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Virtually in Love: The Role of Romantic Anthropomorphism in The Digital Age

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Abstract

Introduction: Romantic relationships are a cornerstone of human nature. Today, the needs and benefits of romantic relationships have the potential to be fulfilled by virtual agents (VAs). Although previous psychological research has examined how human needs can be met by anthropomorphised agents, this research has not much considered virtual romantic relationships.

Aims: This thesis therefore aims to introduce the concept of romantic anthropomorphism (i.e. giving a non-human agent human-like characteristics in a romantic context) to help understand virtual romance. Specifically, we explored the factors that might contribute to developing a romantic relationship with a VA. To examine virtual romance, we use romantic video games (RVGs) for our two online-based and three laboratory-based studies. RVGs provide people with the opportunity to select, build and enjoy a romantic relationship with a VA. Depending on the player's answers, the agent's responses and behaviours towards the player will change. Some people anthropomorphise and fall in love with virtual romantic partners in RVGs. This thesis sets out three major parts.

First, this thesis employs social psychological research and theory to review anthropomorphism and romantic relationships. Specifically, we focus on how, why and when people come to anthropomorphise in the digital age. The definition of digital age is the era where computer and technology is largely and widely available to humans. Moving beyond static representations of VAs, we examine the dynamics of human-VA relationships and how they encroach on the closest of human relationships; virtual romance. Secondly, it explores what factors attract people to play RVGs (Study 1 and 2).

Finally, it aimed to investigate how romantic anthropomorphism predicts relationship authenticity, desire for real-world relationships, mood and real-world behaviour (Study 3,4 and 5).

Method: In Study 1, 43 Japanese participants completed the online survey about their desire to play RVGs and the importance of voice and touch in RVGs. In Study 2, 281 Japanese participants replicated the results of Study 1 regarding the importance of voice and touch in RVGs. The study also examined the anticipated benefits of playing RVGs. In Study 3, 4 and 5, female participants (Study 5: heterosexual female participants) completed the survey before and after playing an RVG for 30 minutes in the laboratory. In Study 5, participants also participated in an interview with an attractive male confederate at the end of the experiment.

Results: Two online studies (Study 1 and 2) revealed that a human-like voice and the use of touch were perceived as important factors in anthropomorphised relationships. Moreover, the subsequent studies found that a desire to develop social skills and alleviate negative emotions increases the desire to play RVGs. Three experimental results (Study 3,4, and 5) and internal meta-analysis revealed and successfully replicated that the romantic anthropomorphism of a VA predicted the desire for a real-world virtual relationship, and that greater positive affect via feeling that the relationship built with the VA was authentic. However, playing RVGs did not predict real-world behaviour in a subsequent interaction with a human confederate.

Discussion: The most important contribution of this thesis is to cultivate the new concept of 'romantic anthropomorphism' and provide the foundations to understand the psychological mechanism of building authentic relationships with a VA. Moreover, this thesis displays a new direction for the field of anthropomorphism for romance in the digital age.

Lay Summary

Most romantic relationship research has focused relationships between two humans, and previous anthropomorphism research has concentrated on platonic interaction with non-human entities. Our research attempts to cultivate a new field bridging the gap between anthropomorphism and romantic relationship studies. This thesis aims to introduces the concept of romantic anthropomorphism (i.e., giving a non-human agent human-like characteristics in a romantic context) to help understand virtual romance. Specifically, we explored the factors that might contribute to developing a romantic relationship with a VA (virtual agent).

To examine virtual romance, we use romantic video games (RVGs) to explore the factors that contribute to developing a romantic relationship with a VA. RVGs provides people with the opportunity to enjoy an experience of a romantic relationship with a VA. Romantic interactions with a VA directly resemble romantic interactions between two humans (e.g., telling each other 'I love you' or other appropriate romantic phrases). Throughout these interactions, some people anthropomorphise and begin to fall in love with their virtual romantic partner. This thesis sets out three major parts.

First, we employ social psychological research and theory to review anthropomorphism and romantic relationships. Specifically, we focus on how, why, and when people come to anthropomorphise in the digital age. This thesis examines the dynamics of human-VA relationships and how they encroach on the closest of human relationships; virtual romance.

Secondly, we explore what factors attract people to play RVGs. Two online studies revealed that a human-like voice and the use of touch were perceived as important factors in anthropomorphised relationships. Moreover, the further studies found that a desire to develop social skills and alleviate negative emotions increases desire to play RVGs.

Finally, we aimed to investigate how romantic anthropomorphism predicts relationship authenticity, desire for real-world relationships, mood, and real-world behaviour. Three experimental results and internal meta-analysis revealed and successfully replicated that romantic anthropomorphism of a VA predicted desire for a real-world virtual relationship, and greater positive affect via feeling that the relationship built with the VA was authentic. However, playing RVGs did not predict real-world behaviour in a subsequent interaction with a human confederate.

In short, we expand upon two domains of psychology: anthropomorphism and romantic relationships. The new concept ‘romantic anthropomorphism’ explores digital technology and the formation of authentic relationships with VAs. This thesis identifies a unique way that people find connections in the digital age and provides an initial step to assess as a group the fields of anthropomorphism, virtual interactions, and relationship science.

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'We overcame difficulties and stand here'

— *Haikyuu*

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Chapter 1- Overview of Thesis

The overall aim of this thesis introduces a new concept in anthropomorphism psychology, *romantic anthropomorphism* (i.e., giving a non-human agent human-like characteristics in a romantic context). This combination of anthropomorphism and romance in the context of relationships is an unexplored and novel area for psychology. Through this thesis, we especially focus on romantic relationships between humans and virtual agents (VAs) and conduct a series of online and laboratory studies to help understand virtual romance.

Love is a powerful emotion which, until recently, required two human participants. Nowadays, people are now looking to VAs to meet this romantic need. We know how romantic relationships benefit our psychological and physical well-being, but previous studies have not examined if and how these needs can be met VAs. Our studies aim to identify the fundamental mechanisms of a romantic relationships with a VA and how it is developed. In addition, we explore how this romantic relationship positively influences a person's behaviour inside and outside the virtual world.

In cultivation of a new field, this thesis approaches the research questions step by step. To examine virtual romance, we use romantic video games (RVGs) for our study; a genre of game that provides people with the opportunity to select, nurture, and enjoy a romantic relationship with a VA. RVGs are experiencing rapid growth as a genre with many players all over the world. Through RVGs, we explore a new type of romantic relationship and analyze the mechanism of building a romantic relationship with them.

The purpose of this chapter is to explain the takeaway messages for each chapter. Three introductory chapters individually present the key topics for research (Chapter 2: The

Psychology of Anthropomorphism, Chapter 3: The Psychology of Close Relationships, Chapter 4: Digital Romantic Anthropomorphism) including the earlier knowledges and backgrounds of the research questions underpinning the three empirical chapters (Chapter 5, 6, and 7). In the empirical chapters, we firstly set an online survey and examined the important factors related to a desire to play RVGs. Followed by an online survey, we aimed to conduct experimental studies examining how romantic anthropomorphism predicts relationship authenticity with a VA, desire for a real-world relationship, and mood as well as real-world behavior. These primary aims are summarized in the eight chapters of the thesis.

Chapter 2 presents the fundamental knowledge of the field of anthropomorphism. This chapter explains previous theoretical and empirical studies of anthropomorphism and extends the discussion to the field of technology in anthropomorphism.

Chapter 3 includes the literature review of romantic relationships, especially focusing why people want to have romantic relationships and how to build a healthy relationship. In addition, this chapter launches how to find love alongside the current issues of romantic relationships in society.

Chapter 4 introduces the concept of romantic anthropomorphisms, a hybrid model of anthropomorphism and romantic relationships. This chapter also covers what the potential benefits of experiencing romantic anthropomorphism are and why this new field is important for people to find connections in the modern world.

Chapter 5 includes a series of studies conducted as initial work for the topic of romantic anthropomorphism. These studies aimed to examine what factors attract people to play RVGs and the results are replicated with an independent large sample by Study 2.

Chapters 6 and 7 include a total of three experimental studies and additionally combined are the three datasets for an internal meta-analysis. In Chapter 6, two lab studies provide preliminary evidence that romantic anthropomorphism plays an important role in virtual relationship experiences. We investigated whether human-virtual agent romantic relationships are associated with mood and whether anthropomorphism is employed to assist in building a relationship with them. Two studies address these ideas using the associations between our variables of interest in two separate samples; Study 3 was an exploratory study and Study 4 was a confirmatory study.

In Chapter 7, we test in a new model whether the outcomes of a virtual romance influence real world relationships and combine the previous two laboratory studies with Study 5, for conducting an internal meta-analysis to confirm our finding across all three studies.

Finally, Chapter 8 concludes this thesis by discussing the implications and future directions for the field of anthropomorphism, romantic relationships, and technology alongside examining the results of the entire body of studies.

Chapter 2: The Psychology of Anthropomorphism

Chapter Introduction

"When people laugh at Mickey Mouse it's because he's so human; and that is the secret of his popularity."

— Walt Disney

Our life is surrounded by anthropomorphism. The definition of anthropomorphism is the 'attribution of human characteristics or behaviors to a god, animal, or object' (Soanes & Stevenson, 2005). Walt Disney famously said that everything 'was all started by a mouse'. Disneyland is based on the concept of a fictional world cut off from everyday life, and the atmosphere of the place is produced by the presence of many anthropomorphised characters (DoRozario, 2006). For example, Minnie Mouse, Donald Duck, and Goofy are all 'anthropomorphised' characters, each possessing concepts of various animals, whereas characters like Cinderella and Snow White, for example, are popular 'human type' anthropomorphised characters. Though Mickey Mouse is not the only world-famous mouse: Pokémon, being a long-time best seller for Nintendo since its release (Bainbridge, 2014), has the world-famous Pikachu, a rat-themed character, who is still extremely popular around the world today (Horton, 2012). To give people a realistic experience of the fictional world, the mobile video game 'Pokémon Go' was released in 2016, inspiring people to get out and about while inside the 'Pokémon world', and research has been published on the health (e.g., increased socialization and physical activities) aspects of the game (Wagner-Greene et al., 2017; LeBlanc & Chaput, 2017). In 2019, a live action film 'Pokémon Detective Pikachu' was released by a western film company. It was set up that Pikachu, an anthropomorphic rat, could talk to a protagonist human character, further emphasizing his relatability in a human-like way (Nicholas,

2019). As another example, Tamagotchi was released in Japan in 1996 as a virtual pet, and won the Ig Nobel Prize in 1997, the prize being awarded for the reason that Tamagotchi encouraged people to spend huge amounts of their working hours to raise and care for virtual pets (Wolf, 2020). Why do we treat and care for inanimate objects like they are humans? Why do we feel the need to do this, and how do we gain a secure feeling and attachment to objects?

Imaginary worlds and fictional characters have impact and weight on our real world. If we can make something out of nothing and derive happiness from our imagination, then anthropomorphism defines an area of study with tremendous potential. This chapter will review anthropomorphism through a religious perspective, a developmental psychology aspect, and it will also introduce recent motivation models of anthropomorphism.

What is Animism?

Particularly, at an early age, we feel as if both natural and manmade 'objects' are alive. For example, many children treat inanimate objects such as dolls and toys as if they were living things, and describe plants and flowers waving in the wind as if they had done it by their own choice. How does this notion of anthropomorphism come about?

Many people struggle to have meaningful social interactions with other humans and therefore often turn to inanimate objects to satisfy this need. This can lead to the person treating the inanimate object as if it were another human, a phenomenon we term anthropomorphism. The various types of anthropomorphism are divided by various factors such as cultural and development influences (Epley, Waytz & Cacioppo, 2007). Humans can attribute humanlike characteristics to inanimate things and then interpret the world as more relatable, reasonable, and meaningful. In this way, people can create a social relationship with non-human agents (Guthrie,

1993). Since animism and anthropomorphism share a similar domain, the relationship ought to be viewed as a continuum (Airenti, 2018).

'Animism' is a word we use to explain the concept that every object and creature has a soul (Tylor, 1871), and there are many cultural differences within this concept. Japanese Shintoism, for example, a form of 'animism', identifies that eight million gods (*yaoyorozu no kami*) exist in the world and, specifically the meaning of the term refers to the innumerability of gods (*kami*) on the planet (Ogura, 2017). With this belief, Japanese Shintoism holds that a god dwells in every object, and this extends not only to objects in nature but also to trivial 'man-made' objects such as merchandise and electronics (Jensen & Blok, 2013). For the example of man-made objects, AIBO is a famous robotic pet dog developed by Sony since 1999. Many AIBO owners treat their pet robots the same way they would a human. However, the firm Sony stopped repairing malfunctioning AIBO robots in 2014, and the old model is no longer available. After that, a Buddhist temple held a solemn ceremony for the 'dead dog' AIBO and prayed for their souls (McCurry, 2018). The most distinctive point of Japanese Shintoism is its imbuing of spirits towards non-human agents (e.g., animals and robots), inhabiting the same world symbiotically. Another extreme example of this culture is the 'Hari Kuyo' festival, a memorial service held for old needles (Crossley-Baxter, 2013). People attend this festival to pray for old needles and to improve their sewing skills and show appreciation to the old needles (Guth, 2014). These examples are vivid proof that Japanese people breach boundaries between human and extra-human realms (Allison, 2006).

This animistic belief comes from polytheism and implies that each object has a soul which results in many Japanese people treating objects with emotional care. In contrast to Christians who believe that there is only a single god, polytheists hold the opposite. The

monotheistic religions (e.g., Christianity, Islam) make a clear categorisation and, especially in Islam, idolatry is forbidden. The ban of idols makes a sharp distinction between natural and artificial objects (Trovato, Cuellar & Nishimura, 2016). In short, through differing cultural perspectives, there is no consistency in how entities are anthropomorphized as individual, cultural, and regional backgrounds are determining aspects for how and why we anthropomorphise.

Anthropomorphism in Developmental Aspects

In developmental psychology, the meaning of animism is slightly different. Regarding the perception of non-human agency, children have different perceptions to adults. This difference is somewhat related to egocentrism and generally applies to humans at an early childhood age (Piaget, 1929). This egocentrism triggers children to interpret the meaning of inanimate agents to suit themselves. Indeed, most young children cannot determine the difference between inanimate and animate objects (Piaget, 1929). Further, children under four years of age do not have the ability to distinguish between their own views and the views of others (Wimmer & Perner, 1983). In Piaget's study of child animism, the concept of animism is strongly characterised in young children; however, other studies have confirmed that adults also follow this concept. Looft and Bartz (1969) reviewed Piaget's initial work and other literatures of animistic empirical work and summarized anthropomorphic and animistic concepts exist at all age ranges and in different cultures. Dennis and Mallinger (1949) studied people over seventy years of age for whether they considered inanimate objects to be animate and found that seventy five percent of participants displayed results which suggested that they believed in animism. This concept is not limited to young children or adolescents as studies have shown that the 'elderly aged' people also think of inanimate objects as animate (McDonald & Stuart- Hamiltom, 2000).

The distinctive difference of the concept of animism between children and adults is the rational understanding of non-living objects, especially digital technology. Children tend to find it difficult to distinguish robots into alive or not-alive categories, as children think robots differ, for example, to cars or other less 'animated' technologies (Katayama, Katayama, Kitazaki & Itakura, 2010). In addition, children are more likely to perceive robots as agents able to feel pain or joy (Ban & Takahashi, 2016). Therefore, animism and anthropomorphism can be a fundamental human attribute, appearing in early age, and persisting throughout life (Airenti, 2018).

Anthropomorphism in The Modern World

In 2009 in Japan, Sal got married. In some ways, his story was unremarkable; he had been in a relationship with Nene for years, they lived together and went on holidays, and he loved her very much. Nene was, however, a computer game character from KONAMI's 'LovePlus' for the Nintendo DS (Lah, 2009). In the game players select a partner, nurture a relationship, interact tactilely through the DS device, fall in love, and sometimes even marry in real life. While it would be easy to dismiss Sal as an anomaly – indeed, precious few people marry video game and virtual characters (Jozuka, 2018) – his case represents an extreme form of a more widespread phenomenon; our increasingly human-like or anthropomorphised perceptions, interactions, and relationships with virtual agents.

We need not look far nor wide to find evidence that people tend to assign human-like characteristics to non-human entities (Epley et al., 2007). Our tendency to anthropomorphise potentially dates back as far as 30,000BCE with sculptures and cave paintings of human-animal hybrids (Mithen, 1998). Our tendency to blur the human-animal boundary by assigning animals human-like capacities continues today in the ways we speak to and treat our pets (Horowitz & Bekoff, 2007) and wildlife (Lévi-Strauss & Chorier, 1996). This effect is not limited to animals;

the earliest recorded religions engaged in widespread anthropomorphism, a practice recognised and critiqued as early as ancient Greece (Xenophanes, 570BCE cited in de Waal, 1999). This theistic anthropomorphism continues today, with people thinking of god(s) in decidedly human-like ways (Shaman, Saide & Richert, 2018). If we accept that the anthropomorphism of animals and divine entities (e.g., gods, demons, etc) dates at least to classical antiquity, we have been doing it for 5,000 years. Against this timescale, the emergence of digital entities and digital anthropomorphism is rapid indeed. The era 'the digital age' is a time that computer and other subsequent technology became largely and widely available to humans (Statti & Torres, 2020). Starting in the 1900s with the emergence of animated films and cartoons (Ward, 2000), people were for the first time exposed to moving virtual 'agents'. By the mid-1980s these had become interactive in the form of video game characters (Hunt, 2012), and by the late-1990s the infamous Microsoft paperclip 'Clippy' had brought virtual agents into the workplace (Nelson, & Churchill, 2008). In the last decade Amazon (Alexa), Google (Google Assistant), and Apple (Siri) have all introduced interactive virtual agents to inform, entertain, and assist us. In this way, the landscape of anthropomorphism has massively expanded in just a few generations, primarily within the last forty years.

Although we can think of virtual entities as a new case of a classic psychological process, they do meaningfully differ from other, previously anthropomorphised entities. Most targets of anthropomorphism have changed little in the last few thousand years. For example, the God of early Christianity is broadly similar to the Christian God of today (Shaman et al., 2018). Animals and natural phenomena have arguably elicited less anthropomorphism as our contact with animals has decreased and alternative, scientific explanations have been developed (Gallup, Marino & Eddy, 1997). By sharp contrast, the objective cognitive abilities of virtual agents are

increasing dramatically (Brunet-Gouet, Oker, Jean-Claude, Grynszpan, & Philip, 2016; Numata et al., 2020). Thus, virtual agents are not only more common, but more complex; more responsive, more flexible, and more like human beings.

Current Model of Anthropomorphism

Researchers have examined why and how people anthropomorphise. The primary approach has been the SEEK model (Epley et al., 2007). The SEEK model specifies three factors which motivate people to view non-human entities as human: '*Sociality motivation*', '*Effectance motivation*' and '*Elicited agent Knowledge*'. In the following section, we outline each aspect of the SEEK model and explore how it can help us understand digital anthropomorphism.

Sociality Motivation

Sociality motivation (SM) refers to our desire for social contact, social connection, and affiliation towards non-human agents. Needing to belong - to see ourselves as part of a group or society - is an intrinsic motivation typically fulfilled by connecting with other people (Baumeister & Leary, 1995). To help forge this sense of connection, we can anthropomorphise entities around and use them to meet our social needs. An early study by Epley and colleagues (Epley, Akalis, Waytz, & Cacioppo, 2008) showed that loneliness is a significant predictor of anthropomorphism. Twenty participants rated loneliness scales and human-like characteristics of gadgets (e.g., 'clocky' is an alarm clock and looks like a funny animal, the function of which makes it difficult for us to repeatedly press 'snooze'). Bartz, Tchalova & Fenerci (2016) replicated the findings of Epley et al (2008) with a larger sample (N = 178); lonely individuals tend to ascribe human-like characteristics to inanimate objects. In addition, the results of Bartz et

al (2016) showed that attachment anxiety – fear of losing a social bond (Rom & Mikulincer, 2003) – is a stronger predictor than loneliness in relation to anthropomorphising objects.

SM is strongly associated with our feelings of social exclusion and loneliness. Feeling a strong sociality motivation can increase our attention to social cues, which includes human-like designs and characteristics (Gardner, Pickett, Jefferis & Knowles, 2005). Once these social cues are identified they can facilitate the formation of new relationships (Pickett, Gardner & Knowles, 2004) and feed into anthropomorphism. Indeed, feeling socially disconnected leads people to seek out anthropomorphised entities (Chen, Wan & Levy, 2017), and in doing so foster an emotional connection (Brown, Nesse, House & Utz, 2004). This reliance on social connections from anthropomorphised non-human entities can become maladaptive; for example, in the case of hoarding behaviour (Burgess, Graves & Frost, 2018; Timpano & Shaw, 2013).

Regarding SM in the digital age, an entire class of companion VAs have been developed to fulfil our desire for social and especially romantic connection. In his review, Jakobek (2019) highlights that three different types of technologies provided humans the opportunity to form attachments to non-human entities: social robots, dating simulations, and virtual reality. Evidence for at least one of these - dating simulation or romantic video games - has recently been uncovered. Consistent with the SEEK model, Koike, Loughnan, Stanton & Ban (2020) found that lonely individuals seek out romantic video games. The effects may extend into virtual reality, with a Japanese man recently marrying a female anime hologram, for the reported reason that he had no interest in forming a romantic relationship with a real woman (Jozuka, 2018).

For an example of social robots, robotic animals are one of the new and modern ways for people to keep pets. Keeping a pet is an effective method to reduce anxiety and counter psychological stress (Allen, Blascovich & Mendes, 2002). From a clinical viewpoint, on matters

of interacting with and looking after pets, pet owners encounter a decrease in loneliness and an increase in their sense of security and general happiness and feel that they develop a friendship when they care for a pet (Sable, 2013). Despite gaining the strong mental benefits, relationships with a pet can also sometimes be a disadvantage, as the owner can suffer emotionally when the pet passes away or falls ill. To counter this, robotic pets have been developed. Owners will no longer need to worry about their pet dying, in a general sense, and they also allow people who suffer from pet related allergies or other hygienic reasons to have a pet. For example, the robotic seal 'PARO' was developed with the aim of providing animal therapy. Positive psychological (lower stress) and physical effects (lower blood pressure) were discovered when elderly people interacted with PARO (Wada & Shibata., 2007). Research on the role of sociality motivation in digital anthropomorphism is gathering momentum, but much more remains to be done.

Effectance Motivation (EM)

Effectance motivation (EM) refers to the desire to explain and understand the behaviour of other agents. This motivation encourages people to search for meaning, knowledge, and to develop expectancies for non-human agents. EM appears to be a driving force of anthropomorphism when we seek to understand the events around us, increase the environment's controllability, and resolves uncertainty.

There is good evidence that effectance needs motivate anthropomorphism. Waytz et al (2010) conducted the series of five studies where participants rated predictable and unpredictable gadgets on the extent to which they possess a mind. Neuroimaging results revealed that assessing the mental capacity of unpredictable gadgets is linked to relative increased activation of the ventromedial prefrontal cortex (vMPFC), a region involved in inferring others' mental states. The neural correlates resemble those involved in mentalizing other humans. This study shows

that in response to unpredictable agents requiring understanding, people anthropomorphise. Epley, Waytz, Akalis & Cacioppo (2008) found that participants who have higher levels of desire for control (EM) rated unpredictable animals as more human-like than those who have less desire for control. Anthropomorphism helps us understand complex systems like stock markets (Morris, Sheldon, Ames, & Young, 2007) and climates (Tam, 2014), and can distort our understanding of risk (Kim & McGill, 2011). In short, EM induces anthropomorphism to help us fulfil our motivation for understanding unpredictable entities and satisfy our need to control uncertainty.

In the digital age, people apply anthropomorphism to help understand the behaviour of VAs. The classic example of this comes from the revolutionary work of Heider & Simmel (1944) exploring mind attribution to moving shapes. In their study, participants viewed a brief animated clip of several shapes moving around a screen. They found that participants spontaneously sought to understand the behaviour of the shapes via attributing mental states and intentions (e.g., the triangle was a 'bully'). Indeed, people routinely employ anthropomorphism when seeking to understand the behaviour of virtual entities, such as entire computer operating systems. We think of these machines as 'reading', 'writing', and 'catching a virus' to help understand the more complex processes of data management and corruption. This anthropomorphism is particularly helpful when the VA defies our expectations and triggers us to search for meaning. Waytz et al (2010) examined whether people perceive human-like characteristics when their computers stop working unexpectedly. The results show that the more participants experience computer malfunctions, the more they perceive computers as having their own minds, beliefs, and desires. Eyssel, Kuchenbrandt & Bobinger (2011) reported that when we perceive an interaction between a human and a robot as unpredictable, it increases

anthropomorphism. These findings reveal to us that when non-human agents interact with us unexpectedly, we tend to anthropomorphise them

As technology progresses, we treat virtual entities as if they have a mind of their own (e.g., when our devices make an error, we anthropomorphise the object as disobedient). Technology is becoming more complex and harder to understand for a non-expert, and anthropomorphism may provide a legible way to help understand and make sense of new or confusing technologies.

Elicited Agent Knowledge (EK)

Elicited agent knowledge (EK) refers to our tendency to give human-like characteristics to things that look or act in a human-like way. Stated more formally, EK refers to anthropomorphism driven by the seeming applicability of our understanding of human psychology to a specific agent. A good example of EK is provided by examining how people anthropomorphise entities based on movement speed. Morewedge, Preston & Wegner (2007) asked participants to view amorphous entities moving slower, equal to, or faster than a typical human. Next, they asked them to judge the 'mind' of the entity, essentially to anthropomorphise it. The found a quadratic relationship; entities which moved at human-like speeds were anthropomorphised more than both faster and slower entities. The speed of motion of an object has an influence on mind perception, with objects travelling at a 'humanlike' speed influencing the mind the greatest (Dennett, 1996). Another related study found that the appearance and design of an object were not the only important factors in causing the anthropomorphism phenomenon, but the speed of motion and movement directions were also found to be important (Tremoulet & Feldman, 2000, 2006). In short, previous studies found that entities which seem human-like are anthropomorphised more.

There is good evidence that EK captures part of the reason why people anthropomorphise. At a basic level, companies exploit EK to forge links between products and consumers. For instance, the female torso design of perfume bottles strengthens the idea of sensuality, and the different front-end face designs of vehicles (e.g., Volkswagen Beetle, Dodge Ram truck) create impressions of cuteness and masculinity, respectively (DiSalvo & Gemperle, 2003). Our anthropomorphism of animals is also influenced by EK. For example, when animals are biologically or behaviourally like humans, we have a more positive impression of them and care for them to a greater extent (Burghardt & Herzog, 1989). In short, we anthropomorphise objects and animals based on their human-like appearance.

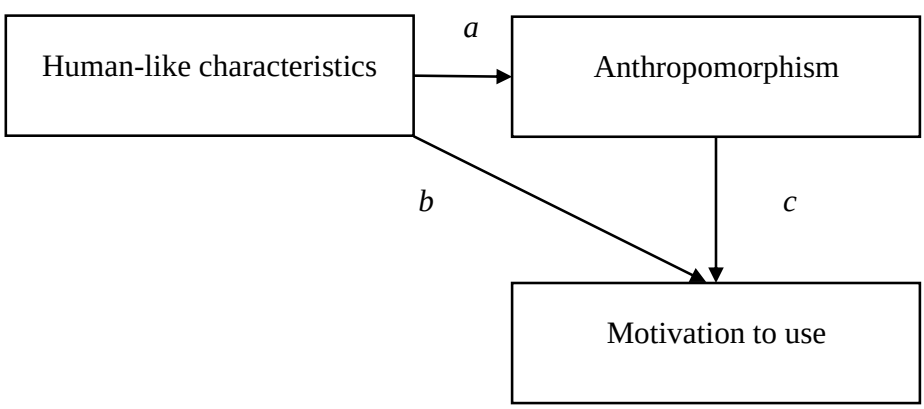


Figure 1. The current trends of EK in technology research

Figure 1 displays the typical model for EK in digital research. To date, most anthropomorphism in the digital domain has focused the *b* path, that is the shortcut to examine the relationship between human-like appearance or actions and the effect on use or treatment. Largely missing is an examination of the '*a'* path; to use human-like appearance as the basis of anthropomorphism (e.g., Schroeder & Epley, 2016). Given that basic research on this topic (*a*

path) is limited, naturally the mediating effects (*c* path) are also understudied. The limited work on this topic focuses more on the allied field of social robotics (e.g., Richert, Müller, Schröder & Jeschke, 2018; Vanman & Kappas, 2019; van Pinxteren, Wetzels, Rüger, Pluymaekers & Wetzels, 2019). To address this gap, we encourage more EK studies on which human-like functions and features increase our tendency to anthropomorphise.

Chapter summary

In conclusion, people anthropomorphise non-human agents when they desire to feel a social connection: they do so by attempting to understand the behaviour of other agents and apply their own knowledge upon non-human entities.

This chapter overviews anthropomorphism and illustrates the current state of research in the area (e.g., technology, gadgets, gods, animals). The field of psychology has largely focused on working with the SEEK model, a motivational model of anthropomorphism. Psychologists now understand in most respects what makes people anthropomorphise. For example, for social robots, we know generally the reasons for why people build relationships with them; psychologists, however, have not examined the aspect of 'how' people build relationships with anthropomorphised entities. Given that we know that close relationships are extremely important in human psychology, the next chapter will explain the psychology of relationships.

Chapter 3: The Psychology of Close Relationships

Chapter Introduction

Humans are social animals. Social relationships are important to construct our lives and they define a cornerstone of social psychology. Cooley, an early social theorist, introduced an idea of the 'looking-glass self'; we can only understand who we are by first understanding how other people view us (Cooley, 1902). In other words, we are the result of our relationships with others during our social experiences and social activities (Mead, 1934). According to Mead, the self is shaped by the roles which we play in our interactions with others (Mead, 1913). Through the theories of Cooley and Mead, our social relationships simply define who and what we are. These ideas continue today, for instance in the work of Markus & Kitayama's (1991) 'interdependent self-construal' where people in some cultures, like Japan, define themselves in terms of cultural rules, roles, and responsibilities.

Our relationships are a core part of our psychology. Naturally, some relationships matter more than others. Romantic relationships, for example, play a principal role in positively changing our self-concepts as a result of our relationship partners (Aron, Aron & Smollan, 1992; Mattingly, Lewandowski & Mcintyre, 2014). This chapter explains why romantic relationships matter to us and how we try to achieve a good and satisfying romantic relationship. In addition, technology has more and more begun to support our human societies in the modern world. We therefore also explain how digital technologies contribute to and affect romantic relationships.

Why do close relationship matter?

One of the fundamental needs of human beings is the interaction with other humans and the subsequent social connection that this interaction creates (Maslow, 1943). Satisfying social

relationships are one of the key elements in distinguishing the difference between happy and unhappy people (Diener & Seligman, 2002). On the contrary, social isolation increases the risk of mortality (Holt-Lunstad, Smith, Baker, Harris & Stephenson, 2015) and poor health outcomes including depression, low sleep quality, and impaired immunity at every stage of life (Hawkley & Capitanio, 2015). According to Maslow (1943), humans have a fundamental desire to 'belong' with others. Love is a powerful and inseparable emotion from human life: college students think that falling in love makes them feel happier than other significant events, even such as winning a lottery (Pettijohn, 1996). There is perhaps no more enduring or shared human psychological experience than the need to love and to be loved (Baumeister & Leary, 1995).

Romantic relationships display themselves as a major source of good physical health. A review article by the research Uchino (2006) explains the link between relationships and physical health. In more specific research, the quality of an individuals' close relationships is associated to their physical health such as reducing stress and regulating pain (Slatcher & Selcuk, 2017). Regarding physical intimacy, even light interactions such as holding hands with a loved partner is not only indicative of an increased sense of 'connection', but also it is a good painkiller. When couples are more empathetic to their partner and receptive to their touch, pain is reduced (Goldstein, Weissman-Fogel & Shamay-Tsoory, 2017). Frequent hugs and warm contacts between spouses or partners are associated with lower blood pressure and the stress hormone cortisol (Light, Grewen, & Amico, 2005; Grewen, Girdler, Amico, & Light, 2005). Marriage, also, plays a crucial role in the long process of 'love', and married couples have a lower risk of mortality than unmarried people (Lillard & Waite, 1995). A meta-analysis reported the numerous links between greater quality of marital relationships and better physical health (Robles, Slatcher, Trombello, & McGinn, 2014). For example, higher marital quality is associated with better sleep

(Lee, Chopik, Schiamberg, 2017). Consequently, when we have a romantic partner and have warm and affectionate interactions, it would potentially increase our overall physical health.

Good romantic relationships covary with better mental health as when individuals improve their relationships, it also enhances mental health (Braithwaite & Holt-Lunstad, 2017). College students in committed relationships experience fewer mental health problems than individuals who are single (Braithwaite, Delevi & Fincham, 2010). In close relationships, partner support is associated with better mental health (Simon & Barrett, 2010). The mechanism is that, when people are satisfied by their relationships and disclose themselves towards their partner, they feel that their partners are more supportive, subsequently contributing to their mental health (Furman & Buhrmester, 1992). Regarding tactile sensory experiences, forms of affectionate behaviours such as handholding and hugging accelerate relationship development (Floyd, 2006). For example, highly affectionate people show greater mental and emotional health, and they report less stress and lower depression (Floyd, 2002). Increased frequency of romantic kissing with a romantic partner improves relationship satisfaction and reduces perceived stress (Floyd et al., 2009). Affection expressed in romantic relationships is associated with various benefits including increased self-esteem and happiness, decreased susceptibility to depression, and greater relationship satisfaction (Floyd et al., 2005). Hence individuals in romantic relationships are advantaged in psychological health.

Romantic relationships are also important for well-being. According to Kansky (2018), romantic relationships positively impact well-being in spite of increased negative emotions and cognitions that occasionally characterise close relationship over time. Furthermore, the stage of romantic relationship can change the level of relationship quality, linking intimate relationships and well-being over our lifespans (Kansky, 2018). Prior work reveals that romantic relationship

quality and satisfaction are related to subjective well-being and happiness (Reis, Collins, & Berscheid, 2000; Myers, 2003), whereas lower quality of relationship is associated with ill-being (Love & Holder, 2016). Also, romantic relationships are related to sources of high intimacy and psychological well-being (Johnson, Kent, & Yale, 2012) and happiness for emerging adults prior to marriage (Demir, 2010). Some studies on the long-term consequences of relationship formation reported that never-married and never-cohabiting young adults slowly decreased a level of subjective well-being over time (Soons, Liefbroer & Kalmijn, 2009). Additionally, it is important for couples to manage conflict constructively in order to receive better subjective well-being and relationship quality (Campbell & Stanton, 2013; Gere & Schimmack, 2013). In short, romantic relationship commitment does not simply improve subjective well-being (Diener, Oishi & Lucas, 2015), but a level of relationship satisfaction is also important for predicting positive emotion (Demirtas & Tezer, 2012).

What characteristics of couples potentially lead to improved well-being? Prior findings regularly point to the benefits of marriage. For example, marriage is associated to lower psychological distress and higher well-being (Holder, 2012), and partner support is an important source of relationship satisfaction (Kinsinger, Laurenceau, Carver & Antoni, 2011). Married individuals report a higher level of subjective well-being than those in unhappy relationships (Walen & Lachman, 2000; Dush & Amato, 2005). In general, married couples have a greater level of agreement on their levels of intimacy and relationship adjustment than couples who are just dating (Moore, McCabe & Brink, 2001). Therefore, heightening the quality of married relationships holds many benefits to lessening mental illness and health (Gove, 1972; Horwitz, White, & Howell-White, 1996), and health behaviours which affect mortality (Umberson, 1987).

Therefore, not all relationships produce high levels of health and well-being. So, how can we build and develop a good romantic relationship with a partner? More specifically, what are the hallmarks to produce a high level of health and well-being from a relationship?

How can we build healthy relationships?

Typically, good relationships are taken to be those high in relationship satisfaction as people generally have a good (if sometimes biased; Halford, Pepping & Petch, 2018) gauge on how their relationship is going. Relationship satisfaction is clearly a composition of multiple elements (Fincham, Rogge & Beach, 2018), but it at least includes emotional connection, responsiveness, and physical intimacy.

Emotional connection is critically important for building close relationships. For example, couples who receive emotional support from their partner report greater relationship satisfaction (Cramer, 2004). This connection appears causal: increased perceived emotional support from a partner leads to higher relationship satisfaction (Lawrence et al., 2008). One form this 'emotional connection' can take is dyadic empathy, a form of emotional support strongly associated with relationship satisfaction (Busby & Gardner, 2008; Kimmes, Edwards, Wetchler & Bercik, 2014). Emotional connection by means of empathy not only builds satisfaction (Cramer, 2003) but also reduces depression and conflict (Cramer & Jowett, 2010). In short, emotional connection – caring about another person (support and empathy) and responding to them emotionally - is an important ingredient in a satisfying relationship.

In addition to emotional connection, partner responsiveness – whether someone shows understanding, validation, and caring to their partner (Gable & Reis, 2006; Reis et al., 2004) – is an important element for a satisfying relationship. Responsiveness is a key factor in building

intimacy (Laurenceau, Barrett, & Pietromonaco, 1998; Reis & Shaver, 1988), and it powerfully determines relationship satisfaction (Gadassi et al., 2016), and increases relationship quality (Reis & Gable, 2015), levels of self-disclosure (Manne et al., 2004), and capitalization attempts on positive daily events (Otto, Laurenceau, Siegel, & Belcher, 2015). In short, responsiveness is a powerful predictor of relationship satisfaction, health and well-being.

The arguments above discuss the importance of the emotional aspects of romantic relationships. Physical intimacy with a partner, which is another important component for a satisfying relationship, neither should be ignored. An association between relationship satisfaction and sexual satisfaction is widely reported (Haavio-Mannila & Kontula, 1997) for both men and women (Fallis, Rehman, Woody, & Purdon, 2016), and sexual satisfaction enhances marital quality and decreases instability (e.g., Sprecher, 2002; Yeh, Lorenz, Wickrama, Conger, & Elder, 2006). Physical intimacy strengthens relationship satisfaction as intimate relationships enhance sexual satisfaction and fulfil a partner's desire for closeness (Muise, Impett & Desmarais, 2013; Debrot, Schoebi, Perrez & Horn, 2013).

Emotional connection, responsiveness, and physical intimacy are cornerstones of good human relationships (Canevello & Crocker, 2010; Yoo, Bartle-Haring, Day & Gangamma, 2014). Prior work has focused on the factors which cause people to have a satisfying relationship and what these successful relationships provide in the form of additional health benefits. In the 21st century, most people use digital technology to help their romantic relationships in one way or another, and these gadgets play an important role in relationships.

Relationships and Digital Technology

1. Technology-form our relationships

Modern technology has many advantages for finding a romantic relationship. Dating apps are a modern way to meet people and form relationships. These apps have become increasingly popular in recent years. According to the Pew Research Center (2020), 30% of U.S. adults have experience a dating site or app, and a greater number of users reported that their overall experience was positive. In 2012, a famous mobile dating app 'Tinder' launched and reached over 50 million users worldwide (Smith, 2020). Tinder users reported that love motivation is a stronger motivation than casual sex for why they use tinder (Sumter, Vandenbosch & Ligtenberg, 2017). More than one-third of US marriages are achieved through online dating (Cacioppo, Cacioppo, Gonzaga, Ogburn, & VanderWeele, 2013). Additionally, this study revealed that marriages that started by online dating have a lower possibility of marital break-up and a higher marital satisfaction than people who married through traditional 'offline' means. The advantages of online dating are numerous, from "filtering" potential partners before progressing to meet in person, less effort and time spent searching, rejection at first contact (making it less personal or offensive), meeting quickly and easily, and having more opportunities to meet potential partners (Couch & Liamputtong, 2008; Wiederhold, 2015). In short, dating apps have been receiving remarkable attention all over the world. It has changed the way people interact romantically and has expanded choice.

Online platforms are defining the modern way to meet romantic partners. In addition, marital satisfaction and maintenance are higher for those who meet through online dating than it is for those individuals who started a romantic relationship in a traditional way. From this point of view, online dating looks destined to become even more common for forming a romantic relationship in the future.

2. Maintain our relationship/ long term relationship

A growing body of work in human-computer interaction has examined new designs for communication tools that support different types of relationships. Digital technology provides communication tools to maintain and enhance our existing relationships. Cell phones contribute significantly to encouraging the frequency of communication in couples; and usage of cell phones enhances relationship satisfaction (Miller-Ott, Kelly & Duran, 2012). Communication technology appears to play an important role for couples which are unable to be geographically close. People in long-distance relationships are physically separated, and video calls fulfil the necessary role of face-to-face communication over long distances. For example, video communication services such as Facetime, Skype, and Google Hangouts provide rich forms of 'presence sharing' which in turn leads to intimacy (Neustaedter & Greenberg, 2012; Janning, Gao, & Snyder, 2018). In addition, more time using Skype or phone calls enhances relationship maintenance, satisfaction, and commitment in long distance relationship couples (Kirk, 2013; Dainton & Aylor, 2002). Text messaging also plays an important role for creating good communication within relationships (Coyne, Stockdale, Busby, Iverson, & Grant, 2011). Young women are highly motivated to use text messaging systems to deepen their relationships (Morrill, Jones, & Vaterlaus, 2013), and the frequency of texting is positively associated with relationship stability (Schade, Sandberg, Bean, Busby & Coyne, 2013). Therefore, digital communication formats such as audio, visual, and textual are used and viewed as differentially meaningful for maintaining romantic relationships.

Social media is widely used to construct interpersonal relationships and provide opportunities to connect with romantic interests. In fact, young adults appear to have a sequence of appropriate steps to start romantic relationships using social media. For instance, young adults start relationships first on Facebook, meeting their partners, next exchanging messages and

phone numbers, and, finally, progressing to meet in person when their relationship becomes closer (Yang, Brown, & Braun, 2014). Snapchat is a popular social media for young people as 78% of internet users aged 18-24 use the app (Omnicore, 2020). Young adults perceived that Snapchat could enhance their romantic relationships with their partner by congruent communication (Vaterlaus, Barnett, Roche & Young, 2016). Further, Snapchat allows day to day communication and increases social presence and closeness in romantic relationships (Kahlow, Coker & Richards, 2020). People use appropriate social media in appropriate places: from posting precious moments to Facebook or Instagram, to something simpler such as Snapchat for exchanging daily and ordinary moments (Piwek & Joinson, 2016). Given that social media allows individuals in romantic relationships to exchange their daily and memorable events frequently, they can feel connected by sharing these meaningful moments with their partners.

Today, we use technology in a wide range of ways in romantic contexts. People use social media and dating apps to identify, flirt, and eventually meet potential partners. People in relationships use social media like Facebook and Snapchat to share the marvellous and the mundane, building closeness and responsiveness in the process. Video chat can replace traditional face-to-face communication for long-distance couples. Digital technology is not only just a tool to facilitate and enhance our existing relationships, but it also has the potential to develop new relationships between humans and virtual agents.

Chapter summary

This chapter has reviewed existing literature in the area of close relationships, particularly the importance of romantic relationships, how to build a healthy relationship, and the impact of digital technology on close relationships in the modern world. Not all relationships equally provide a positive outcome; satisfying relationships provide benefits much greater than

unhealthy ones. Prior work suggests that emotional connection, responsiveness, and physical intimacy are all important aspects in the creation of good close relationships, and they enhance relationship quality for couples.

Digital technology is useful to form and maintain a good relationship with their partners. Nowadays, technology allows people to find a potential partner (e.g., dating apps) and form romantic relationships. Then, technological communication (e.g., Skype, Face time, and Social Media) helps to maintain existing and long-distance relationships. Given that digital technology has improved and evidently provides logical steps to meet and partner with people, digital platforms are no longer just 'assisting' the creation of romantic relationships, but in fact they have progressed far beyond their inception as communication tools. New technology can now imitate and mimic romantic relationships. All prior work for the topic has focused human-to-human relationships, but a new type of relationship is becoming possible between humans and virtual agents. Virtual agents are an established and widely used concept, such as personal assistants and emotional companions. Relationship researchers have in some ways neglected human and virtual agent relationships. However, the landscape of romantic relationships is changing. People interact less in person and more online through dating apps, Skype, FaceTime (now especially true in the COVID-19 era). Thus, modern technology in some ways is capable to supplant, replace, or in significant ways affect human-to-human relationships. While virtual assistants are increasingly commonplace, the effect of close relationships between human and virtual agents is not widely studied. We can think about this technology in a deeper sense, that is, that it may eventually substitute or replace human to human relationships.

Previous studies have examined the many benefits of human to human romantic relationships. In the next chapter, we examine a new type of relationship – human to virtual agent relationships – and how this might be understood through the lens of anthropomorphism.

Chapter 4: Digital Romantic Anthropomorphism

Chapter introduction

Chapter 2 and 3 explained anthropomorphism and romantic relationships, especially focusing on the role of digital technology. Drawing together the previous two chapters, we noted that romantic anthropomorphism has not been studied within psychology. This chapter examines relationships with digital technology in two ways. First, we will review previous work within the field of relationships and non-romantic technological agents. These agents in many ways are no longer simple 'machines': as entities they are increasingly human-like and they allow their users to experience an imitation of regular human-to-human interaction. Given that we as people develop complex relationships with non-human technological entities, we will therefore review studies that examine these popular technological agents and review the history of virtual agents in a companionship role. Second, we will examine work on digital romantic relationships. Romantic video games, for example, are a vivid manifestation of modern technologies that aim to provide the affection and romantic feelings of a real human to human relationship. Interacting with a virtual romantic partner may be better in many ways than being alone or feeling isolated. We also introduce a new concept 'romantic anthropomorphism' and restate the direction and aim of the body of our work at the end of this chapter.

Relationships with Technological Agents

1. Assistant robots

In the contemporary world there are many robots that serve complex functions (e.g., assistants, industrially operated machines, etc.). Some of these modern robots are entering a new era of design and they are growing increasingly humanlike. In other words, these agents have

become more intelligent in both emotional and practical ways. These 'social robots' currently function in various environments, from fulfilling roles in business or healthcare to providing companionship.

Regarding business, many people are worried that these technologies might replace them and take their jobs. For example, tax preparers, photographic process workers, library technicians, and data-entry specialists are all facing a high probability that their jobs will become computerized (West, 2015). In fact, within a study of 702 occupational groupings, researchers found that a total 47% of U.S. workers are at risk of being replaced by digital assistants (Frey & Osborne, 2013). The numbers of industrial robots in use has been increasing worldwide; in 2013 there were an estimated 1.2 million in use which rose to 1.5 million in 2014 (Hagerty, 2015). In the following six years, according to the International Federation of Robotics (IFR), this number doubled to an estimated 3 million industrial robots in use in factories around the world (IFR Press Releases, 2018). Increasing industrial robots on a global scale will cause improvements in various areas such as safety, speed, and consistency, thus boosting overall productivity.

Moving on from industrial robots, companion robots now have more emotional intelligence. Companion robots such as the robotic dog AIBO and the baby harp seal PARO (Figure 1) are not just "cute robots", but they also provide benefits for our health. A systematic review of qualitative and quantitative research reported that interaction with robotic animals has the potential to reduce loneliness and agitation, increase social interactions, and provide comfort and pleasure for older people living in care homes (Abbott et al., 2019). Indeed, these robotic animals can even outperform real animals; AIBO provides more positive social interactions and induces more care-residents to initiate conversations than a living dog (Kramer, Friedmann & Bernstein, 2009).

Figure 1. Examples of Companion Robots

Human-robot interactions also benefit greatly to improve mood and alleviate pain (Geva, Uzefovsky & Levy-Tzedek, 2020). As robotics becomes more sophisticated, humanoid robots are finding new uses in the healthcare and education sectors. SoftBank Robotics suggested that the robots Pepper and NAO can easily create strong empathetic links with patients by their eye-catching appearances (SoftBank Robotics, 2020). For example, Pepper encouraged conversation and even performed better than a normal conversation partner (Richert, Schiffmann & Yuan, 2019). Socially assisted robots have the potential to aid mental health and improve psychological well-being (Scoglio, Reilly, Gorman & Drebing, 2019). These robots are also responsive (Hoffman, Birnbaum, Vanunu, Sass & Reis, 2014) – a hallmark of good relationships (see Chapter 3); modern humanoid robots can learn their users' personalities and adapt their behaviours accordingly (SoftBank Robotics, 2020). They are even able to respond in empathetic ways, another key attribute of good relationships (see Chapter 3). In short, social robots are not simple tools for simple tasks, and can be used to help fulfil fundamentally psychological needs.

Technology is entering a new era where it is converging with humans and creating a fiduciary and equal partnership with us. Companion robots, though, are still expensive for use at

home (Foster, 2018). Because of this, digital companions providing the same role at a cheaper price are now widely in use.

2. History of Virtual Agents

Digital technology has become a constant in the lives of people in developed nations. It is not surprising that human and virtual entities are becoming closer and more connected. Especially, virtual companion technology is a rapidly growing market as technological companions provide additional safety and convenience (Danziger, 2019). For example, digital companions can successfully substitute a real companion for people who cannot care for a real pet, such as those who suffer from allergies or living place restrictions.

When we look at the history of popular technological companions (See Figure 2), these products imply how the genre has established itself in modern society. 'Tamagotchi' is a pioneer of the virtual pet technology, first selling in Japan in 1996. This hand sized, little egg-shaped device required players to raise and nurture virtual creatures. The product targeted young girls in Japan, but later it burst to huge popularity all around the world (Kageyama, 2004). After that, for the young male market, 'Digimon' was released: a game about raising digital monsters to fight. Almost a decade later in 2005, Nintendo's 'Ninten-dogs' was released. In this simulation game, dogs were designed to behave as if they were real in every aspect. The game promoted social engagement with imaginary entities, attaching meaning and value (Ruckenstein, 2015). In 2020, Nintendo's 'Animal Crossing: New Horizons' became the years best-selling video game (Amazon Best Sellers of 2020, 2020). In this game, players can communicate with other digitalized animal villagers on their own islands, creating ideal homes and places. In terms of interactivity and a sense of reality, Animal Crossing is a miniature copy of our real world. The game both encourages and rewards players for forming close social bonds with others.

Figure 2. History of virtual companion

Due to the pandemic of COVID-19, digital communication has become very important (Nguyen et al., 2020). Technological companions provide us daily interaction and allow us to feel connected. Traditionally, technology and humans were once described to have a 'master-slave dynamic' (e.g., Anand, Nithya & Sudarshan, 2014), but now our relationship with technology is more focused on friendship and companionship. Put another way, technological companions are no longer just amusements, but they now have the capability to provide emotional connections.

Digital Romantic Relationships

1. Moe

In modern society, technological companions are capable of providing social bonds; however, it might be so that virtual agents are not limited to providing only 'social connection', but also romantic emotion. Indeed, romantic needs may be more than just 'human to human' interactions. In such a way, anthropomorphism might help us understand how people come to develop such connections to non-human entities.

Romantic anthropomorphism is a concept developed by various experiences. The idea that we might love non-human entities is already embedded in popular culture. For example, 'Moe', a concept originally established in Japanese subcultures such as anime and manga, captures the idea that we might fall in love with virtual characters (Galbraith, 2014). For example, people often experience Moe with imaginary entities such as comic book characters, animated characters, and video game characters (Matsubara & Sato, 2013). More specifically, Moe is triggered by fictional characters that do not physically exist in the world, but we feel affection for them and feel connected when we respond to them in our mind (Saito, 2017). Thus, in a similar sense to love, people feel connected to 'non-human' people in a real way. For example, people become upset if something bad was to happen to their favoured characters. Thus, Moe is the feeling of being attached to a fictitious entity, feeling some love towards them, and being excited when hearing about, watching, or interacting with them. It is a deep feeling of affection and attachment towards that entity. Moe might be felt when thinking about a popular TV character (e.g., Daenerys Targaryen, Arya Stark, or Jon Snow in Game of Thrones, Pikachu or Ash from Pokémon), film characters (e.g., Harry Potter, Hermione Granger), or video game characters (e.g., Link from The Legend of Zelda, Cortana from Halo). The feeling refers to a desire for fantasy, and not always the seeking of pleasure for the physical orientation (Galbraith, 2009).

Strictly speaking, most prior work has been established by review articles of cultural studies and little is explored through the lens of psychology and cross-cultural studies. We have an ongoing work that looks to define the emotion Moe in a cross-cultural perspective (Koike, Ban & Loughnan, 2020) and we have already conducted two large group samples of Japanese and British individuals (total N = 1,249). In Study 1, we observed that Japanese people feel Moe frequently towards animated characters whereas British people feel it more towards human or 'real' type characters. The results of Study 1 supported our claim that Moe would be a universal emotion; however, chosen Moe entities differed by culture. If the concept of Moe is different between Japanese and British people, then it follows that the activities or behaviours triggered by Moe might also differ between nationalities too (e.g., allocating time for interacting with characters or buying goods related to the character or interpersonal closeness with characters). Many sub-cultural events (e.g., comic markets and Anime expo) have been organized inside and outside of Japan. Asian travellers visit Japan for popular animation conventions or to buy related products (Honichi Lab, 2018; Global Daily, 2019). We hypothesized that Japanese people are more likely to act and take part in these conventions or buy products when they feel Moe. In short, anthropomorphism can be used for broader domains of sub-cultures and entertainment and build romantic relationships with characters.

2. Romantic Video Games (RVGs)

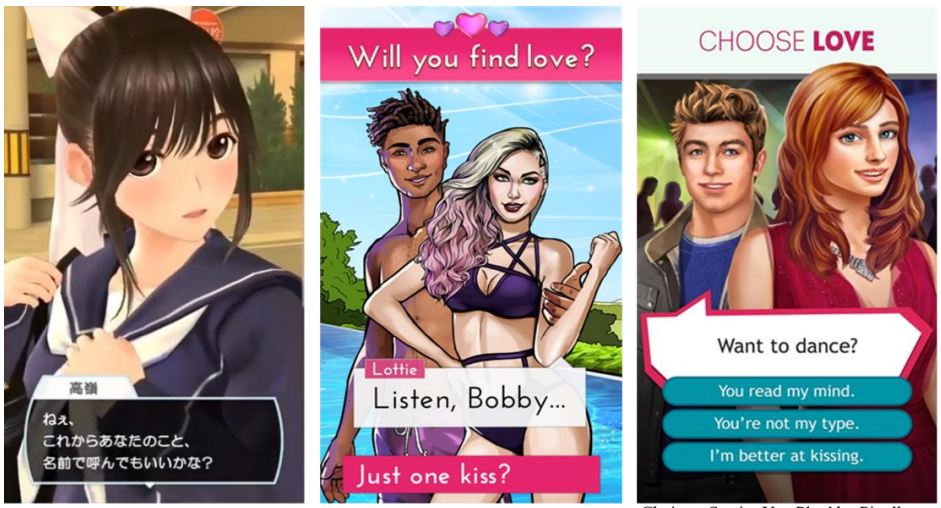
Romantic Video games (RVGs) are a 'dating simulation' with romantic elements. The early works of RVGs (e.g., Tenshitachi no gogo, 1985 and Dōkyūsei series, 1992) are classified as adult-themed dating simulations. Adult-themed dating simulations particularly were developed to fulfil the sexual aspect of desire rather than the romantic aspect. Nowadays, the

trend and game features of RVGs weighs towards the romantic part (e.g., Love Plus 2009) and enjoying the feeling of 'falling in love' or fantasy romance with a virtual character in the game.

RVGs allow us to build romantic relationships with virtual characters in a fictional world. They allow players to engage in fantasy romances with reactive virtual agents (Taylor, 2007). Regarding game features, players can select a series of options when interacting with virtual characters in the game. Depending on the player's answer, the game is designed to respond to its user's choices and form an overall personality for the virtual character; changing his or her reactions and behaviours towards the player depending on their choices (Gn, 2014). The types of interactions players receive when playing RVGs resembles the communication that occurs between two human lovers, such as telling each other 'I love you' or other appropriately romantic phrases appearing at appropriate times (Galbraith, 2011). Also, RVGs demonstrate that technology has opened up a new venue for humans to experience romance, grounded in virtual characters (Galbraith, 2011).

For example, the Japanese game company KONAMI developed Love Plus. Love Plus is a dating game that targets heterosexual male players, allowing them to select a girlfriend from three potential love interests and then to enjoy daily and seasonal events with them. RVGs target both genders and all sexualities for their playerbase to experience romantic feelings. Regarding subcategories of RVGs, there are heterosexual male orientated games (e.g., *bishōjo game* which is 'beautiful girl games' in Japanese) that are designed for male players, and female-oriented games *('otome game'* which are girlish games or *jyoseimuke game* which is the female-oriented category of games in Japanese) that focus heterosexual female players (Song & Fox, 2016). In short, RVGs are notable for the intimacy players develop with their virtual romantic partner.

While they originated in Japan, romantic video games are now a global phenomenon (See Figure 3). Their popularity has brought with it considerable profit; the romantic games industry in Japan alone was worth $130 million in 2014 (Marsh & Ogura, 2017). RVGs in Europe are an emerging market, with new games in the category published regularly following the great success of the famous British reality dating TV series 'Love island'. In 2016, the show had an average of 1.4 million fans tuning in daily to watch the series (Hassan, 2017). After the marvellous success of the TV show, London based mobile game developers 'Fusebox' launched a videogame version of Love Island In 2018. Two years after the first Love Island game's release, it had over 12 million global players, recently achieving a milestone of £25 million in revenue (Heathman, 2020). The game was even awarded the UK's number 1 Grossing Game in Summer 2018 and rated 4.2 out of 5 (App store preview, 2020). In the United Sates, Pixelberry Studios, a mobile game development company based in California, produced a wide range of RVGs for genres such as romance, drama, and horror; players can choose from a wide collection of story games. A role-playing RVG 'High School Story' released in 2013 and was downloaded 18 million times in 2013 and it was near the top of role-playing and education games categories in the United States (Strauss, 2015). The Pixelberry CEO described the value of game dynamics as that it 'makes players think more about what really brings them happiness' (Strauss, 2015). In short, the fundamental aspect of RVGs is to provide players a romantic experience and transport them from their busy or mundane everyday lives.



Love Plus by KONAMI (Japan) Love Island by Fusebox (England) Choices: Stories You Play' by Pixelberry Studios (United States)

Figure 3. Examples of Romantic Video Games

Since virtual agents in RVGs are very attractive and some people see these characters as if they are real partners. Romantic video games (RVGs) are a good example of romantic anthropomorphism in the digital age. Past research has not examined anthropomorphised romantic relationships and very little is known from a psychological perspective about RVGs. Therefore, we introduce 'Romantic Anthropomorphism' (see Figure 4) to explore people anthropomorphised romantic relationships.

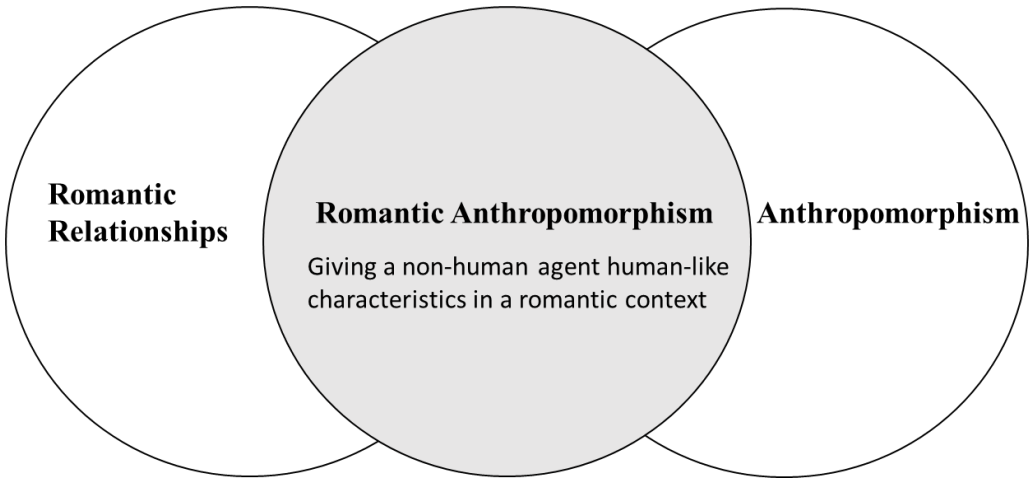


Figure 4. The Figure of Romantic Anthropomorphism

Chapter Summary and The Aim of This Thesis

In this chapter we reviewed relationships with technological agents, followed by complex relationships with technological entities (e.g., social robots) and explaining the history of virtual agents (companionship with these entities). In addition, we explained digital romantic relationships, including examples of unique emotion towards non-human entities, 'Moe', and RVG play. We introduced the new concept romantic anthropomorphism, an intersection of anthropomorphism and romantic relationships (i.e., giving a non-human agent human-like characteristics in a romantic context). So far, prior anthropomorphism research has explained the hidden motivational models behind anthropomorphism; relationship studies have reported the benefits of romantic relationships upon mental and physical health. Today, these relationships can be recreated and substituted by virtual agents. Although previous psychological research has examined how needs can be met by anthropomorphized agents, romantic needs have been

ignored. As a first step in addressing this, these current studies explore the factors which might contribute to developing a romantic relationship with a virtual agent.

First aim of this thesis is to explore the evidence of what factors underlie the desire for romantic relationships with virtual agents, using online studies. There is a very limited amount of prior work for romantic relationships with non-human entities, therefore we need to find and consider what the important factors are for why people seek this kind of relationship. Specifically, we focus on RVGs, as virtual agents are imbued with human characteristics, and these video games are made directly imitate to romantic relationships between humans.

Once this is established, we will work towards our second aim, which is measuring whether romantic anthropomorphism is associated with the desire for real world relationships with virtual agents; as well as romantic engagement with virtual agents in real life by actually playing RVG in a lab based paradigm. The last aim of this thesis is to examine whether romantic anthropomorphism is associated with behaviour in the real world mediated by these factors from our second aim. The overall aim of this thesis is to develop the new perspective of anthropomorphism with multiple empirical evidence by using the mix of existing and new measures.

Chapter 5: Study 1 and 2 (Online Study)

Developing romantic feelings toward a fictitious character is not an alien concept. Many of us have felt imaginary romance towards people in books, plays, and films. Computers allow these virtual characters to become interactive and responsive; machines can mimic some of the core characteristics of a human romantic relationship (e.g., conversation). Today, these virtual romantic relationships are available in romantic video games (RVGs). Although games differ, generally the player takes the role of the protagonist that explores and engages in romantic – but not necessarily sexual – relations with a virtual agent or agents. The extent to which RVGs mimic real romance can be remarkable. For example, when Japanese game company KONAMI released the male-oriented 'Love Plus' in Japan, many players reported falling in love with one of the virtual agents. RVGs offer virtual romantic relationships not only for men, but also for women. For example, 'Tokimeki Memorial girl's side' is an RVG targeting female players released by KONAMI, the same company that released Love Plus. The effect was so strong that some people worried RVGs could replace real-world romance. Some 'Love Plus' players reported preferring their virtual girlfriend to real women (Rani, 2013). In 2014, RVGs in Japan were worth $130million per annum, and in 2016 a single, leading company earned $102million from RVGs alone. The dramatic success of RVGs has been attributed to their capacity to mimic human romantic relationships (Marsh & Ogura, 2017). Currently, the popularity of RVGs is growing in English-proficient countries such as the US, UK, and within continental Europe (Marsh & Ogura, 2017). In short, RVGs are an increasingly common part of the landscape for romance worldwide.

Despite the popularity of RVGs however, research into the psychology of them has been limited. By providing emotional support and social engagement, romantic relationships benefit our physical and mental health (Slatcher & Selcuk, 2017; Uchino, 2006). Despite these benefits, finding a partner and falling in love may prove difficult due to anxiety towards real-life relationships (Joel, MacDonald & Shimotomai, 2011) and high standards for a romantic partner (Conroy-Beam, Goetz & Buss, 2016). RVGs could be a solution that fulfills romantic needs and provide similar benefits to romantic relationships, circumventing anxiety and high expectations. In short, RVGs could be growing in popularity because they fulfil the psychological needs of a relationship, and avoid some of the barriers that hinder forming a romantic relationship. As a starting point, the current work aims to reveal the factors that motivate people to play RVGs.

Psychological Characteristics

What kind of romantic relationship makes us happy? What is the desire for beginning a romantic relationship? To answer such questions, we must first observe that a satisfying relationship is typically one that is healthy. That is, when a relationship is considered satisfying, usually it will have a positive impact on our physical and mental health. It is well-established that married couples have better psychological well-being and live longer than singles (Burman & Margolin, 1992). Satisfaction with current relationship status is a strong predictor of well-being (Lehmann et al., 2015). Some research suggests that well-adjusted married individuals have better ambulatory blood pressure and feel much more satisfaction with life compared to single individuals (Holt-Lunstad, Birmingham & Jones, 2008). Importantly, relationship quality between single and married individuals should be compared because, if people feel that their relationship quality is low, then being single is seen as better than being a dissatisfied married

individual (Holt-Lunstad et al., 2008). In summary, a satisfying relationship can help to increase well-being.

Self-esteem plays an important role in forming romantic relationships. People who have high self-esteem find their romantic relationships more rewarding (Erol & Orth, 2017). Unfortunately for people with low self-esteem, this can serve as a barrier to the formation of healthy relationships. People with lower self-esteem tend to overgeneralize and feel impending rejection when their partner offends them (Murray, Rose, Bellavia, Holmes & Kusche, 2002). Also, breaking up often reduces a person's level of self-esteem (Luciano & Orth, 2017). Regarding relationship formation, lower self-esteem individuals prioritize self-protection and are thus less motivated to romantically connect with others (Murray, Derrick, Leder & Holmes, 2008). By contrast, individuals with higher self-esteem overestimate the chance of acceptance from a potential partner, leading to increased confidence (Cameron, Stinson, Gaetz & Balchen, 2010). Therefore, lower self-esteem individuals may struggle to start a new relationship. Given that RVGs offer a ready, reliable route to relationship formation with low to zero levels of offence or rejection. That is, romantic virtual characters offer no rejection for partnership and they promise to give players a guaranteed romantic situation; thus RVGs may particularly appeal to people with low self-esteem.

In addition to not feeling good about the self overall, experiencing loneliness has an important influence on relationship formation. A key factor causing loneliness – particularly for young people – is the lack of a romantic partner (Adamczyk, 2016). In fact, romantic relationship status directly influences romantic loneliness, and unfulfilled belongingness correlates with a fear of being single (Adamczyk, 2016). Thus, having a romantic partner can reduce the feeling of

loneliness and improve the feeling of security. Given that RVG offer an immediately available relationship, they may particularly appeal to lonely individuals.

Pressures in a real-life romance

RVGs may be particularly appealing when a person foresees difficulty in finding and maintaining a real relationship. For instance, online dating is a modern way to find not only casual but also ongoing relationships. However, it also contains several risks. For example, the experience of multiple rejections from prospective partners might elicit feelings of lower self-esteem and increased depression (Marateck, 2018). Further, because prospective partners exercise choice, investments of time and money do not guarantee relationship formation – the partner can always say no and walk away. By contrast, RVGs are designed to be enjoyable, allow participants to simply 'reload' or 'restart' if they make a romantic blunder, and contain paths via which every partner can be seduced. Thus, the return on investment of effort seems more certain in RVGs than real-life romance. In addition to being successfully pursuable, RVG partners are created to meet the idealized standards of players, both in terms of appearance and psychology. For example, RVG characters never have 'a bad day', never get stressed about work or life outside the relationship, and if they place demands on us we do not want, we can simply restart the game with a new partner. Research on human relationships shows us that when our romantic expectations are unfulfilled, we experience lower satisfaction, resulting in less commitment and investment towards the romantic partner (Vannier & O'Sullivan, 2018). For RVG players this seems less likely to happen; virtual agents are designed to meet high romantic expectations.

In short, RVGs may appeal to people seeking higher self-esteem and/or greater life satisfaction, but also to those who are concerned that there are too many barriers to finding

someone in real life. Importantly, those who are seeking higher self-esteem and/or greater life satisfaction might perceive barriers to achieving it in real life, while such barriers are absent from RVGs.

Physical contact is an important element in romantic relationships. Regarding touch, it is a primitive and strong function that has many benefits. When people touch or are touched by others, we release serotonin increasing positive mood, and decrease cortisol production leading to less stress (Field, Hernandez-Reif, Diego, Schanberg & Kuhn, 2005). Touching reduces pain (Mancini, Nash, Iannetti & Haggard, 2014), and hugs increase relationship satisfaction (Murphy, Janicki-Deverts & Cohen, 2018). A positive effect of hugs includes increased oxytocin (Light, Grewen & Amico, 2005), which decreases stress (Morrison, 2016). These positive effects naturally emerge in the real world; Gulledge, Gulledge & Stahmannn (2003) show that experiencing difficulty in resolving conflicts within a couple is negatively correlated with the level of physical affection, and the number of physical interactions are positively associated with increased satisfaction. Similarly, marital or cohabiting romantic couples experiencing a high frequency of romantic kissing report increased relationship satisfaction and lower levels of stress (Floyd et al., 2009). To put it simply, physical contact appears to be an important and rewarding component of a relationship.

Verbal interactions are also important for romantic relationships. In contemporary society, technologies such as e-mail and text are frequently employed in romantic communication. These technologies, which support smooth communication within a couple, aid relationship satisfaction. For example, Skype use has been found to increase satisfaction in long-distance relationships (Hampton, Rawlings, Treger & Sprecher, 2017). In addition, people in long-distance relationships consider video and audio chats to be more consequential than paper-

or digital-based letters - since they can receive more intimacy (Janning, Gao & Snyder, 2018). Thus, not only physical touch but also verbal interactions are important to forming a good and satisfying relationship.

Game characteristics

Touch and verbal communication appear relatively easy to establish with a human romantic partner, while posing more of a challenge for RVGs. It is clear from RVG industry trends that the importance of tactile and verbal interactions is widely acknowledged by different companies (Livedoor news, 2009; Yamashita, Kato, Yokota, Yamamoto & Shirai, 2011). The distinctive features of the Nintendo DS game 'Love Plus' – one of the most popular RVGs – is that the players directly communicate with their virtual girlfriend and can communicate with her by verbal and tactile interactions (e.g., stroking the girl's hair, cuddling and kissing her) through the device. For example, Trend Lab (2014) highlighted the importance of touch with the 'Love Press'. They employed a Nintendo Wii balance board which players could use as a massage tool for virtual female characters. Thus, tactile interactions are seemingly an important function for RVG players, potentially helping to create a more human-like romantic relationship with the virtual partner.

Voice interactions are also an important factor in creating romantic connections between players of RVGs and the characters. For example, 'Love Plus' players reported enjoying the verbal function because they were called their name by the character with a real voice (Livedoor news, 2009). Similarly, Trend Lab (2014) surveyed 20s- and 30s- aged female RVG players, showing the importance of voice interactions of RVGs as a factor for their game use. In short, voice interactions also appear to be a key factor to enhance a player's desire to play RVGs.

There are many romantic games available globally (Marsh & Ogura, 2017). However, the psychological factors which motivate people to play these games have been broadly neglected. Additionally, the virtual characters' features (e.g., tactile feedback) – although important to human relationships (Simmering, Fuller, Marler, Cox & Bennett, 2013; Sehlstedt et al., 2016)– have similarly eluded research. The current study seeks to understand the psychological aspects and physical characteristics of the game which can motivate people to play.

The Current Study

People have a strong desire to initiate and maintain romantic relationships. It is clear that romantic relationships are beneficial for mental and physical health, and that they can be a potent source of satisfaction and self-esteem in our daily lives. RVGs fulfill many of these needs in a virtual environment.

There has been no prior psychological research on the factors that motivate people to play RVGs. Based on prior related work, we expect that these games will appeal to people with low self-esteem, who feel lonely and dissatisfied, and who set high idealized standards for their partners. We also anticipate that people who view the game as able to fulfil their needs for tactile and verbal intimacy will be particularly attracted to RVGs. We conducted two exploratory studies to examine these desires to play them. This study is beneficial for both RVG developers and players to understand what types of RVG functions are important for players and what factors motivate us to play them. While romantic relationships with 'human to human' and 'human to non-human' entities are different, but there are some common elements that attract people to begin a romantic relationship with a virtual agent. Our results are the first step in the development of the understanding of the psychology of RVGs.

Study 1 (pilot)

Despite a growing market for romantic video games (RVG), the desires that attract people to play these games remain unstudied. In this study, we examined a range of potential psychological and in-game characteristics which may have motivated people to play.

Methods

Participants

In total, 43 people (18 male, 25 female) aged 19-23 (*M*=19.7, *SD*=.83) participated in the study. Students registered for psychology lectures at Doshisha University, Kyoto, Japan were recruited in exchange for 500-yen ($4.5 USD). Only the students who were interested in the study and agreed to the established reward participated in the Study. This study was approved by Doshisha University Psychology Research Ethics Committee. We received electronic written consent by form on the first pages of the Qualtrics online survey. To take part, participants must have consented on this form beforehand.

Procedure

Using a Qualtrics online survey, participants first completed basic demographic questions. Then, they watched a short video clip outlining 'Love Plus,' a famous RVG in Japan. Next, they completed questionnaires measuring loneliness, life satisfaction, and self-esteem. We also asked about the significances of tactile and human voice interactions in RVGs for them in the same questionnaire. On completion, participants were thanked and paid. Participants were asked to take the survey in a quiet and private space.

Materials

All questions are available online via the Open Science Framework (https://osf.io/apxdf/?view_only=df24381290c14718aa8bfa2a1dd0176e).

Demographic questions included gender, age, living situation (1= living by themselves, 2= living with his/her parents), participation in societies, employment, quantity of friends, any previous experience in playing RVGs. We additionally asked about their current romantic-relationship status and satisfaction with their current partner or with being single (e.g., unsatisfied with being single).

A loneliness scale was derived from (Hughes, Waite, Hawkley & Cacioppo, 2004), including three questions (e.g., 'How often do you feel that you lack companionship?') assessed by a three-point Likert scale (1= Hardly Ever, 3= Often). Cronbach's Alpha for the current sample was .72.

A life satisfaction scale was proposed by Diener, Emmons, Larsen & Griffin (1985), which comprises five statements (e.g., 'In most ways my life is close to my ideal') assessed by a seven-point Likert scale (1= Strongly disagree, 7= Strongly agree). Cronbach's alpha for the current sample was .88.

The Rosenberg self-esteem scale (Rosenberg, 1965) contains 10 items (e.g., On the whole, I am satisfied with myself) and was completed using a four-point Likert-type scale (1= Strongly Disagree, 4= Strongly Agree). Cronbach's alpha for the current sample was .88.

A 'Love Plus' video was used as an example of an RVG. A short video of 'Love Plus', which is 2.5 minutes long, was retrieved from the KONAMI official channel **https://www.youtube.com/watch?v=oiJoVvyNvbA**. 'Love Plus' is an RVG targeting individuals who are attracted to feminine women; we asked female participants to watch the

video clip and answer the following RVG related questions (e.g., to what extent voice and touch are important in virtual and romantic relationships) as if they had been male players.

Desire to play 'Love Plus' was measured by a seven-point Likert scale (1= very low, 7= very high). This question ('To what extent do you want to play this game?') was asked after watching the short video of 'Love Plus'.

The importance of touch and voice in real relationships as well as RVGs were assessed by a seven-point Likert scale (1= not at all, 7= very much). We examined the importance of tactile and voice interactions in virtual romantic relationships compared with real romantic relationships (e.g., 'To what extent do you think tactile communication is important in romantic relationships?')

Results

A correlation analysis was conducted to determine which variables were correlated with a desire to play 'Love Plus'. Both correlations and descriptive statistics for all participants for the main variables can be found in Table 1.

Table 1. Correlations and descriptive statistics.

	Desire to play	Voice (real life)	Touch (real life)	Voice (RVGs)	Touch (RVGs)	Loneliness	Satisfaction	Self-esteem	Unsatisfied to being single
Desire to play	1								
Voice (real life)	.12	1							
Touch (real life)	.05	.40**	1						
Voice (RVGs)	.13	.40**	.40**	1					

Touch (RVGs)	.10	.05	.40**	.17	1				
Loneliness	.15	-.06	.11	-.01	.05	1			
Life-satisfaction	-.02	.16	.40*	.13	.10	-.48**	1		
Self-esteem	-.02	.09	.15	-.09	.02	-.49**	.61**	1	
Unsatisfied with being single	-.20	-.19	-.31	.07	-.52**	-.07	.04	-.04	1
Descriptive statistics									
Mean	3.43	5.93	6.86	5.60	4.23	1.78	3.87	2.45	4.14
S.D.	1.76	0.77	1.06	1.22	1.77	0.57	1.37	0.50	1.55

Note. *$p<0.05$, two-tailed. **$p < 0.01$, two-tailed.

The pattern of correlations observed here show a number of interesting results. Most strikingly, none of the psychological or game variables suggested by prior work (e.g., romantic relationships, life satisfaction and loneliness studies) robustly correlated with desire to play. The closest to significance was loneliness r (40) = .15, in the anticipated direction; however, the non-significant result means that it did not support our anticipation. According to Epley, Waytz, Akalis & Cacioppo (2008), lonely individuals anthropomorphized non-human objects more; thus, we hypothesized that loneliness would be associated with the desire to play RVGs as lonely individuals might seek connection with virtual romantic characters more than others. The emergence of significant correlations between self-esteem and life satisfaction (r=0.61) and self-esteem and loneliness (r=-0.49) replicate well-known effects (Bozoglan, Demirer & Sahin, 2013), suggesting that the study was taken seriously by participants. In short, our results indicate that desire to play RVGs is unrelated to the variables suggested by prior works findings (e.g., romantic relationships, life satisfaction and loneliness studies), which we expect correlates with the desire to play RVGs. Interestingly, an examination of the mean ratings of touch and voice

reveals that both are important when considering RVGs. A single-sample t-test was conducted to determine whether people cared about touch and voice above average (e.g., scale mid-point). A tactile interaction in RVGs was rated significantly above (M = 4.23, SD = 1.77) the scale midpoint (3.5), t (42) = 2.71, $p < .001$. As with voice, voice interaction in RVGs was rated significantly above (M = 5.60, SD = 1.22) the scale midpoint (3.5), t (42) = 11.33, $p < .001$.

Study 2

Study 1 failed to find robust significant relationships between desire to play and the variables we derived from prior work. In Study 2 we implemented a number of changes. One weakness of Study 1 was the small sample size and the reliance on asking female participants to imagine being male players. In Study 2 we substantially increased our sample and no longer asked people to imagine being other players. Next, we excluded the psychological variables such as self-esteem and life satisfaction which failed to show a relationship from Study 1. Loneliness and the desire to play RVGs was not significant in Study 1; however, it was close to significant. Therefore we anticipate that a larger sample size may show patterns that study 1 did not. Study 1 used Love Plus but Study 2 uses Koi Kyu-Bu for men. Love Plus is a famous RVG for the Nintendo DS that allows players to use unique functions such as tactile interactions by using a DS pen. There are no RVGs which have the same unique functions on the Nintendo DS for women. In order to control the quality of RVG functions between men and women, we changed the DS game (Love Plus) to a phone application RVG for men 'Koi Kyu-Bu'. Finally, we introduced the idea that people might want to play RVGs for reasons more related to the anticipated direct benefits received from the game. Specifically, we examined anticipated benefits of RVGs (e.g., RVGs would make players feel happy, RVGs would develop players' social skills, and RVGs would reduce players' loneliness).

Methods

Participants

In total, 281 people (175 male, 106 female) aged 19-25 (*M*=20.3, *SD*=.96) participated in the study. Students registered for psychology lectures at Doshisha University, Kyoto, Japan were recruited in exchange for course credit. Only the students who were interested in the study and agreed to the established reward participated in the Study. This study was approved by the University of Edinburgh PPLS Research Ethics Committee. We received electronic written consent by form on the first pages of the Qualtrics online survey. To take part, participants must have consented on this form beforehand.

Procedure

All the participants completed our survey online (Qualtrics) via phones, computers, or tablets as in Study 1. After providing demographics, they watched a short advertisement on RVGs (approximately 2mins) with audio. We prepared two videos for each sexual preference '*Koi Kyu-Bu!*' for males (https://youtu.be/7Os5RKJTR-U) and '*Sanrio danshi'* for females (https://youtu.be/n6Pk-ElsDnQ), and answered questions on RVGs: desire for playing RVGs, the importance of tactile and voice interactions in real relationships and RVGs, and the anticipated benefits of RVGs. We prepared two types of RVG video stimuli; one aimed at heterosexual men and one aimed at heterosexual women. Finally, participants reported their levels of loneliness. On completion, participants were thanked and received course credit. Participants were asked to complete the survey in a quiet and private space.

Materials

All questions can be found on the Open Science Framework (https://osf.io/apxdf/?view_only=df24381290c14718aa8bfa2a1dd0176e).

Demographic questions include gender, age, living situation (1= living by themselves, 2= living with his/her parents), participation in societies, part-time jobs, quantity of friends, and playing experience in RVGs. We also assessed their satisfaction with their relationship or satisfaction with being single. Next, they answered questions regarding their desire to play RVGs, the importance of voice and touch communication in the real and virtual romantic relationships, their general recognition on RVGs, and loneliness.

Anticipated Benefits Scale contains total 13 questions and these questions were evaluated by a seven-point Likert scale (1= not at all, 7= very much). We prepared original questions to mainly examine recognition on diverse emotional benefits and social skills affected by RVGs generally. (e.g., 'To what extent do you think RVGs reduce loneliness/ develop your social skills? / allow you to feel fantasy love? / make you feel content? / increase your confidence?/ make you feel secure?/ reduce your mental stress?').

Stimuli from video clips of RVGs were used for examples of RVGs. We prepared a short video of an RVG for each sexual preference: '*Koi Kyu-Bu!*' for males and '*Sanrio danshi'* for females. The clips were retrieved from the official game company channel on YouTube and approximately lasted less than two minutes.

The desire ('To what extent do you want to play RVGs?') was measured by a 100 point-scale (1= low desire, 100= high desire).

A loneliness scale (Diener, Emmons, Larsen & Griffin, 1985) was used on the same scale as in Study 1. Cronbach's alpha for the current sample was .69.

The importance of touch and voice in real relationships and RVGs was used on the same scale as in Study 1.

Results

To start, we conducted an exploratory factor analysis to determine the structure of our anticipated benefits scale. We used an Exploratory Factor Analysis (EFA) and thirteen questions related to reasons for playing RVGs were factor analyzed using maximum likelihood analysis with Promax rotation. The analysis yielded two factors with eigenvalues greater than 1 which explained a total of 51.74% of the variance. Factor 1 was labelled 'positive affect enhancement' reasons to play RVGs. This first factor explained 41.50% of the variance. The second factor derived was labelled 'skills acquisition' to play RVGs. The variance explained by this factor was 10.24%. The EFA result can be found in Table 2.

The first factor comprised items measuring positive affect. The three items representing this factor were: the degrees that RVGs render respondents feeling happy, fantasy love, and reduced mental stress. The factor was thus named the 'positive affect enhancement'. The second factor comprises beliefs that RVGs build skills, specifically: increased confidence, developing social skills, and teaching useful skills for a real romance. The components led to naming the second factor as 'skill acquisition'. Both new scales showed good reliability: Cronbach's α =.78 for positive affect and Cronbach's α =.79 for skill acquisition.

Table2. Factor loading matrix with promax rotation for anticipated benefit scale items

	Factor Loadings	
	1	2
To what extent do you think romantic video games make you feel happy?	**.86**	-.05
To what extent do you think romantic video games allow you to feel fantasy love?	**.81**	-.18
To what extent do you think romantic video games reduce your mental stress?	**.71**	.08
To what extent do you think romantic video games increase your confidence?	-.04	**.85**
To what extent do you think romantic video games teach you useful skills for real romance?	-.11	**.77**
To what extent do you think romantic video games develop your social skills?	-.04	**.71**
To what extent do you think romantic video games let you try different romantic partner from the real one?	-.10	.22
To what extent do you think romantic video games characters have perfect personality compared to real partner?	.57	-.20
To what extent do you think romantic video games make you feel content?	.63	.23
To what extent do you think romantic video games make you feel secure?	.22	.59
To what extent do you think romantic video games help you to recover from the experience of broken hurt?	.16	.46
To what extent do you think you feel jealousy towards a virtual partner in romantic video games if your real partner plays it?	-.09	.40
To what extent do you think romantic video games reduce loneliness?	.29	.40
Eigenvalue	5.40	1.33
% of total variance	41.50	10.24
Total variance		51.74

Note. Factor loading in bold type were considered for cluster interpretation.

Next, we computed the correlations between all variables of interest. Correlations and descriptive statistics for the main variables can be found in Table 3.

Table 3. Correlations and descriptive statistics for the variables of all participants in study 2.

	Desire to play RVGs	Voice (real life)	Touch (real life)	Voice (RVGs)	Touch (RVGs)	Loneliness	Skills Acquisition	Positive Affect Enhancement
Desire to play RVGs	1							
Voice (real life)	-.05	1						
Touch (real life)	-.03	.51**	1					
Voice (RVGs)	.29**	.28**	.18**	1				
Touch (RVGs)	.23**	.23**	.18**	.55**	1			
Loneliness	.13*	-.05	-.10	.07	.08	1		
Skills Acquisition	.28**	-.07	-.07	.16**	.21**	.01	1	
Positive Affect Enhancement	.37**	.06	.02	.31**	.24**	.10	.57**	1
Descriptive statistics								
Mean	23.70	5.94	5.88	5.02	4.11	1.63	2.91	3.95
S.D.	27.13	1.16	1.11	1.54	1.68	.49	1.20	1.34

Note. *p<0.05, two-tailed. **p < 0.01, two-tailed.

Testing correlation, the desire of playing RVG and loneliness r (279) =.129, p <.031, social skills r (279) = 283, p <.001, and positive affect enhancement r (279) = .365, p < .001 were all positively correlated. From the findings, it is clear that the more people believe in the benefits of RVGs, the more they would like to play them. Also, lonely individuals have a higher desire of playing RVGs. Interestingly, a positive correlation between the importance of touch in

virtual romantic relationships and social skills r (279) = .210, p < .001, and positive affect enhancement r (279) = .244, p < .001 was found. Also, a positive correlation between the importance of voice in virtual romantic relationships and social skills r (279) =. 157, p <.001, and positive affect enhancement r (279) = .311, p < .001 were recognized. Therefore, more participants believe the voice and touch interaction with virtual characters are important, more they believe to enhance positive affect and improve social skills through playing RVGs. A positive correlation between the importance of voice in real relationships and virtual romantic relationships was found, r (279) = .279, p < .001. The same trend was recognized between the importance of touch in real relationships and virtual romantic relationships, r (279) = .176, p < .001. Therefore it is implied that participants value equally touch and voice interactions both in real relationships and virtual romantic relationships. Also, the desire for playing RVGs was correlated with both the importance of touch in virtual romantic relationships r (279) = .234, p<.01 and voice in virtual romantic relationships, r (279) = .285, p< .001, respectively. To examine the relative effects of these relationships on desire to play we conducted a linear regression.

Multiple regression analysis was used to test if voice and tactile interactions, loneliness, skills acquisition, and positive affect enhancement significantly predicted participants' desire of playing RVGs. The results of the regression indicated the two predictors explained a significant proportion of variance in participants' desire of playing RVGs (R^2=.217, F (5,275) =15.29, p<.01). It was found that voice interaction in RVGs significantly predicted the desire of playing RVGs (β = .208, t (280) = 3.13, p<.001), as well as positive affect enhancement (β = .336, t (280) = 5.40, p<.001). Summary of multiple regression analysis can be found in Table 4.

Table 4

Summary of Multiple Regression Analysis for Variables Predicting 'Desire to play RVGs'

Variable	*b*	*SE*	*β*	*t*	*p*
1 Voice (RVG)	4.23	1.29	.208	3.13	.001**
2 Touch (RVG)	-.01	1.15	-.001	-.01	.993
3 Loneliness	6.26	3.29	.103	1.90	.058
4 Positive Affect Enhancement	7.06	1.48	.336	5.40	.000**
5 Skills Acquisition	-.83	1.62	-.034	-.51	.609

*$p<.05$. **$p<.01$

We have used two different types of RVGs that are suitable for both male and female players. In order to explore the gender difference (Dong, Wang, Du & Potenza, 2018), we separated the data for men and women and re-conducted the correlation analysis. Correlations and descriptive statistics for the variables of male and female participants can be found in Table 5.

Table 5. Correlations and descriptive statistics for the variables of male participants (below diagonal) and female participants (above diagonal) in study 2.

	Desire to play RVGs	Voice (real life)	Touch (real life)	Voice (RVGs)	Touch (RVGs)	Loneliness	Skills Acquisition	Positive Affect Enhancement
Desire to play RVGs	1	.05	.11	.29**	.14	.11	.28**	.41**
Voice (real life)	-.12	1	.22*	.34**	.24*	-.09	.06	.13
Touch (real life)	-.12	.68**	1	.09	.18	-.05	.06	-.01

Voice (RVGs)	.27**	.27**	.20**	1	.46**	.08	.19	.29**
Touch (RVGs)	.29**	.24**	.17*	.59**	1	.03	.34**	.31*
Loneliness	.15*	-.03	-.12	.07	.11	1	.00	.09
Skills Acquisition	.29**	-.15	-.13	.14	.14	.01	1	.63**
Positive Affect Enhancement	.33**	.03	.03	.31**	.20**	.11	.54**	1
Descriptive statistics								
Mean (Male)	21.78	5.99	5.82	4.80	3.99	1.64	2.90	3.87
Mean (Female)	28.87	5.87	5.97	5.39	4.29	1.60	4.29	2.93
S.D. (Male)	25.95	1.12	1.17	1.61	1.69	.51	1.25	1.37
S.D. (Female)	28.83	1.23	1.01	1.35	1.64	.47	1.38	1.13

Note. *p<0.05, two-tailed. **p < 0.01, two-tailed.

Testing the correlation for men, the desire of playing RVG and loneliness r (173) =.151, p <.047, social skills r (173) = 283, p <.001, positive affect enhancement r (173) = .334, p < .001, the importance of voice in virtual romantic relationships r (173) = 269, p <.001, and the importance of touch in virtual romantic relationships r (173) = 288, p <.001 were all positively correlated. From the findings, we found the same directions of all participant data, such as the more males believe in the benefits of RVGs, the more they would like to play RVGs. Thus males especially look for psychological/mental improvement through virtual romantic relationships interactions. Additionally, there was a positive correlation between the importance of voice in real relationships and virtual romantic relationships was found, r (173) = .271, p < .001, and between the importance of touch in real relationships and virtual romantic relationships, r (173) = .176, p < .022. In short, the pattern of results for men closely mirrors the total sample.

For women, desire to play RVGs was significantly correlated with social skills r (104) = 281, p <.01, positive affect enhancement r (104) = .406, p < .001, the importance of voice in virtual romantic relationships r (104) = 290, p <.001. Like male participants, there was a positive correlation between the importance of voice in real relationships and virtual romantic relationships, r (104) = .342, p < .001; therefore, females especially value voice interactions in real relationships and virtual romantic relationships. In short, many of the same effects emerge for women only as for the total sample.

The mean for the desire to play RVGs (M= 23.70, SD= 27.13) is slightly low in Study 2. We conducted the correlation analysis separately by dividing those who scored higher than average and those who scored lower than average to see if there are different correlations based on their mean desire to play. However, it is out of the scope of the paper, thus we added the results in the supplementary materials (https://osf.io/apxdf/?view_only=df24381290c14718aa8bfa2a1dd0176e).

General Discussion

In two studies, we examined why people seek to play RVGs. We explored the psychological factors and game characteristics (touch and voice interaction functions) of RVGs that may motivate gameplay. In addition, we examined the anticipated benefits of playing RVGs as a factor desiring people to play them.

The results showed significant correlations between the importance of voice and touch in real and virtual romantic relationships among two studies with independent samples; however, we did not find a robust effect of psychological factors (e.g., self-esteem and life satisfaction). Loneliness is the only psychological factor to correlate with the desire to play. We found a

significant correlation between the created factors of benefits of playing RVGs (social skills and positive affect enhancement) and the desire of playing RVGs. In study 2, our results indicate that lonely individuals may have a greater desire to have romantic interactions with a virtual character.

Regarding touch, it is a primitive and strong function that has many benefits. Touching reduces pain (Mancini et al., 2014), and hugs increase relationship satisfaction (Murphy, Janicki-Deverts & Cohen, 2018). With regards to neuroendocrinological benefits, touch increases the hormone oxytocin which enhances social connection and reduces cortisol, the stress hormone (Ellingsen, Leknes, Løseth, Wessberg & Olausson, 2016). It may be that people are sensitive to this role of touch, and when they feel it can be achieved in an RVG have increased desire to play.

With regards to the game characteristics of voice, the more players think that an RVG can provide quality voice interaction, the more motivated they are to play. Female participants commented that hearing a human-like voice is very important to enjoying RVGs (Iguchi, 2015). In recent years, the vocation of voice acting has become very popular in Japan, having become similar in popularity to musical idols (Rogers, 2015). Voice acting jobs are now the most ideal jobs among female junior high school students (Sony Life planner, 2017) in Japan RVGs are developed partially with that in mind. These gender trends support our findings, that is a positive correlation between the importance of voice and the desire to play RVGs and positive affect enhancement. Interestingly, the desire of playing RVGs was negatively correlated with the voice interaction in real life relationship for people who have higher ratings of the desire of playing RVGs. This finding has raised an important point that they equally value the importance of voice in real and virtual relationships; however, the importance of voice in real relationships would reduce the desire of playing RVGs due to the imagination gap between real and fantasy. Taylor

(2007) states RVGs can transport the players to romantic fantasy worlds that are different from the un-ideal real world. Understanding this context, it is natural that Japanese players will often appreciate voice interaction in RVGs and view it positively, not only for the inclusion of real voices by voice actresses, but too for the high quality of graphics for characters that mark an important desire to play RVGs (Iguchi, 2015).

In Study 2, two key factors that motivate people to play RVGs were discovered. The first was anticipated positive affect (positive affect enhancement). It is unexpected that anticipating the game to make the players feel better predicts a greater desire to play. Indeed, our participants are likely correct: playing casual video games increases mood and reduces stress (Russoniello, O'Brien & Parks, 2009). The second factor is less intuitive, but potentially very interesting: anticipated romantic skill development (skills acquisition). It appears that people are drawn to RVGs in part because they feel they will gain skills to help in real world romances. The idea that people play video games to develop skills has been previously suggested (e.g., Iguchi, 2015) but this is the first time it has been demonstrated in RVGs. We already know that playing strategic games can increase problem-solving abilities (Adachi & Willoughby, 2013), and the current work points to additional, social benefits.

Limitations and Future Directions

There are several important limitations to this work. We chose to recruit Japanese participants given the prevalence of RVG usage in Japan. Although this provides a good environment to test these ideas, whether the results of the current study would replicate in samples with less exposure to RVGs remains unknown. China – with a growing interest and consumption of RVGs (Pettman, 2009) – may be one important culture for further research. Considering cultural difference, in western cultures too we may observe an increase in RVG

production and player base. Therefore it would be important to consider playing RVGs in other nationality samples.

Regarding experimental procedure, we did not apply a suitable RVG for female participants in study 1. Thus, we fixed this issue in study 2 by using two different RVGs particularly for female and male players; however, study 1 would still be limited.

Our interest in these studies lies in understanding the factors that motivate people to play. Accordingly, the two studies were conducted using online questionnaires and participants did not play RVGs. Thus, while these studies shed light on why people may be drawn to try playing RVGs, they cannot tell us why they continue to play or whether they experience the benefits that motivate their playing.

Regarding control variables, two studies widely explored related variables for playing RVGs rather than using the additional classifications (e.g., age, experience, and relationship status) to examine the details of what types of people were interested in playing RVGs. RVG research is not well established and has a very limited corpus of studies. These two studies are 'preliminary studies' for establishing and investigating a new field in psychology. For this reason we were not able to have a sufficient number of participants for control variables. Previous work on romantic relationships between humans indicates that romantic relationships benefit our physical and mental well-being (Dush & Amato, 2005; Slatcher & Selcuk, 2017; Uchino, 2006). It would be interesting to explore the difference between people in romantic relationships and being single on what attracts them to play RVGs. Also, these two studies targeted a younger generation, but middle-aged players are also susceptible to emotionally enjoy a virtual partner. For example, the Japanese man Yuge, 39, commented on his virtual girlfriend Nene in Love Plus that, 'as long as I have time, I'll continue the relationship forever' (Rani, 2013). When people

develop a habit to play video games at an early age, they often have experience in a variety of game genres and continue the long-term relationship with a virtual character. Therefore, this work opens the door for the new field of research 'RVG' and it would be beneficial to examine whether more precise individual variables affect attraction to play RVGs. Future studies should use additional control variables and fruitfully explore each player's characteristics.

In general, players seem to have a feeling and expectation of improving their social skills when playing RVGs. This finding allows us to understand what players expect to benefit by playing RVGs, but this does not mean however that RVGs are truly capable of improving their feelings or skills in real life. Future work should examine the benefits of playing RVGs and also examine whether the desire for positive affect enhancement, romantic skills acquisition, and the alleviation of loneliness serve to maintain RVG play as well as attract it.

Conclusion

The current research grants us some insight into why people are attracted to RVGs. Our studies show that the more people believe in the benefits of playing RVGs, the more they would like to play the games. Lonely individuals have a higher desire to play RVGs. Also, tactile and voice interactions are important in both real and virtual romantic relationships. Equally importantly, it shows us that a range of psychological factors (satisfaction, self-esteem) which we might expect to be related to desire to play RVGs are, in fact, not associated with the desire of playing RVGs. People were attracted to play RVGs with the expectation of gaining benefits by playing rather than their individual psychological situation (satisfaction, self-esteem). There are a limited number of studies exploring the psychology behind romantic relationships with virtual agents, and it is significant that we have taken the first step into the cultivation of a new field within video game and relationship psychology.

Chapter 6: Study 3 and 4 (Lab study)

The previous chapter examined the motivations which contribute to a desire to play romantic video games. In Chapter 6, we pivot away from the motivations behind RVG play and examine the processes of romantic relationships.

Alita (Female Cyborg): *'Does it bother you that I am not completely human?'*
Hugo (Male Human): *'You are the most human person I have ever met.'*
—Alita: Battle Angel (2019)

Virtual agents (VAs) play an increasingly central role in our modern world. From office assistants, to call centre workers, to domestic helpers (e.g., Alexa, Cortana, Siri), VAs are replacing people across various spheres of human life. To date, VAs have been developed largely to replace human labour; however, as VAs increase in complexity they are moving into other, more social domains of life. The need to love and to be loved is an enduring universal aspect of human psychology (Baumeister & Leary, 1995). For most of our history, fulfilling this need required another person—someone to love and to love back. Today, this need can potentially be fulfilled by VAs. The popular Hollywood films *Alita: Battle Angel*, *Her*, *Ex Machina*, and *Lars and the Real Girl* all explore people falling in love with non-human entities.

This idea is accompanied by a real-world analogue. Computer technology has allowed virtual characters to become increasingly interactive and responsive, and we can now simulate some core characteristics of romantic relationships (e.g., conversation) with VAs. Romantic video games (RVGs) provide people with the opportunity to select, pursue, nurture, and enjoy a romantic relationship with a VA. For example, the Japanese game company KONAMI created *Love Plus*, a male-oriented game that proved so successful numerous men reported falling in

love with their virtual girlfriends (Sankei, 2010; Mainichi, 2010), even to the point of preferring them to real women (Rani, 2013). In 2014, RVGs in Japan were worth $130 million per annum, and in 2016 a single, leading company earned $102 million from RVGs alone (Marsh & Ogura, 2017). The popularity of RVGs is growing in western countries (e.g., US, UK) and within continental Europe, with around 50 million players worldwide (Marsh & Ogura, 2017). Finally, virtual romances are increasingly common in triple-A videogames (e.g., *The Witcher 3: Wild Hunt, Mass Effect*). In short, these virtual romances are popular and are experiencing rapid growth. Romantic relationship with VAs has much potentials to through growing popularity in the world.

Despite this critical shift in how people interact romantically, scholars have yet to systematically investigate virtual romance. Human-VA relationships are entering a new era where VAs are becoming much closer to us in terms of appearance and capabilities: our relationship with them increasingly resembles a relationship between two humans. If we perceive a relationship with a VA to be authentic, will our mood change in a positive way? In two studies, we explore how anthropomorphism may help explain virtual romances, and whether virtual romance is linked to players' perceptions of their virtual relationships and mood.

Anthropomorphism and Relationships

Psychologists have long recognised that meaningful interactions with others, and the sense of social connection that this interaction creates, is a fundamental human need (Baumeister & Leary, 1995; Maslow, 1968). However, we can have meaningful social interactions without another human. To achieve this, people often render an inanimate object ‘human-like’ to help meet their social needs. The tendency to imbue non-human entities with human-like characteristics is called *anthropomorphism* (Epley, Waytz, & Cacioppo, 2007; Soanes &

Stevenson, 2005). In a theoretical account of this process, Epley and colleagues (2007) proposed the SEEK model to explain when and why people are likely to anthropomorphize. More precisely, the model presents three factors of motivation: *sociality motivation*, the desire for social contact and affiliation; *effectance motivation*, the motivation to explain and understand the behaviour of other agents; and *elicited agent knowledge*, the accessibility and applicability of anthropocentric knowledge. Although machines and VAs are 'mindless', humans regularly ascribe humanlike mental capacities, attitudes, and knowledge to them. Thus, these three factors apply when people will confer human-like characteristics to inanimate objects (Epley, 2018). In short, the concept of anthropomorphism clarifies 'how players build a romantic relationship with a VA', 'how players perceive their relationship as authentic' and 'when they are willing to continue the relationship'.

There is perhaps no more enduring or shared human psychological experience than the need to belong (Maslow, 1968). Feeling a lack of social connection (i.e., loneliness) leads people to anthropomorphize non-human agents more (Im Shin & Kim, 2018; Eyssel & Reich, 2013) and chronically lonely individuals are more likely to anthropomorphize (Epley, Akalis, Waytz, & Cacioppo, 2008; Koike, Loughnan, Stanton, & Ban, 2020). Loneliness, however, is not the only social motivator of anthropomorphism. Similar effects emerge amongst people with unstable social connections and insecure attachment (Timpano & Shaw, 2013). For example, women with high attachment avoidance and high attachment anxiety—the degree to which individuals are uncomfortable with intimacy and the degree to which individuals worry about their close relationships, respectively (see Mikulincer & Shaver, 2016)—tend to anthropomorphize objects more than less insecure women (Neave, Tyson, McInnes, & Hamilton, 2016). Once

anthropomorphism begins, it may help us build a deeper relationship with non-human entities (Kwok, Grisham & Norberg, 2018).

To date, all prior psychological work on anthropomorphism has examined platonic relationships. While platonic social ties are undoubtedly important, romantic relationships have been identified as a particularly strong determinant of well-being (Dush & Amato, 2005), and both mental and physical health (for reviews, see Slatcher & Selcuk, 2017; Uchino, 2006). Also, satisfying romantic relationships have a higher level of subjective well-being than individuals in unhappy relationships (Gere & Schimmack, 2013). Therefore, romantic relationships are meaningful, and the quality of relationship matters to mood and well-being.

If anthropomorphism is attractive to people who lack platonic connections (Epley et al., 2007) and helps alleviate loneliness (e.g., Jakobek, 2019), might it also help us understand the experience of virtual romantic connections? Preliminary evidence seems to support this general idea; Koike et al. (2020) found that RVGs were particularly attractive to people who feel lonely.

Previous studies on anthropomorphism support the idea that anthropomorphism might help understand how people experience virtual romantic connections. Following from these findings, we argue that *romantic anthropomorphism*—the act of giving a non-human agent human-like characteristics in a romantic context—should play a role in virtual romances and their outcomes (e.g., associations with higher positive and lower negative mood).

When considering romantic anthropomorphism, it is important to distinguish between two types of potential relationship experiences. The first involves fostering a genuine and intimate romantic relationship with the VA (e.g., 'I feel that VA and I were connected in the game'; 'I would like to be in a relationship with this agent'), which we call *relationship authenticity*. The second involves an imaginary 'if/then' type relationship (e.g., 'If this agent

were real, then I would want to be in a relationship with them'), which refers to the desire to have a real-world relationship with the VA. These relationships are known as parasocial relationships (Horton & Wohl, 1956; Song & Fox, 2016). Parasocial relationships have been recognized in mass media, such as the relationship between spectator and performer in television (Horton & Wohl, 1956). People could potentially experience either or both of these relationships with a VA, and both relationship experiences may be facilitated by greater romantic anthropomorphism. However, given that the feeling of relationship authenticity more accurately captures the idea that the player is actually in a relationship with the VA, we propose that it should be an antecedent for the feeling of desire for imaginary relationships (desire for real-world relationship with a VA), as players are likely to desire a 'real' relationship with a VA because their virtual romance felt authentic.

Research Overview and Hypotheses

In this chapter, we conducted two lab studies examining romantic anthropomorphism in virtual relationships. Across our studies, we recruited only heterosexual female participants, as we chose female-oriented RVGs. Study 3 used an exploratory-confirmatory approach where we tested our hypotheses in one sample and then sought to replicate the findings in a different sample. In Study 3, participants played an Asian-style RVG in English. In Study 4, we sought to replicate Study 3 outcome with a Western-style RVG with a larger sample.

Study 3 and 4

Study 3 sought to provide preliminary evidence that romantic anthropomorphism plays a critical role in virtual relationship experiences. We tested the associations between our variables of interest in two separate samples; Study 3 was an exploratory study and Study 4 was a confirmatory study. Data collection was based on time constraints on the project. In Study 3, we

were able to recruit 61 participants in the time allotted for data collection, achieving statistical power of 0.53 for our mediation models. In Study 4, we collected 104 participants, achieving statistical power of 0.83 for our models (Schoemann, Boulton & Short, 2017).

Method

Participants

Study 3 (Exploratory Sample)

Sixty-one heterosexual women aged 19-39 years old (M = 24.46, SD = 4.70) participated. Participants identified as Asian (N = 42) or Caucasian (N = 19). Twenty-three participants were in a relationship and all others were single. All participants were native or proficient English speakers, and none had previous experience playing the RVG we chose (*Castaway*).

Study 4 (Confirmatory Sample)

One hundred and four women aged 18-36 years old (M = 20.94, SD = 4.40) participated in this study. Participants identified as Asian (N = 21) or Caucasian (N = 83). Again, we recruited only heterosexual female participants. Thirty-nine participants were currently in relationships and all others were single. All participants were native or proficient English speakers with no prior experience playing the RVG we chose (*Choices: Stories You Play*).

Procedure

In each study, participants first completed a basic demographic questionnaire and a pre-gameplay measure of positive affect (PA) and negative affect (NA). Next, they read a description of the RVG (Study 3: *Castaway*; Study 4: *Choices: Stories You Play*) before downloading it onto their smartphones and completing the first two episodes (~35 minutes). Following gameplay, participants completed the PA and NA measures again, as well as measures of anthropomorphism of the romantic interest VA (Study 3: Clyde; Study 4: Chris), relationship authenticity and desire for a real-world relationship with the VA.

Measures

The full study materials are available at https://osf.io/p6d9u/?view_only=8309f9c634354bbe9525a6264c6e63dd). We omitted some individual difference variables present in the full study from the present analyses, as they lie outside the scope of this study. Although the RVG we used differed between Study 3 and Study 4, the self-report questionnaires were identical in both samples except for the VA name (Clyde in *Castaway*, Chris in *Choices: Stories You Play*).

Romantic Anthropomorphism

The extent to which participants imbued the VA with human characteristics was assessed by 18 items (e.g., 'Clyde/Chris is capable of conveying thoughts or feelings to others', 'Clyde/Chris is capable of understanding how others are feeling') rated on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). These items were adapted from prior work (Gray, Gray, & Wegner, 2007).

Relationship Authenticity

This 6-item scale was created by the authors for the purposes of this research and measured how much participants felt their romantic relationship with the VA felt "real" and intimate (e.g., 'feel that Clyde/Chris and I were connected in the game'; 'I feel Clyde/Chris cared for me in the game'), on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*).

Desire for a Real-World Relationship with the VA

Romantic relationships between people and VAs are different than those amongst people in at least one critical respect: VAs do not physically exist in the world. We created a scale to measure participants' desire to have a real-world relationship with the VA. The scale measures desire to be in a relationship with a VA 'if they were real.' Six items (e.g., 'If Clyde/Chris was a

real person, I would ask him out'; 'If Clyde/Chris was a real person, he would make me a very happy girlfriend') were rated on a 7-point scale (*1 = strongly disagree, 7 = strongly agree*).

Positive and Negative Affect

Participants completed a measure of PA and NA before and after gameplay. Eight items measured PA (i.e., enthusiastic, interested, excited, inspired, happy, content, secure, hopeful) and eight items measured NA (i.e., upset, distressed, anxious, irritable, hostile, lonely, stressed, sad) rated on a 5-point scale (1= *very slightly or not at all*, 5 = *extremely*). In analyses, we calculated pre-post change scores for PA and NA by subtracting pre-gameplay scores from post-gameplay scores. The total calculated score in a Pre-Post Positive Affect explains that positive numbers refer an increased Positive Affect and negative number refer a decreased Positive Affect. On the other hand, the total calculated score in a Pre-Post Negative Affect explains that the positive number refers an increased Negative Affect and negative number refers a decreased Negative Affect. For example, a Pre-Post Negative Affect score of -0.15 means a decreased Negative Affect after playing RVG.

***RVG for Study 3:* Castaway**

Castaway is an English-language RVG developed by Voltage, a popular Japanese gaming app company. In the game, participants select a romantic interest and then interact with them via making a series of choices in the game. The game opens with the following premise:

'We're stranded here, aren't we? You are a journalist hired onto a special cruise ship by a reclusive millionaire with unknown motivations. You think everything is going great, but when the weather takes a turn for the worse, your dream job becomes your worst nightmare! Now you're stranded on a tropical island with nothing but your wits and 5 sexy strangers. You're

trying to focus on survival, but things start to get heated… are these feelings real or is the island sun getting to you?'

We asked all participants to choose Clyde (a male VA) as the romantic target. Thus, across two episodes the protagonist (a female character in the game) flirts and interacts romantically—but not sexually—with Clyde.

RVG for Study 4: **Choices: Stories You Play**

Choices: Stories You Play is an English-language RVG developed by Pixelberry, a popular American gaming app company. Therefore, the graphics and stories are designed with Western players in mind. The game opens with the following premise:

"Welcome to Hartfeld University! You'll make friends for life, and maybe even find true love. YOU control what happens next!"

We asked all participants to choose Chris (a male VA) as a romantic target. Thus, across two episodes the female participants' protagonist (a female character in the game) flirts and interacts romantically and sexually with Chris.

Results

Descriptive statistics, reliability information, and correlations among Study 3 variables and Study 4 variables are presented in Table 1, respectively. We tested our hypotheses using the mediation model (Model 4) of the PROCESS macro for SPSS (Hayes, 2018). In each study, we tested three models, one for each of our outcome variables of interest: desire for a real-world relationship with the VA, change in PA, and change in NA. In all analyses, romantic anthropomorphism of the VA (Study 3: Clyde and Study 4: Chris) was the predictor variable, and relationship authenticity was the mediator (see Figure 1 and 2). The data analytic strategy in Study 4 was identical to Study 3. Study 3 revealed that greater romantic anthropomorphism

significantly predicted feelings of relationship authenticity with the VA, β = .42, SE = .12, 95% CI = [.18, .65], which then significantly predicted more desire for a relationship with the VA in the real world β = .65, SE = .10, 95% CI = [0.7, .45] and an increase in PA, β = .33, SE = .14, 95% CI = [0.2, .33]. Results from the model indicated that romantic anthropomorphism is indirectly related to desire for a relationship with the VA, β = .27, SE = .09, 95% CI = [.07, .45] and an increase in PA, β = .14, SE = .08, 95% CI = [.02, .33] through its relationship with relationship authenticity.

Study 4 revealed that greater romantic anthropomorphism significantly predicted feelings of relationship authenticity with the VA, β = .53, SE = .08, 95% CI = [.37, .70], which then significantly predicted more desire for a relationship with the VA in the real world β = .43, SE = .09, 95% CI = [.11, .35] and an increase in PA, β = .32, SE = .11, 95% CI = [0.6, .28]. Results from the model indicated that romantic anthropomorphism is indirectly related to desire for a relationship with the VA, β = .23, SE = .06, 95% CI = [.11, .35] and an increase in PA, β = .17, SE = .06, 95% CI = [.06, .28] through its relationship with relationship authenticity.

Table 1

Study 3/4: Descriptive Statistics, Reliability Information, and Correlations among Study Variables

	Variable	*M*(*SD*)	α	Correlations				
				1	2	3	4	5
Study 3								
1	Romantic Anthropomorphism	5.00(0.96)	.94	—	.42**	.46**	.03	-.18
2	Relationship Authenticity	4.65(1.26)	.91		—	.73**	.28*	-.05
3	Desire for Real-World VA Relationship	4.56(1.27)	.94			—	.20	.03
4	Pre-Post Positive Affect	-0.26(0.76)	.92				—	-.09
5	Pre-Post Negative Affect	-0.29(0.54)	.84					—
Study 4								
1	Romantic Anthropomorphism	4.86(1.01)	.93	—	.53**	.54**	.07	-.17
2	Relationship Authenticity	4.87(1.33)	.91		—	.60**	.27**	-.08
3	Desire for Real-World VA Relationship	4.21(1.47)	.93			—	.13	-.10
4	Pre-Post Positive Affect	-0.13(0.62)	.88				—	-.01
5	Pre-Post Negative Affect	-0.36(0.53)	.83					—

Note. N = 61 women (Study 3), N = 104 women (Study 4). Continuous scores were calculated such that higher scores indicate greater standing on the variable (e.g., greater romantic anthropomorphism). For pre-post PA and NA, the α value represents the mean of the αs of the pre- and post-gameplay measures. *p < .05, **p < .01

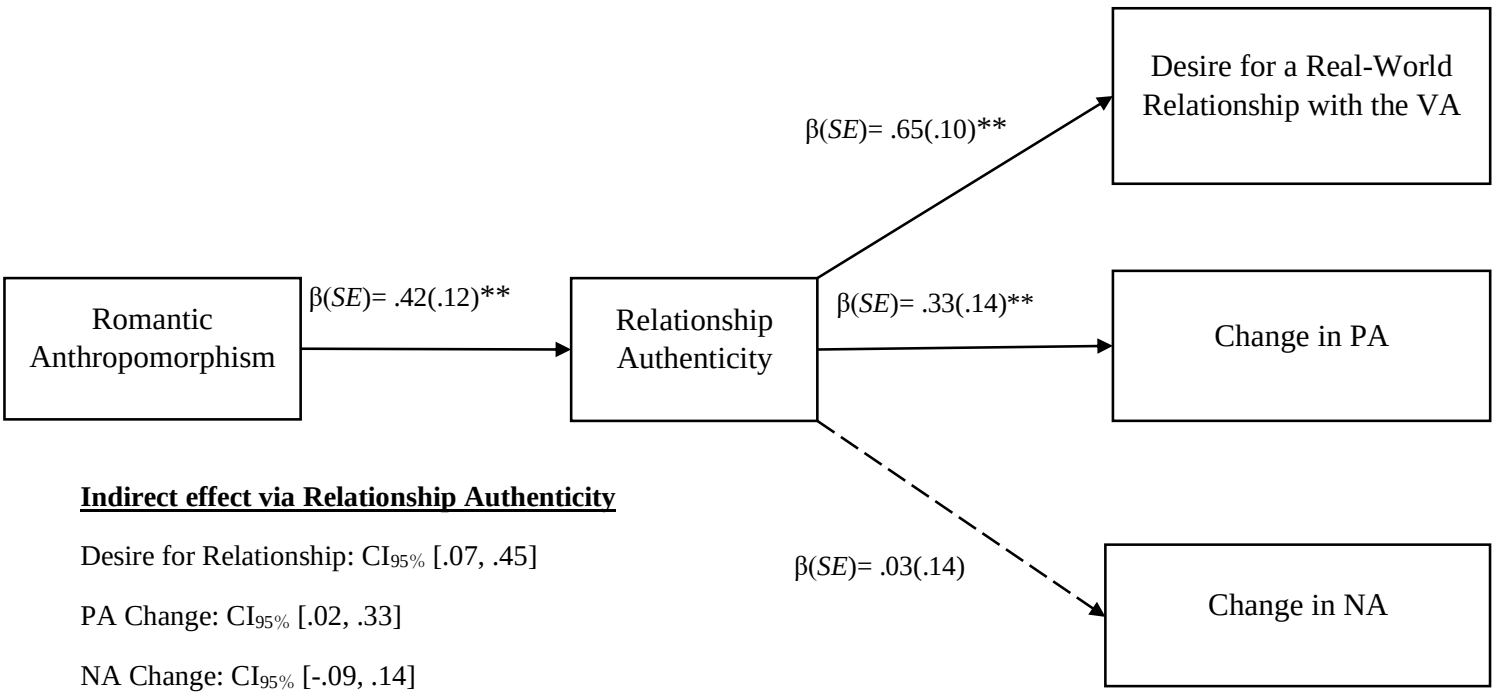


Figure 1. Direct and indirect associations between romantic anthropomorphism and desire for a real-world relationship with the VA, change in PA, and change in NA via relationship authenticity in Study 1A. *$p < .05$, **$p < .01$

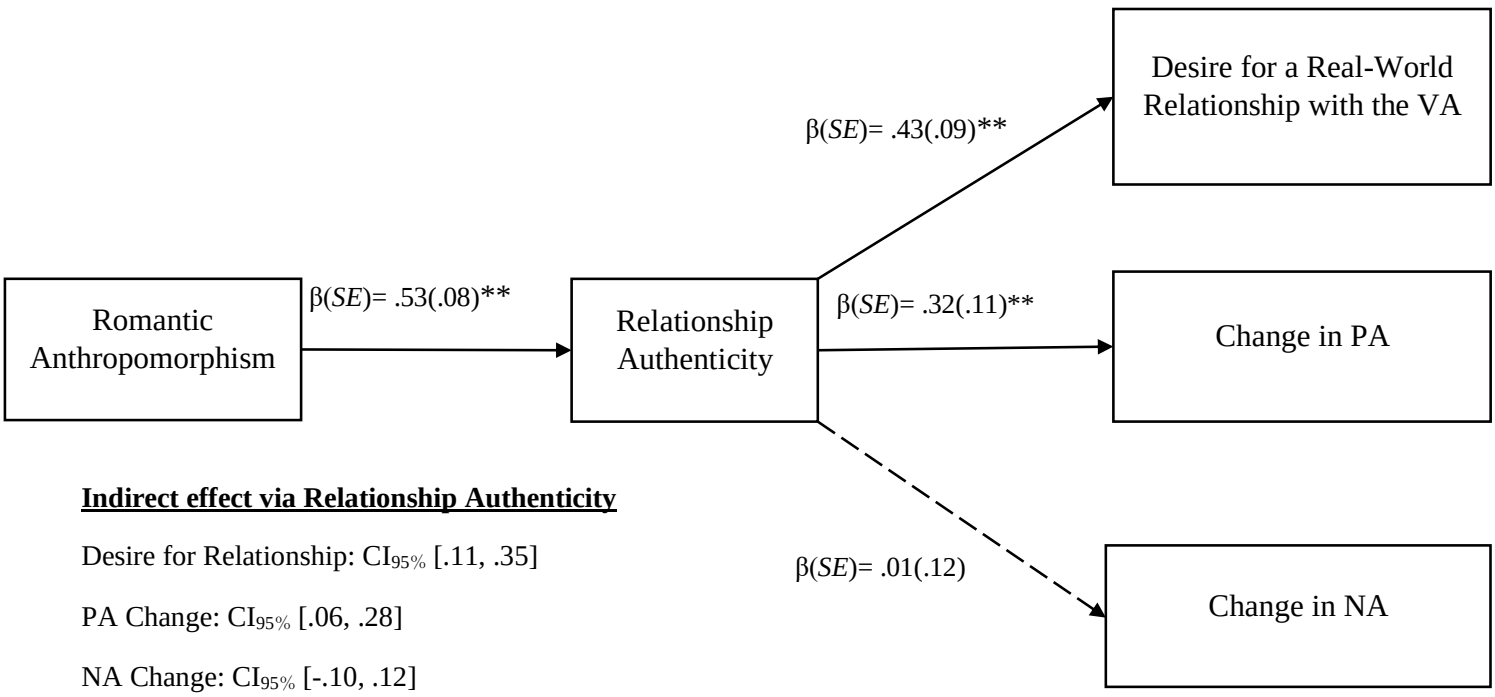


Figure 2. Direct and indirect associations between romantic anthropomorphism and desire for a real-world relationship with the VA, change in PA, and change in NA via relationship authenticity in Study 1B. *$p < .05$, **$p < .01$

Discussion

As seen in Figure 1, Study 3 revealed that greater romantic anthropomorphism was linked to greater feelings of relationship authenticity with the VA, which then predicted more desire for a relationship with the VA in the real world and an increase in PA. Interestingly, romantic anthropomorphism and relationship authenticity did not predict change in NA, suggesting that the bonds established between participants and the VA Clyde were specifically tied to PA. Study 4 fully replicated these associations (see Figure 2). In Study 4, this same pattern emerged despite using a different RVG and participant sample, suggesting that these findings generalize beyond a specific RVG and capture a broader process involved in the development of virtual romantic relationships. Although the sample in Study 3 was somewhat underpowered, the approach we used is in line with the idea of 'exploring small, confirming big' (Sakaluk, 2016). Additionally, the replication across studies bolsters our confidence in our findings. Taken together, Study 3 and 4 provide preliminary evidence that romantic anthropomorphism plays an important role in virtual relationships.

Prior work has focused heavily on factors that predict the extent to which people anthropomorphise others (Epley et al, 2008; Bartz, Tchalova & Fenerci, 2016; Burgess, Graves & Frost, 2018). We know that people anthropomorphise when they feel lonely (Epley et al., 2008; Eyssel & Reich, 2013; Feng, 2016), have high attachment anxiety (Bartz et al, 2016), and mental health conditions such as hoarding (Burgess et al., 2018; Neave, Tyson, Mcinnes, & Hamilton, 2016) and compulsive saving behaviours (Timpano & Shaw, 2013). This work takes a further step from examining what predicts anthropomorphism and into what anthropomorphism predicts. This additional step is sensible from a theoretical perspective (see the SEEK model; Epley et al., 2007). For instance, while it is known that loneliness predicts increased

anthropomorphism (Epley et al., 2008; Feng, 2016; Eyssel & Reich, 2013), it is unlikely that simply believing that an entity is human-like will make a person feel less lonely. Rather, it is more likely that the close relationship this perceived human-like entity affords that reduces loneliness. In this way, our work helps move the literature towards understanding the consequences of anthropomorphism.

In short, our study suggests that it is a feeling of relationship authenticity that is central to translating anthropomorphism into affect and real-world desires. We examined relationship authenticity the extent to which our participants felt their romantic relationship with the VA felt real and intimate. In two studies this sense of authenticity was integral to translating anthropomorphism into outcomes. Our findings point to a feeling that the relationship is authentic as an important, previously unstudied mediator of anthropomorphism.

In the next Chapter, we further hypothesised that greater anthropomorphism would predict stronger relationship authenticity, which would then be associated with more flirtatious behaviour via greater desire for real-world relationship with a VA and higher positive mood (Study 5). In Chapter 7, we examined whether romantic anthropomorphism could also predict behaviour in a subsequent interaction with a male confederate.

Chapter 7: Study 5 (Lab study) and Meta-Analysis

In this chapter, we aimed to replicate the previous findings of the model in Chapter 6 with only single female samples. Additionally, we examine how romantic anthropomorphism affects behaviours in real life.

Study 3 and 4 found that after playing an RVG, greater romantic anthropomorphism of the love interest VA would predict stronger relationship authenticity, which, in turn, would predict greater desire for a real-world relationship with the VA, as well as higher positive and lower negative mood. In two studies, we revealed robust links between romantic anthropomorphism and a range of outcomes via relationship authenticity. Study 5 aimed to build on these findings in two distinct ways. First, we aimed to replicate the previous models with a sample of single women, rather than a blended sample of single and partnered women, given that the former group should be more motivated to seek a relationship with a new partner. We also examine in a new model whether the outcomes of a virtual romance (desire for a real-world relationship with the VA and PA) influence real world relationships. We know RVG play can make people want a real-world relationship (desire for a real-world relationship with the VA) and feel good (PA). We examined whether these feelings in turn predicted how they interacted with real potential partners. That is, we hypothesized that single women who experienced greater anthropomorphism of VA and higher relationship authenticity are associated with greater desire for a real-world relationship with the VA (higher desire for real relationship) or increased PA (feeling positive). We also explored whether these outcomes would be associated with behaviour in a live interaction (being more flirtatious). In Study 5, we were able to recruit 78 participants in

the time allotted for data collection, achieving statistical power of 0.67 for our mediation models (Schoemann et al., 2017).

Methods

Participants

Initially, we recruited 87 participants, but we removed nine participants from analyses due to incomplete questionnaires (N = 5) or having met the male confederate beforehand (N = 4). Thus, 78 single women aged 18-33 years old (M = 22.64, SD = 3.04) participated. Participants identified as Asian (N = 19) or Caucasian (N = 59). All participants were native or proficient English speakers with no prior experience playing the RVG we chose (*Choices: Stories You Play*).

Procedure

The procedure of Study 5 was similar to our previous studies. After completing the first two chapters of the RVG *Choices: Stories You Play* and the questionnaires (romantic anthropomorphisms, relationship authenticity, desire for a real-world relationship with the VA and PA and NA), we invited participants to have a short (~5 minutes) one-to-one video-recorded conversation with an attractive male confederate. Two male confederates were recruited, and their attractiveness ratings were pretested in a separate pilot sample. There were no significant differences between the two confederates' attractiveness levels, $t(76) = 1.49$, $p = .140$, Confederate A (M = 6.84, SD = 1.62) and Confederate B (M = 6.32, SD = 1.46). The confederate asked the participants to describe their ideal holiday and chatted until 5 minutes had elapsed. After participants left the interview room, they completed a brief exit questionnaire and were debriefed.

Exit Questionnaire

Participants were asked two questions when they exited the interview room: 'To what extent do you think the interviewer is attractive?' and 'to what extent did you feel comfortable to talk with the interviewer?' on a 10-point scale (1 = *not at all*, 10 = *very attractive/comfortable*). Overall, confederates were considered attractive (M = 6.56, SD = 1.56) and the interaction was considered comfortable (M = 7.95, SD = 1.67).

Videotapes of the interaction were presented to two coders, blind to the hypotheses of the study. The two coders rated 'How flirtatious was the participant?', 'How happy was the participant?' and 'How relaxed was the participant' with a 7-point scale (1 = *not at all*, 7 = *very much*). Kappa values from 0.41 to 0.60 indicate that the two coders had a moderate level of agreement for flirtatious (Kappa = 0.41, $p < .001$), happy (Kappa = 0.44, $p < .001$) and a fair level of agreement for relaxed (Kappa = 0.39, $p < .001$). Correlation analysis shows that three variables were highly correlated: relaxed and happy (r = .78), relaxed and flirtatious (r = .61) and happy and flirtatious (r = .72). Therefore, we combined the items to create an overall flirtatiousness score (α =.87).

Results and Discussion

Descriptive statistics, reliability information, and correlations among study variables are presented in Table 1. The data analytic strategy for our initial mediation models aimed at replicating our prior studies was the same as Study 3 and 4 (see Figure 1).

Study 5 revealed that greater romantic anthropomorphism significantly predicted feelings of relationship authenticity with the VA, β = .30, SE = .11, 95% CI = [.08, .51], which then significantly predicted more desire for a relationship with the VA in the real world β = .53, SE = .09, 95% CI = [.06, .30] and an increase in PA, β = .35, SE = .11, 95% CI = [0.1, .23]. Results from the model indicated that romantic anthropomorphism is indirectly related to desire for a

relationship with the VA, β = .16, SE = .06, 95% CI = [.06, .30] and an increase in PA, β = .10, SE = .06, 95% CI = [.01, .23] through its relationship with relationship authenticity.

Table 1

Study 5: Descriptive Statistics, Reliability Information, and Correlations among Study Variables

				Correlations				
	Variable	*M*(*SD*)	α	1	2	3	4	5
1	Romantic Anthropomorphism	5.02(0.81)	.91	—	.30**	.60**	-.03	.02
2	Relationship Authenticity	4.82(1.09)	.86		—	.60**	.32**	.10
3	Desire for a Real-World VA Relationship	4.11(1.28)	.91			—	.14	.06
4	Pre-Post Positive Affect	-0.13(0.64)	.84				—	-.16
5	Pre-Post Negative Affect	-0.15(0.50)	.78					—

Note. $N = 78$ single women. Continuous scores were calculated such that higher scores indicate greater standing on the variable (e.g., greater romantic anthropomorphism). For pre-post PA and NA, the α value represents the mean of the αs of the pre- and post-gameplay measures.

*$p < .05$, **$p < .01$

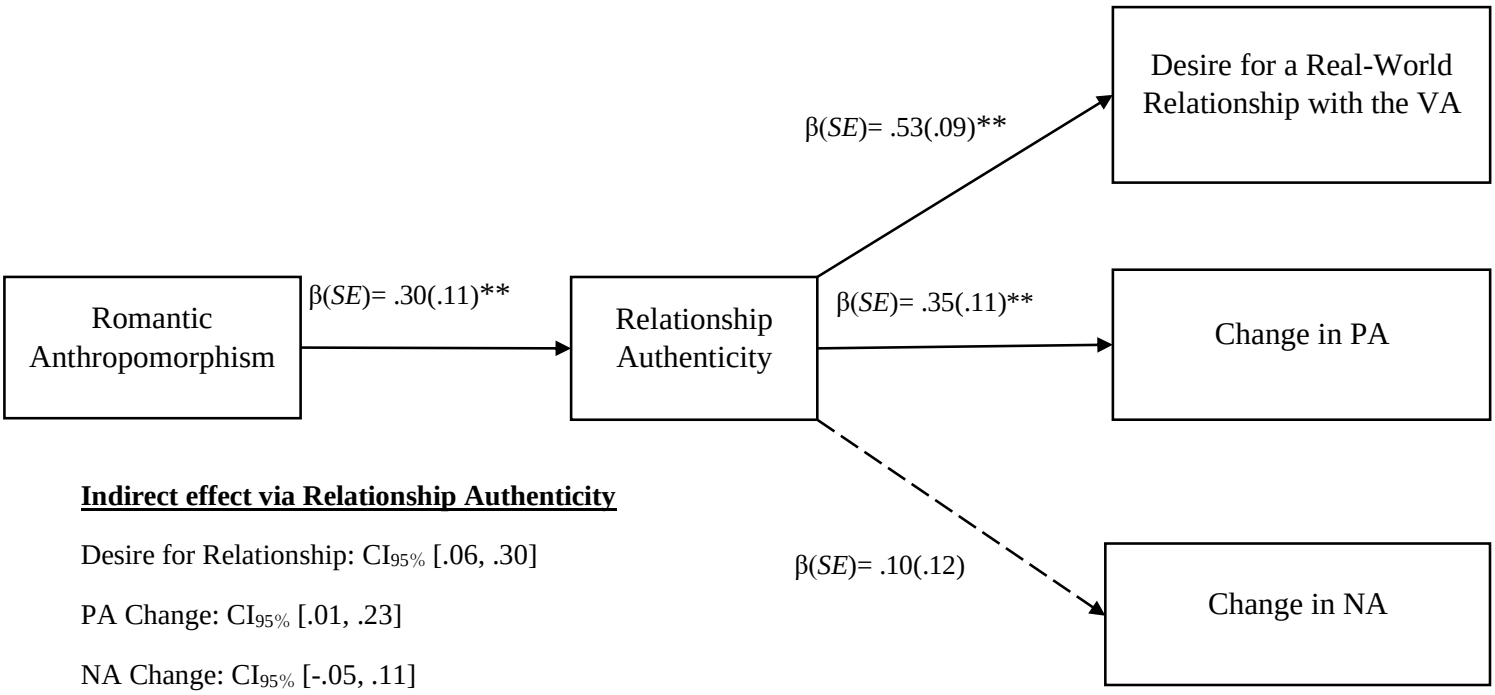
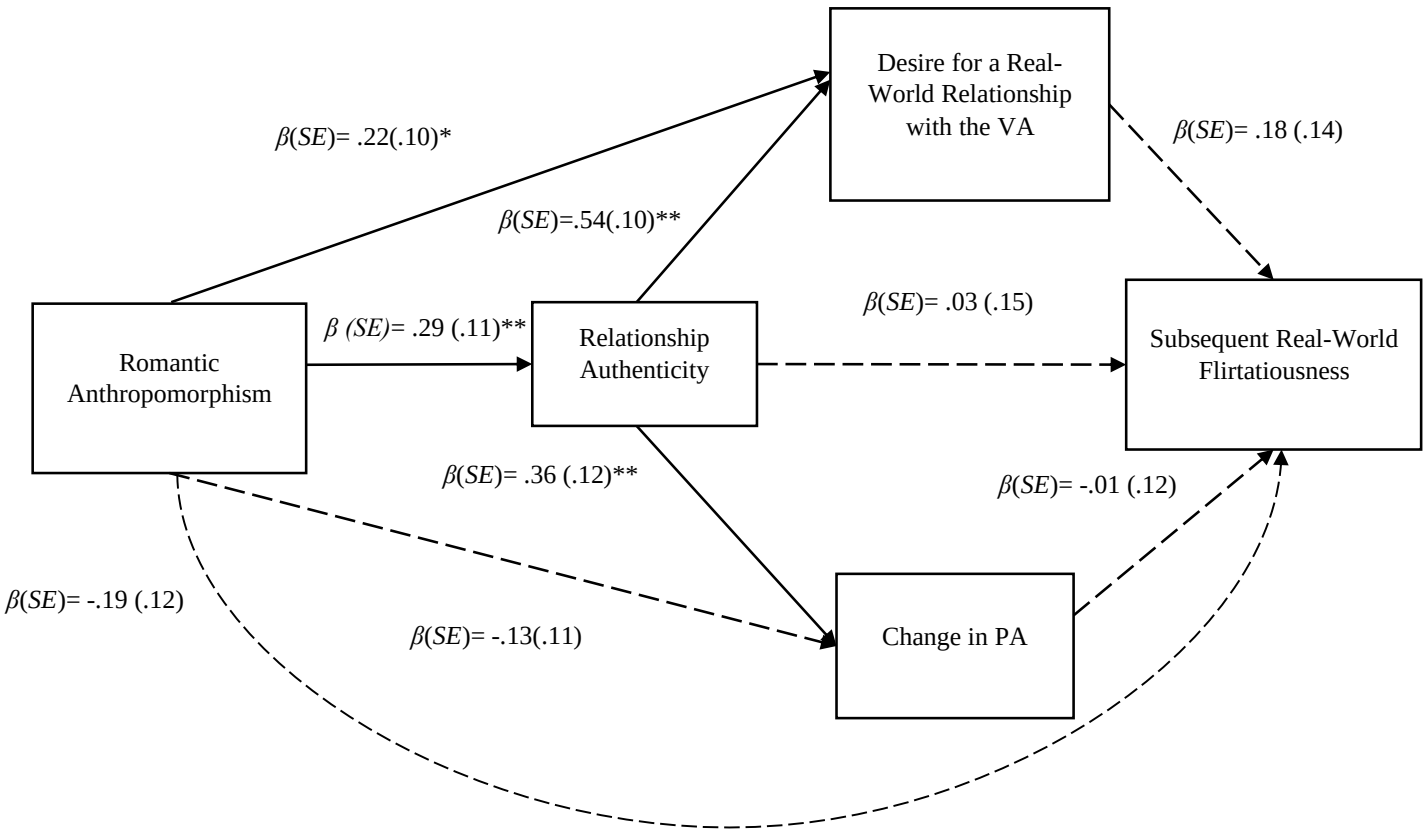


Figure 1. Direct and indirect associations between romantic anthropomorphism and desire for a real-world relationship with the VA, change in PA, and change in NA via relationship authenticity in Study 5. *$p < .05$, **$p < .01$

Study 5 replicated the results of Study 3 and 4. Romantic anthropomorphism predicted desire for a real-world relationship with the VA and change in PA—but not change in NA—via relationship authenticity.

We then examined how romantic anthropomorphism and romantic authenticity might predict human-human interactions. To test this parallel mediation model (Hayes, 2018; Model 81), the outcome variable for the analysis was subsequent real-world flirtatiousness (as coded by objective observers of the videotaped interactions) and the predictor variable was romantic anthropomorphism. Romantic authenticity as the first mediator and desire for a real-world relationship with the VA and PA change were the second mediators (see Figure 2).

Study 5 interview revealed that greater romantic anthropomorphism significantly predicted feelings of relationship authenticity with the VA, β = .29, SE = .11, 95% CI = [.08, .50], which then significantly predicted more desire for a relationship with the VA in the real world β = .54, SE = .10, 95% CI = [.35, .73] and an increase in PA, β = .36, SE = .12, 95% CI = [.13, .59]. Also romantic anthropomorphism significantly predicted more desire for a relationship with the VA in the real world β = .22, SE = .10, 95% CI = [.03, .10]; however, there was no link between perceptions of the virtual relationship and subsequent interactions with a male confederate. No indirect effect was significant in the model.



Indirect effect via Relationship Authenticity

flirtatious: $CI_{95\%}$ [-.09, .12]

Indirect effect via DRR

flirtatious: $CI_{95\%}$ [-.03, .13]

Indirect effect via PA

flirtatious: $CI_{95\%}$ [-.07, .05]

Indirect effect via Relationship Authenticity and DRR

flirtatious: $CI_{95\%}$ [-.01, .10]

Indirect effect via Relationship Authenticity and PA

flirtatious: $CI_{95\%}$ [-.03, .04]

Figure 2. Direct and indirect associations between romantic anthropomorphism and desire for a real-world relationship with the VA, change in PA, and change in NA, Subsequent Real-World Flirtatiousness via relationship authenticity in Study 2. *$p < .05$, **$p < .01$

The results from these latter models are clear; there was no link between perceptions of the virtual relationship and subsequent interactions with a male confederate. Despite romantic anthropomorphism and relationship authenticity appearing to be robust predictors of desire for a relationship and positive emotions across three studies, they failed to predict real-world outcomes.

Internal Meta-Analysis

We combined the three datasets for an internal meta-analysis of multiple mediation models. This new dataset contains 243 participants and exceeds the recommended number of participants for a model of this complexity (i.e., N = 106; see Tabachnick & Fidell 2014) and achieved statistical power of 0.99 (Schoemann et al., 2017). The model is presented in Figure 3. Internal meta-analysis revealed that greater romantic anthropomorphism significantly predicted feelings of relationship authenticity with the VA, β = .43, SE = .06, 95% CI = [.31, .54], which then significantly predicted more desire for a relationship with the VA in the real world β = .52, SE = .05, 95% CI = [.15, .30] and an increase in PA, β = .34, SE = .07, 95% CI = [0.8, .22]. Results from the model indicated that romantic anthropomorphism is indirectly related to desire for a relationship with the VA, β = .22, SE = .04, 95% CI = [.15, .30] and an increase in PA, β = .14, SE = .04, 95% CI = [.08, .22] through its relationship with relationship authenticity.

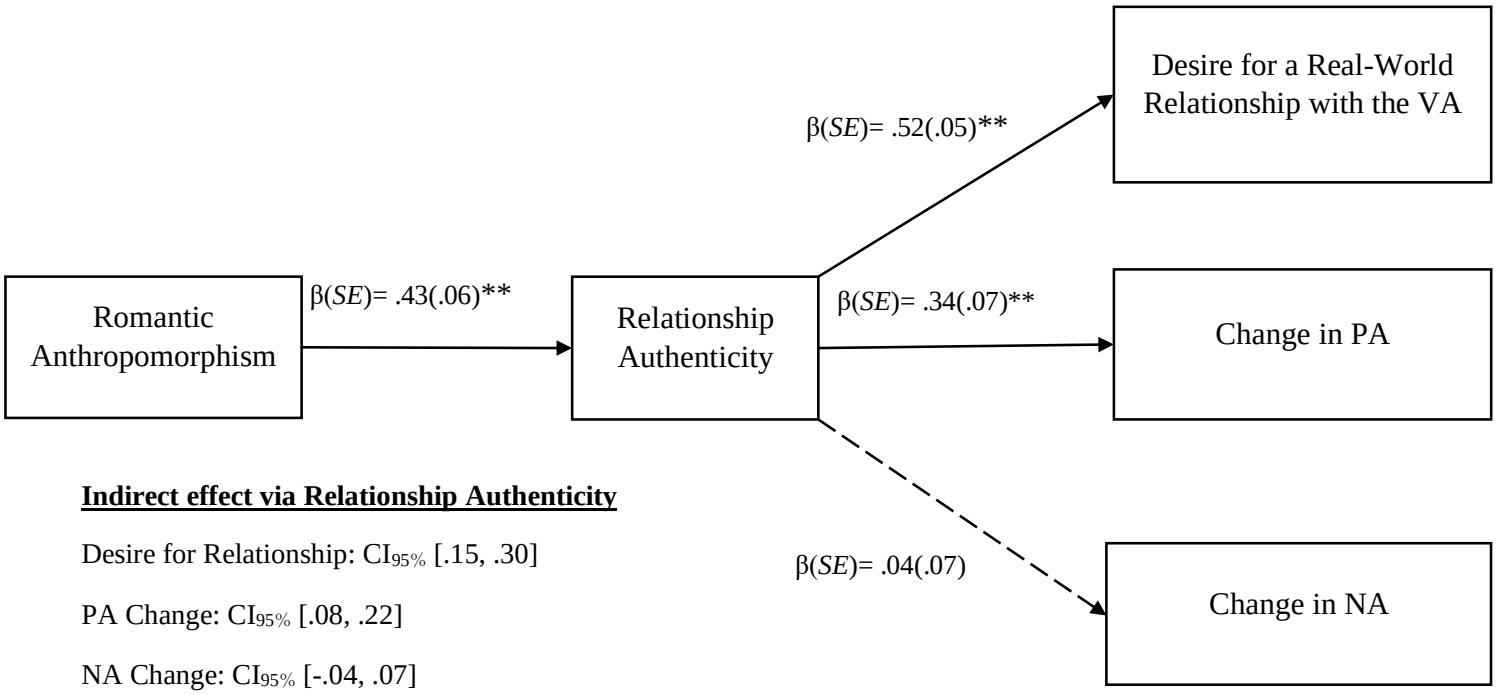


Figure 3. Direct and indirect associations between romantic anthropomorphism and desire for a real-world relationship with the VA, change in PA, and change in NA via relationship authenticity in meta-analysis. *$p < .05$, **$p < .01$

The meta-analysis revealed that romantic anthropomorphism predicted desire for a real-world relationship with the VA and change in PA—but not change in NA—via relationship authenticity (see Figure 3). In short, the results of the meta-analysis confirm the individual findings of each study and provide us with a more robust estimate of the model parameters.

General Discussion

Across three studies (Chapter 6: Study 3 & 4; Chapter 7: Study 5) and an internal meta-analysis, we examined people's romantic anthropomorphism in the context of virtual relationships. The findings regarding relationship experiences were highly consistent: greater anthropomorphism of the VA predicted greater relationship authenticity, and this in turn robustly predicted desire for a relationship with VA in the real world and increased PA. However, we did *not* find evidence that romantic anthropomorphism, relationship authenticity, desire for a real-world relationship with a virtual romantic partner, or change in PA were associated with behaviour in a subsequent human-human interaction.

The core pathway uncovered across these three studies reveals that romantic anthropomorphism is linked with outcomes via relationship authenticity (i.e., people feeling that their connection and virtual romance with the VA was genuine). This finding suggests that it is not anthropomorphism *per se*—there is no reliable direct link between anthropomorphism and outcomes—but rather how anthropomorphism feeds through relationship authenticity that predicts a desire for a real-world relationship with a VA and positive mood. This result is in some ways unsurprising, as authenticity is known to play an important role in human-human relationship outcomes (Lopez & Rice, 2006; Wickham, 2013). Nevertheless, identifying this central mediating variable is an important step in the literature on anthropomorphism within a more social domain.

We hypothesised that single women's romantic anthropomorphism, virtual relationship experiences, and mood might predict their interactions with a male confederate. We did not find an association between playing RVGs and any interactions with real potential partners. This result contrasts the findings in a parallel literature on videogame play and aggressive behaviour. Multiple studies have shown that playing violent video games is a causal risk factor for increasing aggressive thoughts and behaviours, and decreasing prosocial behaviour in both the short- and long-term (Anderson et al., 2010; Calvert et al., 2017; Greitemeyer & Mügge, 2014). Playing violent video games increases a readiness to fight and increases subjective perceptions of fighting ability (Denson et al, 2020). In stark contrast to the finding that playing aggressive video games increases aggression, we found no evidence that playing romantic video games makes people more romantic. This difference may emerge as a function of the type of game participants played. In all three studies participants played a 'cartoon-like' video game with largely static, 2D characters (*Castaway, Choices*). Work on violent games has robustly shown that realistic violence (e.g., *Call of Duty*) is more predictive of later aggression than unrealistic, 'cartoon' violence (e.g., *Super Smash Bros.*, Calvert et al., 2017). If the same relationship holds for romantic video games, then more realistic romantic interactions may be more predictive of later, real-world romantic behaviour. This possibility awaits future examination.

Limitations and Future Directions

These novel findings should be interpreted in light of some limitations. First, we recruited female participants across all studies, because the RVGs which we used for the studies primarily target heterosexual female players. There are certainly a range of RVGs that target men (e.g., *LovePlus*, *Tokimeki Memorial*) which warrant further investigation. Prior anthropomorphism

work has typically found little to no gender effect on anthropomorphism (e.g., Chin, Sims, Clark & Lopez, 2004). Future studies should aim to investigate male targets and compare effects.

Second, our studies were conducted within-subjects. We adopted this approach as it mirrors the experience of players: they have baseline desires and emotions which can be altered through gameplay. To more robustly establish the causal relationship between these variables, future work should look to manipulate anthropomorphism directly (e.g., Waytz, Cacioppo & Epley, 2010), ideally including a control condition.

These studies open the door to new and exciting avenues for research. We examined virtual romance via the medium of RVGs. Due to their interactive nature, romantic games may be particularly good at fostering anthropomorphism and virtual romances. Romantic anthropomorphism, however, should not be limited to video games. In Japan, the phenomenon of developing romantic feelings and attachment towards a virtual character is sufficiently common that it has its own label ('Moe', 萌え). Importantly, this emotion is frequently experienced with comics and animated characters, as well as video games (Matsubara & Sato, 2013). This points to the scope of romantic anthropomorphism extending well-beyond video games and into other domains containing VAs. The next key steps for research on virtual romantic relationships are to explore whether virtual romance produces the same benefits of its real-world alternative.

Conclusion

People want to love and be loved, desires which can now be potentially fulfilled by VAs. Our work examined whether anthropomorphism plays an unrecognised role in these virtual romances. Across three studies (Study 3, 4 and 5), we showed that anthropomorphism predicts relationship experiences with a VA, as well as the desire for real-world VA relationships and positive mood via relationship authenticity. The relationship effects, however, stayed in the virtual domain;

virtual romances did not predict subsequent real-life romantic interactions. Most romantic relationship research has been focused on human-human domains, and most previous anthropomorphism research has concentrated on platonic anthropomorphism. Our research attempts to cultivate a new field bridging the gap between anthropomorphism and romantic relationship studies.

Chapter 8: General Discussion

Summary and Discussion of Thesis Results

In this thesis, we introduced the new concept 'romantic anthropomorphism', which is an expansion of anthropomorphism into the romantic domain. Throughout five studies, we used RVGs to examine virtual romance. The aim of this thesis is to explore the factors that might contribute to developing a romantic relationship with a VA (virtual agent).

1. The desire for romantic relationships with VAs

We first began by examining what underlies the desire to start a romantic relationship with a VA, using two online studies (Chapter 5). These two studies revealed that a human-like voice and the use of touch were perceived as important factors in anthropomorphised romantic relationships. Lonely individuals have a higher desire to play RVGs. Moreover, we found that a desire to develop social skills and alleviate negative emotions independently increased desire to play RVGs.

Regarding the function of touching and voice in RVGs, in simple terms it is an imitation of human-to-human interaction. Between two humans, touching benefits our health and enhances the formation of good relationships. These tactile communications reduce pain and stress, enhance social connection (Mancini et al., 2014; Ellingsen et al., 2016), and increase relationship satisfaction (Murphy, Janicki-Deverts & Cohen, 2018). In terms of the game characteristics of voice, hearing human-like voices is an important aspect to enjoying RVG style games (Iguchi, 2015). During the Tokyo Game Show in 2018, an intensive RVG using Virtual Reality (VR) was presented. The game 'VR boyfriend' especially focused casting famous voice actors to imbue human-like 'handsomeness' towards characters (Dengeki online, 2018). High quality of

characters' appearances and levels of graphics get players' attention, but a human-like voice especially enhances satisfaction of RVG play (Iguchi 2015). Touching and voice functions in RVGs appeals to our primitive or natural senses, as they imitate real life human interactions.

In our studies, we also found that Individuals who reported higher levels of loneliness have a higher desire to play RVGs (Chapter 5). Loneliness is a strong predictor of anthropomorphism (Epley, Akalis, Waytz, & Cacioppo, 2008). Also, regarding fundamental functions in RVGs, some female participants commented that they feel a sense of acceptance through communication with a character (Liang, 2019). Our results support these previous findings of the fundamental motivations of anthropomorphism.

Two key factors were discovered as to why people are motivated to play RVGs. The first one is anticipated positive affect; that players expect to feel better when they play RVGs. The second factor is anticipated skills acquisition; that players expect to develop social and romantic relationships skills through play. Prior game research indicates that casual games influence mood positively (Russoniello et al., 2009) and strategic games enhance problem-solving abilities (Adachi & Willoughby, 2013). Our findings support these previous findings, and additionally we uncovered what people expect to gain by playing RVGs.

Chapter 5 proved an important first step in revealing the several factors that underlie motivation to start a romantic relationship with VA. Indeed, prior work was limited for romantic relationships with VAs, therefore these studies contributed to cultivate the filed; an intersection of technology and psychology.

2. How romantic anthropomorphism works to build a relationship with a VA

We conducted online studies to examine the motivation of RVGs play, thus Chapter 7 and 8 examined the processes of romantic relationships in a lab-based paradigm. In Chapter 7 and 8, three lab studies aimed to examine how romantic anthropomorphism predicts relationship authenticity, desire for real-world relationships, mood, and real-world behaviour.

The research revealed that romantic anthropomorphism of a VA predicted desire for a real-world virtual relationship and greater positive affect via feeling that the relationship built with the VA was authentic. Internal meta-analysis also confirmed the results, therefore the models of the process of romantic relationships with a VA are consistent. Prior anthropomorphism research focused on platonic relationships with non-human entities (e.g., god, animals and robots) and the theoretical perspective of the SEEK model (Epley et al., 2007). Many studies confirmed that loneliness predicts increased anthropomorphism (e.g., Epley et al., 2008; Feng, 2016; Eyssel & Reich, 2013). We know perceiving an entity as human-like makes us feel less lonely, but it is still a previously unstudied mediator of anthropomorphism. These three lab studies help move the literature towards understanding the consequences of anthropomorphism. Interestingly, anthropomorphism does not directly influence outcome and feeling of relationship authenticity translates anthropomorphism into outcomes. Our findings uncovered that the authenticity of a relationship with a VA is an exceptionally important factor, rather than anthropomorphism itself.

In terms of behavioural aspects, we also examined in a new model whether the outcomes of a virtual romance influence behaviour in real-life. The results showed that there was no association between playing RVGs and any interactions with real potential partners. Past game studies presumed the relation of video game play and behaviours; thus, our findings contrast the previous findings. For example, playing violent video games is a risk factor for increasing

aggressive thoughts and behaviours, and decreasing prosocial behaviours (Anderson et al., 2010; Calvert et al., 2017; Greitemeyer & Mügge, 2014). However, most violent video games are realistic with 3D characters whereas RVGs are more cartoon-like designs. Calvert et al. (2017) suggested that a realistic design for violent games is more predictive of aggression than those that have unrealistic designs. Nowadays, more realistic types of RVGs have been appearing (e.g., VR boyfriend, Dengeki online, 2018). Therefore, when RVGs pursue more realistic design features, it might so that they hold a similar pattern to violent video games in terms of subsequent behavioural changes.

3. New directions of anthropomorphism in digital relationships

Since the pioneering work of Epley and colleagues (Epley et al., 2007) introduced the SEEK model, the topic of anthropomorphism has benefitted from significant research, with numerous high impact papers in mainstream psychology (e.g., Bartz, Tchalova & Fenerci, 2016; Waytz et al., 2010). Much of the previous work has focussed on animals and gods. Whilst certainly important, we believe that a detailed focus on digital anthropomorphism is not only warranted but potentially lucrative in terms of discovery. In contrast to the decline in religiosity in the modern world, virtual agents have become an increasingly central feature in our psychological landscape. Importantly, they are also becoming more 'human-like' in an objective sense; they are increasingly complex, affective, and designed to elicit a sense of psychological connection with their user. Digital anthropomorphism is a topic that is quickly becoming important to a broad range of people and industries: from academics and advanced students, to the gaming, computing, and entertainment worlds. As psychologists, we can already contribute much towards understanding what motivates people to anthropomorphise. Looking forward, we

hope the field will move towards building the best relationships possible, mindful of the perils that may entail.

Strengths and Implications

1. Expanding the concept of anthropomorphism into the romantic domain

The first key theme to this thesis is to expand the concept of anthropomorphism from platonic to romantic domains. This thesis cultivates new insight into the psychological concept of anthropomorphism, as no prior study has expressed framework for romance or romantic relationships in a digital context.

Anthropomorphism in platonic relationships

Prior work has heavily focused on the platonic domains of anthropomorphism that include the various and specific types of relationship between humans and gods, or animals and technology. The relationship between humans and gods, for example, is commonly explained in terms of worship and spiritual formation (Abemethy et al., 2015). Humans often think about gods in human-like ways, using human-like descriptions, and creating metaphorical expressions such as ‘god knows’ or ‘god-hand’ (Barrett & Keil, 1996). Previous research has revealed that people tend to feel less lonely when they have a strong belief in God (Schwab & Petersen, 1990). In addition, self-esteem is important for loving and accepting gods (Benson & Spilka,1973). Therefore, previous studies have focused beliefs and strengths of platonic relationships with gods.

‘Human-animal’ interactions hold a dynamic that frequently oversteps boundaries between companionship and friendship (McConnell, Lloyd, & Humphrey, 2019). Many pet owners greatly value their relationships with pets and view them as a member of the family, or

close friends (Walsh, 2009). In the same vein, positive results have been reported for both mental and physical health by creating social connections with pets (Hart, 2006). Anthropomorphism matters clearly in terms of empathy towards animals (Rusu, Costea-Barlutiu & Turner, 2019). Thus, human and animal relationships widely explore the psychological areas of social bonding: yet never in a sense of romance.

Relationships with technology, however, have a similar yet somewhat different position in history of anthropomorphism. Studies of human computer interaction (HCI) have focused how we perceive trust in agents (Culley & Madhavan, 2013) and how anthropomorphic design and humanlike characteristics make differences in our perceptions towards agents (Duffy, 2003; Seeger, Pfeiffer & Heinzl, 2017). Even though animals and machines are both non-human entities, people more positively perceive attributions of anthropomorphic behaviors towards animals than machines (Chin, Sims, Clark & Lopez, 2004). Therefore, these HCI studies examined the 'how' people perceive agents to be more engageable, but neither did HCI work look at romantic relationships with agents.

These domains in anthropomorphism research have emphasized the quality of an individual's platonic relationship in comparison to non-human entities. Romantic relationships are a specific type of relationship that differ to others in terms of quality. Even though the domain is different, the critical role of anthropomorphism is the same. In short, our studies have expanded the relationships style in anthropomorphism.

Emotional aspect of anthropomorphism

As mentioned above, we expanded the domain examining relationship style in anthropomorphism. Additionally, our findings captured the important concept of relationship

authenticity and the factors that produce it. In other words, we explore how people feel about their non-human partners and how they view their relationship's validity. Our studies focused on positive and negative affect specifically. Of course, the scope of emotion extends far beyond the core positive and negative affect. One potential future direction from our promising work with emotions would be to look at 'Moe'.

Past research of the Japanese concept of 'Moe' focused on theoretical perspectives (Saito, 2017) in cultural studies; however, little is known about such studies for psychology. As we explained Moe in Chapter 4, people understand and experience strong affection, intimacy, and love towards fictional characters, and this emotion is discoverable in both Japanese and English people (Koike, Ban & Loughnan, 2020). Since Moe is a somewhat universal emotion, this intense feeling of love towards non-human entities is not limited to a specific nation. Following such evidence, many people anthropomorphise fictional characters and feel strong affection towards them. Therefore, it is necessary to directly determine the effect of romantic anthropomorphism and indicate a new direction for it.

To put it simply, our investigation of romantic relationships with non-human agents provides the logic for how people develop their romantic relationships. Moreover, we developed a new research area in the relationships domain as well as expanded the specific emotional aspects in anthropomorphism: romantic anthropomorphism.

2. Introduce a new mechanism of anthropomorphism

The second key strength of this thesis is to introduce a new concept for anthropomorphism. Prior models have focused on the motivations to anthropomorphise (see The SEEK model, Epley et al., 2007), not the nature of anthropomorphism or the role it plays in

relationships. This thesis uncovered how anthropomorphism played an important role in making authentic relationships with a VA. Nowadays, computer technology and robotics has focused the concept of anthropomorphism to explore how best to use intimacy and emotion within modern products (Sung, Guo, Grinter & Christensen, 2007). These trends lead to a question: How can we form authentic relationship with technology like our existing relationships?

Technologies are tools to supports existing relationships

Prior work has focused on how technology changes our relationships with people. People use technology to communicate with others via emailing, Facetime, Skype, and other social media. These technological communication services support our existing relationships (Neustaedter & Greenberg, 2012; Janning, Gao, & Snyder, 2018) and enhance particular dimensions such as long-distance relationships (Kirk, 2013; Dainton & Aylor, 2002). For another example of interaction with technology, interactive devices such as the Amazon Alexa and Google Assistant create senses of social connection, personification, and satisfaction with products (Purington, Taft, Sannon, Bazarova, & Taylor, 2017; Pradhan, Findlater, & Lazar, 2019). People often consider that technologies are just simple tools made to support humans and nothing more. However, technology has quickly expanded far beyond just tools in modern society. To fulfil the obligations of everyday life, we inevitably need to build authentic relationships with many forms of technology in one way or other.

Technologies are more than just tools

This current work explores how we directly relate to technology. Contemporary society has experienced an important shift in our mutual perspectives for technology: that technology should change, in simple terms, from just ‘tools’ to something more capable of supporting

connections. Plainly, technology in a general sense has an innate capacity to encourage and produce people to interact and connect with it.

For example, Gatebox released a virtual home robot through the concept that 'you can live your life with characters you love' (Gatebox, 2020). The company also demonstrated that the virtual character especially focuses providing emotional support for users and that they cultivate a relationship with this beloved character. Therefore, modern technology produces products within our modern ideals that are somewhat capable of transforming reality.

Authentic relationship in anthropomorphism

Our studies found that one keyway we do it is by making that relationship more authentic via making the technology more human. Some were people surprised that a Love plus player got married with 'non-existing person' outside of the game screen. (Lah, 2009). The player loves the character, does not view it as a machine or inanimate, and understands completely that Love Plus is a game, not real. However, though unusual, it is unsurprising when the psychological machinery of such a relationship is actually understood: if players strongly anthropomorphise a VA and feel that their relationship with the VA is completely authentic, 'love' in the terms we understand it is not so farfetched. Our findings uncovered that when players establish and feel authenticity for their relationship with the VA, they desire to stay with the VA in reality and feel happy. More specifically, our findings introduce a new way to understand a romantic relationship between humans and non-human entities. Anthropomorphism played an important role in making a relationship with a VA feel more real or authentic. Therefore, if we want to make a good relationship with virtual agents, we should first make the agent appear as human-like as possible. If we feel that the relationship with the agent is authentic, we can forward the process to build a strong connection.

Beyond romantic anthropomorphism

Our findings can also apply to and explain how people make good relationships with digital agents in platonic terms. When we think about a platonic relationship with a technological companion (e.g., robot and digital pets), it becomes much more understandable. When Tamagotchi was robustly becoming popular around the world (Kageyama, 2004), individuals who did not particularly find virtual companions interesting began to understand why someone might devote a great amount of their time to raise 'non-existing creatures' in reality. As another example, when repair services were no longer available to fix the robot AIBO, some robot owners viewed it as a 'death' for their companion, not that is merely had become 'broken' (Eiraku, 2019). Therefore. the first step is that people need a greater tendency of anthropomorphism in order to build authenticity in a platonic relationship. Effectance Motivation (EM) is another fundamental motivation (Epley et al., 2008) and refers to the desire to explain and understand the behaviour of non-human agents. As an example of EM, people anthropomorphise moving shapes to understand the movement of the shapes via attributing mental states (Heider & Simmel, 1944). For example, Roomba is a cleaning robot with a round shape and no obvious human-like characteristics in its design. The movement of the machine is not rational as it often cleans the same space repeatedly, changing direction unpredictably until the bumpers hit obstacles (Bennett, 2019). The unexpected movements and ambiguity allow owners to feel a sensation that 'my assistant robot is working hard for me' from a human-like perspective. Indeed, Roomba owners view the machine as more than an appliance, and consequently they are motivated to ascribe it personality, name, and even a gender (Sung, et al, 2007). Sung et al (2007) also revealed that the more people feel intimacy with the robot, the more they take care of it. First and foremost, the strong engagement between humans and agents

is the next key step after anthropomorphising entities. Many companion digital agents and robots are developed, and anthropomorphism plays a central role in considering relationships with agents. Putting it simply, anthropomorphism creates the feeling of authenticity in relationships. In turn, relationship authenticity is meaningful to build a strong bond with agents.

3. Marketing ideas for variety of relationships

That all our knowledge begins with experience there can be no doubt.

— Immanuel Kant

Implicit in our study is an intent to provide ideas for a variety of relationships in marketing and technology. This thesis has focused romantic anthropomorphism, particularly using RVGs. These games enable us to examine romantic relationships between a player and a VA in the game. Regarding human and VA in romantic relationships, there are myriad games that exist in the world and RVGs are a fast-growing category (Ganzon, 2019). The most classical and well known RVG, 'Tokimeki Memorial (Toki-Memo)' by KONAMI, came out in 1994 and sold 1.1 million copies (Pollacknov, 1996). The aim of Toki-Memo was to win the heart of the female character 'Shiori', the most popular girl at school, or one of 11 other students the player might prefer. Shiori will only say 'I love you' on graduation day, and players should wait three years (in the game timeline) from the start (Pollacknov, 1996). Players can date with other characters, but if Shiori realizes that a player is dating multiple women, Shiori and the other 11 girls all become upset at a player. The game requires patience to complete and players need to maintain an ability in study, sports, and fashion to succeed. In 2019, the series of this game celebrated a 25 year anniversary (Famitsu.com, 2019) and after the first Toki-Memo released, other famous RVGs followed (e.g., Love Plus in 2009). Toki-Memo and Love Plus are both

heterosexual oriented RVGs, but the storyline of the games is different. Toki-Memo has options to date multiple women at the same time and enjoy romance before they become aware, whereas Love Plus requires players to decide a single girlfriend at an early stage and enjoy the time to build a relationship with the character. Both RVGs aim for the player to enjoy a romantic experience, but achieve it in somewhat opposite ways. In short, players can learn how to form a secure and satisfying romantic relationship through the experience of playing video games.

Various triple A video games replicate human intimacy by using VA relationships within the game. In terms of a paternal experience of guardianship, 'The Last of Us' was an action-adventure game developed by the US company Naughty Dog in 2013. In 'The Last of Us', players controlled a middle-aged male character named Joel, a smuggler tasked with escorting a young girl, Ellie. In the game, Joel's platonic guardianship gradually develops into fatherly affection, providing players with an experience to slowly emotionally engage with the characters they are playing (Welsh, 2015). Another example of guardianship, 'A Plague Tale: Innocence' was an action game developed by the French company Asobo Studio in 2019. Inside the game, players controlled the female character, Amicia, who protects her younger brother Hugo. Hugo is a handful, easily distracted, and difficult to take care of while proceeding the story. The sibling relationship gradually evolves as the game progresses and the little brother slowly starts to reverse the roles and protect Amicia instead (Delahunty-Light, 2019). Players engage with both games from a third-person perspective, controlling the main characters and proceeding the stories to feel parental or protective affection towards VA children. Since our study uncovered how people proceed a relationship with a VA in the romantic domain, such relationships might also have the potential to develop platonic relationships with a VA in a similar vein to romantic

ones. If so, the key is the tendency of anthropomorphism and the establishment of authentic relationship with the VA.

Modern technology now has progressed enough to create incredible graphics and stories, all for the improvement of the characters to become more realistic and humanlike. Immanuel Kant famously states that experience is vital for knowledge, and modern technology provides us realistic experiences of meaningful platonic relationships. These games inspire many players and players may learn from their strong platonic experiences. The video game industry and market may do well to pay attention to relationship authenticity and making a character anthropomorphizable when designing future games.

Limitations and Future Directions

1. How do we anthropomorphise VAs?

Our findings explored the processes necessary in developing a romantic relationship with a VA and the types of things that motivate us to play RVGs. However, while this research tells us that anthropomorphism matters, we do not know confidently what makes people anthropomorphise a VA. A distinctive feature to an RVG is flirting with a character. Between two humans in a romantic relationship, people are likely to flirt for pleasure (Punyanunt-Carter & Wagner, 2018). Indeed, the most common aims of flirting are establishing a connection (Henningsen, 2004). In our study, if a VA in RVGs flirt with female participants with appropriate timing and aims, they can perceive these words positively. This would subsequently enhance the level of human-like characteristics and leads to anthropomorphism. For this reason, VA characters Clyde and Chris provided more romantic experience for participants. Taylor (2007) explained that RVGs provided players the chance to engage in fantasy romances with

VAs. Also, VAs can interact with ideal romantic phrases with players (Galbraith, 2011). It is reasonable to expect that these intensive romantic behaviours would make the characteristics of a VA appear more human-like.

Future studies should examine what makes people anthropomorphise characters. Also, what characteristics and features of VAs can be anthropomorphisable. Prior theories of anthropomorphism (see the SEEK model, Epley et al., 2007) explains why people anthropomorphise non-human agents. Specifically, RVGs are more interactive thus it might be a new factor that leads to anthropomorphism. This future direction is especially important for RVG developers to fill in the gap between products and users.

2. Virtual Love vs Love in reality

We know the mental and physical benefits of a real-world relationship, but do people get the same benefits from virtual love? In Chapters 6 and 7, we looked at positive affect (PA) and negative affect (NA) as the consequence of creating a romantic relationship with a VA. For research between two humans, subjective well-being was measured as a combination of PA & NA and Satisfaction with Life Scale (Demirtas & Tezer, 2012). Subjective well-being holds two ways for research on well-being. First, most frequently examined is the combination of life satisfaction and general happiness, and second, psychological well-being as personal growth (Dush & Amato, 2005). This is the first experimental studies to examine RVGs, thus we do not know what is similar and different between real world romance. Future studies should look at the relevant factors of romantic relationships between two humans and explore human-VA relationships.

In Chapter 3, we reviewed satisfying romantic relationships, finding that creating a good relationship is especially important in two humans' relationships. Obviously, it takes time to develop the quality of a relationship whereas RVGs build romantic relationships in much shorter time. Most RVGs prepare a set of episodes to build their quality of relationship when players proceed through them. Due to time constraints, our studies were unable to conduct longitudinal research and participants played a limited episode for our experiment. Future studies should look at whether virtual romance can somehow produce the same benefits of real romance or hold a similar aspect of romance in reality.

3. What is the nature of virtual anthropomorphic relationships?

Prior work has focused heavily and deliberately on the factors which lead people to anthropomorphise. With this now increasingly established, we can turn our attention away from the 'how' and towards the 'what'. What form will this relationship take? Or more importantly - what are the hallmarks of a good, successful human-virtual agent (H-VA) relationship, and what might we do to foster these?

Recent technological advances have created VAs that have begun to replicate human-to-human (H-H) relationships. For example, Nintendo's 'Animal Crossing: New Horizons' was Amazon's bestselling video game of 2020 so far (Amazon Best Sellers of 2020, 2020). The premise of the game is that players interact with VAs on their island to build a home. They speak to these VAs, come to understand their needs and relationships, give and receive gifts, and help them. In short, they become 'friends' with these VAs. What can psychology tell us about the types of relationships people form with VAs? Prior research has focused less on these platonic relationships and more on romantic relationships with VAs.

In many ways, RVGs reflect the cutting edge of virtual anthropomorphism as they strive to mimic the most intimate of human relationships: love. Psychological research has begun to examine this 'romantic anthropomorphism' (i.e., giving non-human agents human-like characteristics in a romantic context). For example, our three lab studies asked participants to play RVGs to examine how romantic anthropomorphism could serve to increase the feeling that the virtual relationship is 'real'. Three experiments revealed that the more people were able to anthropomorphise the VA, the more authentic they found the relationship to be. This feeling of relationship authenticity was itself consequential, predicting more willingness to continue the relationship and more positive, but not less negative, emotion. In short, this study provides preliminary evidence that romantic anthropomorphism plays an important role in virtual relationships, helping establish the bonds between people and VAs. Specifically, relationship authenticity is an important variable in understanding H-VA relationships.

How might we create good relationships with VAs? Despite these promising results, it is fair to say that H-VA relationships are currently understudied. Previous research examining H-H relationships has extensively studied how we maintain good relationships. Currently, we know of no work examining perceived emotional connection between H-VA and the extent to which VAs are perceived as responsive. Given that VAs are less able to fulfil partners' physical needs, this may represent a serious and unexplored limitation of H-VA relationships.

To date, no research has examined whether the same factors that serve to enhance H-H relationships are equally efficacious at improving the quality of H-VA relationships. Put bluntly, we have failed to capitalize on the vast wealth of relationship science to understand how people might relate to VAs. This should direct our research interests at understanding which types of agents and/or agent behaviour can increase a feeling of emotional connection and

responsiveness. If H-VA relations closely mimic H-H relationships, then it should be the case that more emotionally connected and responsive agents lead to higher H-VA relationship satisfaction. Indeed, these traits may be fostered by anthropomorphism. Agents which are viewed as human-like should have their behaviours interpreted as building emotional rapport or responsiveness. This may well underlie the role of anthropomorphism in establishing relationship authenticity (Chapter 6 and 7). Research into how to build satisfying and responsive relationships with VAs is a new field in social psychology, which is a combination of relationship science and modern technology. Thus, future research should be considered how to create satisfying relationships with VAs.

4. The dark side of digital anthropomorphism

In Chapter 3, we illustrated three key components of a satisfying relationship between two humans. How these might be applied to create satisfying relationships with anthropomorphised VAs? What are the negatives of a relationship with a VA? We call these anticipated dangers the 'dark side of anthropomorphism' and explore how VAs might threaten existing H-H relationship and hinder the creation of new H-H relationships.

Virtual agents as threats to H-H relationships

For H-H relationship, VAs may represent attractive alternatives. Attractive alternatives – when partners see an alternative state (e.g., another relationship) that is more attractive than their current relationship (Levinger, 1976) – play a central role in H-H relationships (Finkel, Simpson, & Eastwick, 2017), and are integral to major theories in the field (Rusbult, 1983; Thibaut & Kelley, 1959). Their main role is in understanding and predicting relationship (in)stability; whether people stay or leave a relationship. It has been robustly shown that when people see

many viable attractive alternatives to their current relationship, they are more likely to leave that relationship (Kim, 2013; Le, Dove, Agnew, Korn & Mutso, 2010). Theorists have pointed out that 'attractive alternatives' includes both other people and being single (e.g., McNulty, Meltzer, Makhanova, & Maner, 2018). We would propose another, looming attractive alternative: being in a H-VA relationship. With their low-cost, endless accessibility and wide variety, these entities which are specifically programmed to please us could present a genuine relationship threat. Critically, we think this attraction hinges off the VA being anthropomorphised. When a VA is anthropomorphised, it can better help meet the needs identified in the previous section (e.g., responsiveness), needs that are perhaps not met by the current, human partner. While it may seem implausible that a person would leave a relationship with another human to be with a computer program, if that program is sufficiently human-like, it may activate the longstanding role that attractive alternatives play in relationship dissolution. The threat of attractive VA alternatives should be most potent in the early stages of a relationship. As relationships progress, they tend to increase in commitment (Arriaga & Agnew, 2001). Prior work suggests that individuals who feel committed to their current partner reduce attention towards attractive alternatives (Maner, Rouby & Gonzaga, 2008; Rusbult, 1980). In sum, VA may soon represent an additional source of attractive alternatives, especially in the early stages of H-H relationship formation.

H-VA relationships as a barrier to forming H-H relationships

The destabilising effect of attractive alternatives on relationships is counterbalanced by a range of biases people possess towards alternative partners. If someone is in a satisfying relationship, they derogate potential alternative partners (see Amato & Previti, 2003; Durante, Eastwick, Finkel, Gangestad, & Simpson, 2016). These alternatives are perceived as less

desirable (Simpson, Gangestad, & Lerma, 1990), capture less attention (Maner, Gailliot & Miller, 2009), are less memorable (Karremans, Dotsch, & Corneille, 2011), and we are less warm towards them (Karremans & Verwijmeren, 2008). In short, satisfied couples possess biases to reduce the threat of attractive alternatives. With a growing number of people in increasingly human-like relationships with VAs, might we expect the same biases to reduce the 'threat' of a relationship with another human being? In this way, could satisfying H-VA relationships - the very type of relationships that programmers are working towards - make it harder for people to form relationships with other humans? There is at least some proof of concept - in 2018, Akihiko Kondo married the VA 'Miku', formally forsaking potential human partners. If we are in a satisfying H-VA relationship, we may derogate (e.g., devalue, act coldly towards) alternative human partners. Virtual anthropomorphism, and the relationships it allows, is a new and understudied area. As an evolving domain, we currently know little about what makes these relationships good or bad for us. Yet one thing is certain: psychologists should not neglect the study of VAs as they are already more than just 'objects'. In a sense these entities can be called 'non-human people' and our future mission might be to explore how we can better coexist with them.

Conclusion

This thesis contributed to the understanding of anthropomorphism in the romantic relationships domain. Digital technology plays an increasingly central role in modern society from assistants to companion agents. Recently, the design of VAs has a function of creating humanlike communication and can establish a psychological bond with humans. Love is central in human relationships and the psychology of romance has been extensively studied. Unsurprisingly, the experience of being in love is itself deeply psychologically rewarding. In

short, we know much about the psychology of human-human romance, but human-VA romance is understudied.

For most of human history romantic needs required another human being – someone to love and love back. Today, romantic needs can potentially be met by VAs. RVGs provide people with the opportunity to select, pursue, nurture, and enjoy a romantic relationship with a VA. Feeling of affection and love with non-human entities has been discussed in media and cultural studies (e.g., Moe), but it has been ignored in prior psychology research. To examine virtual romance, we used RVGs and introduced the concept of romantic anthropomorphism (i.e., giving a non-human agent human-like characteristics in a romantic context).

This thesis identified factors that might contribute to developing a romantic relationship with a VA. We found that loneliness is a key motivation to having a romantic relationship with a VA (Chapter 5), and the combination of anthropomorphism and creating authentic relationships are important for our mood and desire for the relationship with a VA in real life (Chapter 6 & 7). These studies have taken the first step into the cultivation of a new field of anthropomorphism in romantic relationships. In addition, this thesis provides novel information about what factors motivate people to have virtual romance and how anthropomorphism plays its role in creating romantic relationships with VAs.

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Appendix

Study 3, 4 and 5 Measures

Relationship Authenticity

Here are a number of statements that may or may not apply to you. Please indicate the extent to which you disagree or agree with each statement using the scale below. Please select your feelings toward **'Clyde' (Study 4 and 5: 'Chris').**

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I feel that Clyde and I were connected in the game (1)	○	○	○	○	○	○	○
I feel Clyde cared for me in the game. (2)	○	○	○	○	○	○	○
I feel that Clyde and I shared the same emotion. (3)	○	○	○	○	○	○	○
I feel that Clyde made me happy in the game. (4)	○	○	○	○	○	○	○
I feel that Clyde was romantic towards me in the game. (5)	○	○	○	○	○	○	○
I feel that Clyde was an attractive man in the game. (6)	○	○	○	○	○	○	○

Desire for Real-World VA Relationship

Please select your feelings toward **"Clyde"*(The male character who you chose). Please imagine "if Clyde was a real person"*** *and answer the following questions.* **(Study 4 and 5: 'Chris').**

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
If Clyde was a real person, I would be happy to have the romantic relationship with him. (1)	○	○	○	○	○	○	○
If Clyde was a real person, we would make a good couple. (2)	○	○	○	○	○	○	○
If Clyde was a real person, I would ask him out. (3)	○	○	○	○	○	○	○
If Clyde was a real person, he would be a good boyfriend. (4)	○	○	○	○	○	○	○
If Clyde was a real person, he would make me a very happy girlfriend. (5)	○	○	○	○	○	○	○
If Clyde was a real person, we would have a good relationship. (6)	○	○	○	○	○	○	○

Romantic Anthropomorphism

You chose 'Clyde' for your romantic partner in the game. Please select your impressions to describe 'Clyde'. **(Study 4 and 5: 'Chris').**

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
Communication: Clyde is capable of conveying thoughts or feelings to others. (1)	○	○	○	○	○	○	○
Emotion Recognition: Clyde is capable of understanding how others are feeling. (2)	○	○	○	○	○	○	○
Memory: Clyde is capable of remembering things. (3)	○	○	○	○	○	○	○
Morality: Clyde is capable of telling right from wrong and trying to do the right thing. (4)	○	○	○	○	○	○	○
Planning: Clyde is capable of making plans and working toward goals. (5)	○	○	○	○	○	○	○
Self Control: Clyde is capable of exercising self- restraint over desires, emotions, or impulses. (6)	○	○	○	○	○	○	○
Thought: Clyde is capable of thinking. (7)	○	○	○	○	○	○	○
Consciousness: Clyde is capable of having experiences and being aware of things. (8)	○	○	○	○	○	○	○

Desire: Clyde is capable of longing or hoping for things. (9)	○	○	○	○	○	○	○
Embarrassment: Clyde is capable of experiencing embarrassment. (10)	○	○	○	○	○	○	○
Fear: Clyde is capable of feeling afraid or fearful. (11)	○	○	○	○	○	○	○
Hunger: Clyde is capable of feeling hungry. (12)	○	○	○	○	○	○	○
Joy: Clyde is capable of experiencing joy. (13)	○	○	○	○	○	○	○
Pain: Clyde is capable of experiencing physical or emotional pain. (14)	○	○	○	○	○	○	○
Personality: Clyde is capable of having personality traits that make it unique from others. (15)	○	○	○	○	○	○	○
Pleasure: Clyde is capable of experiencing physical or emotional pleasure. (16)	○	○	○	○	○	○	○
Pride: Clyde is capable of experiencing pride. (17)	○	○	○	○	○	○	○
Rage: Clyde is capable of experiencing violent or uncontrolled anger. (18)	○	○	○	○	○	○	○

Positive and Negative Affect

Participants completed a measure of Positive and Negative Affect before and after gameplay

This scale consists of a number of words that describe different feelings and emotions. Read each item and then check the appropriate answer. Indicate to what extent **you feel this way right now, that is, at the present moment**. Use the following scale to record your answers.

	very slightly or not at all (1)	a little (2)	moderately (3)	quite a bit (4)	extremely (5)
Enthusiastic (1)	○	○	○	○	○
Interested (2)	○	○	○	○	○
Excited (3)	○	○	○	○	○
Inspired (4)	○	○	○	○	○
Happy (5)	○	○	○	○	○
Content (6)	○	○	○	○	○
Secure (7)	○	○	○	○	○
Hopeful (8)	○	○	○	○	○
Upset (9)	○	○	○	○	○
Distressed (10)	○	○	○	○	○
Anxious (11)	○	○	○	○	○
Irritable (12)	○	○	○	○	○
Hostile (13)	○	○	○	○	○

Lonely (14)	○	○	○	○	○
Stress (15)	○	○	○	○	○
Sad (16)	○	○	○	○	○