, N15, N16), and frequently focused upon the possibility of an agent feeling lonely, abandoned, unwanted or left out, and were often described as triggering feelings of sadness or guilt:

"My stuffed animals were and still are kept on a high shelf in the closet, and often I'd feel pretty guilty about that, but then I would also catch myself and think well, they're not alive, so that was part of maturing, realising that. But I still feel a little bit guilty, even now I still feel the same way about those objects." (N16)

These feelings were not limited to participants' own possessions, with one explaining that:

Going shopping, for example, is really difficult. When I go to the superstore and there's tons and tons of objects on the shelf, I should be able to enjoy looking at all the things, but I feel sorry for this object because it's not as expensive as the other one, or the one that looks better than another one, so I feel sorry for the other one, and I get so overwhelmed by their stuff that I end up making not great decisions about what to buy… it's a really terrible thing. (A8)

Two non-autistic participants (N11, N12) and two autistic participants (A3, A8) indicated that their experiences of anthropomorphism were mostly or solely based on these types of upsetting emotional attributions. Such attributions commonly relate to the individual's intentions, actions, or speech affecting the agent. Three of these four participants had a past or present diagnosis of OCD, and identified that the negative content of their anthropomorphic attributions led to

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distressing emotions, similar to those associated with their experience of OCD symptoms, such as anxiety and sadness:

"I think it was related to OCD, because it's the same kind of feeling of anxiety." (A3)

"It's almost like everything reflects sadness back to you. So it's Sadness, but this is where it seems to maybe overlap with OCD I think, and the autism I mean, I think they all overlap a bit." (A8)

In these cases, it seems difficulty controlling anthropomorphism played a key role in their distress, and led to attempts to regain control by performing actions to regulate their stress (e.g. throwing items away in pairs). As one participant explained:

To the extent of the control piece that comes with OCD, it was kind of projecting my own fears on to the objects, trying to control them in that sense, to prevent things... So I suppose there is a bit of interplay there. (N11)

One autistic participant's (A8) anthropomorphism was distressing to the point that they sought professional counselling to help understand and manage such experiences.

Deliberate malfunction

The second theme associated with negative feelings towards anthropomorphism relates to the category of mechanical or technological devices, and to situations in which they fail to work properly. Half the participants in each group (A1, A2, A4, A6, N10, N12, N13, N14) indicated that these situations tended to result in the view that the agent was intentionally undermining the individual, leading to feelings of irritation, anger, or frustration:

"The car, and also I.T. things, like computers, it's more when they're not working, I kind of think that they're doing it on purpose to piss me off, that's how I feel." (A4)

Some of the participants associated this type of experience with their own mental or emotional

state:

"Maybe in a negative mood, when I'm having a really bad day I would tend to think everything is conspiring against me, like the cord was there specifically to trip me, like it's doing it on purpose just to get me angry." (A2)

"Perhaps if I don't get my way with those things, I look at either the video game or the system that runs the game as something that colluded against me to tick me off and to anger me purposely, just doing what it wants to annoy me." (N10)

What other people may think

Participants in both groups (A3, A4, A6, N9, N10, N13, N15) indicated that they felt their anthropomorphic tendencies might be perceived negatively by others:

"My boyfriend knows that I do it, it's quite a natural thing, but in front of people I didn't know very well I might be worried about what they were thinking about me doing it, they would think it was abnormal or a bit strange." (N15)

For those whose anthropomorphism triggered certain behaviours, there was also an attempt to hide their active engagement with anthropomorphised agents:

"I remember kind of trying to hide it... I remember being embarrassed and ashamed when I got to teenage years. I think I knew that it wasn't kind of normal behaviour, so I was embarrassed in case someone saw me doing it, or realised what I was doing." (A3)

Discussion

This study examined the lived experiences of anthropomorphism in a group of autistic and non-autistic individuals. The findings build on results from a recent study that found a high proportion of autistic individuals anthropomorphise inanimate objects.[2]

Those who spoke to us had mixed views regarding whether the phenomenon was positive, neutral or negative. Participants in both groups explained that they derived comfort from their personal relationship with non-human agents but also worried about their wellbeing– which for some, could lead to great distress. Such views appear to be complex, since they are not based on a single type of experience; in most cases, participants with an overall positive view also described some negative experiences, and vice versa. The autistic individuals acknowledged that anthropomorphism often supported some of the challenges they experienced (e.g., understanding emotions and relationships).

Autistic and non-autistic participants reported similar experiences of anthropomorphism. This was intriguing for a number of reasons. First, anthropomorphism in the general population has been postulated to be an expression of enhanced motivation to connect with others, yet autistic individuals' social motivation has been hypothesised to be reduced.[12,13] As such, we sought to explore whether the nature of anthropomorphism might be different for autistic and non-autistic people. Results from the current study suggest otherwise, with autistic individuals describing their relationships with different non-human agents as meaningful experiences which supported their need for social connectedness. This may suggest that social interest and motivation in autism should not be considered as diminished, but perhaps as less constrained to human entities. This is in keeping with recent research that challenges assumptions about social motivation in autism by highlighting that autistic people's external social behaviours might *appear* different, but this does not equate to a diminished tendency to seek social interaction.[32,33]

Second, previous research has linked autism to difficulties with mentalising, but traditionally this difference was framed as a reduced (or even absent) ability to understand that others have thoughts and feelings which may differ from one's own.[34,35] And yet, the accounts given by

participants in the current study reveal many examples of mentalising: the attribution of emotions, mental states and personality traits to different non-human agents. This may be in line with Brosnan and colleagues' study,[36] in which autistic adolescents showed better performance when identifying emotion in cartoon faces, compared to human faces. It should be stressed that for most, an interaction with non-human agents was not mentioned as necessarily preferable, but as an alternative that was non-threatening and provided a sense of social connectedness. Other studies similarly support participants' views regarding the ease of interaction with non-human agents, showing the use of non-human agents was associated with improved performance in autistic adults on mentalising tasks,[37] and in autistic children on imitation[38] and joint attention[39] interventions. Interaction with non-human agents may be experienced as more comfortable compared to human interaction due to various reasons, such as their level of predictability,[1] controllability and lower social and sensory complexity.[20]

Third, participants in both groups described experiencing concern and feelings of sympathy and empathy toward agents, in line with previous studies indicating anthropomorphism predicts moral concern for anthropomorphised agents.[12,13] Previous accounts have proposed autistic individuals are lacking in cognitive empathy,[40] possibly due to poor introspective ability and a lack of self-other distinction,[41] yet autistic participants in the current study described extensive empathic responses to non-human agents. More recent discussions of empathy, however, point to a lack of conceptual and empirical distinction between socio-cognitive constructs such as empathy and mentalising within the literature,[42] and raise the possibility—and resulting damage—of misinterpretation of autistic behaviour and understanding by non-autistic individuals.[33, 43,44]

The anthropomorphism experienced by most participants does not seem to be a form of social synaesthesia, insofar as fifteen participants did not find that their specific anthropomorphic

associations were consistent across time. Only one participant (N16) reported that their attributions were highly stable (i.e. all objects elicited the same attributions over time).

The autistic participants in our study raised the value of anthropomorphism as a possible stepping stone to better understanding their own emotions and interacting with other people. Given that these abilities can prove challenging for those on the autistic spectrum, mentalising using anthropomorphised agents (even for those who do not spontaneously anthropomorphise) may serve to improve emotional awareness and social skills in autism. Such potential is demonstrated by an intervention study by Golan and colleagues[45] in which autistic children (aged 4-7 years) showed significantly improved performance in emotion recognition of human faces following an intervention that included anthropomorphised agents with human faces. In addition, as noted by participants in the current study, unlike interaction with non-human agents, human interaction may be experienced as stressful for individuals on the spectrum. This highlights the importance of non-human agents in providing a comfortable alternative that may alleviate stress, and therefore enable a safer path to exploring and further developing social skills.[20] Indeed research has suggested that object attachment is a compensatory strategy used when human others are perceived as unreliable or unavailable.[46]

While embracing the potential value of anthropomorphism, we are also mindful of the negative aspects. Upsetting experiences (to various degrees) were common among participants in both groups, and for four individuals, worries about anthropomorphised agents were the most salient aspect of anthropomorphic experiences. Three of these individuals had a past/present diagnosis of OCD, and described greater distress in such situations, as well as feeling compelled to act in a way that would ease their stress (e.g. throwing items in pairs so they wouldn't be lonely). Anthropomorphism has been linked with emotional attachment to objects and hoarding behaviours

(which are common in OCD) in clinical and non-clinical samples,[47,48] and the current findings add support to this association. The potential for distress caused by anthropomorphism highlights the importance of further research aimed at investigating how best to support individuals for whom anthropomorphism negatively affects mental wellbeing.

While the findings offer an insight into social cognition for autistic and non-autistic adults, the sample size in the current study was relatively small, and as such should be followed up by larger scale studies on this topic. Additionally, subsequent research should directly explore the link between anthropomorphism and factors such as mentalising ability, loneliness and social connectedness to build on the self-report approach taken in the current study.

In conclusion, though many factors thought to play a central role in anthropomorphism are considered to be atypical in autism, the anthropomorphic experiences of autistic and non-autistic participants were found to be generally similar. Participants in both groups described anthropomorphism as eliciting a sense of friendship and closeness. The autistic participants additionally highlighted the specific importance of such experiences to individuals on the spectrum: non-human anthropomorphised agents serve as a non-threatening, comforting alternative to human interactions when these are unavailable, or pose socioemotional and/or sensory difficulties.

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