

The relationship between the number of photos on online dating profiles and perceived
attraction and attributional confidence

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Abstract

Despite the popularity of online dating and the importance of photos on dating profiles, little is known about the effect of number of profile photos on perceived attraction and the role of attributional confidence. A between-subjects experiment with 180 participants was conducted to examine perceived social and physical-romantic attraction and attributional confidence when presented with two dating profiles containing one, four, or seven profile photos. Moreover, it was examined whether attributional confidence (which refers to the degree that people experience certainty concerning their perception about someone) mediates the relationship between the number of profile photos and perceived attraction. Results show that attributional confidence enhanced perceived social and physical-romantic attraction. However, contrary to the expectations, it was not the number of photos that influenced attributional confidence. Together, these results indicate that it is not necessarily the number of photos that enhances attributional confidence and perceived attraction. The implications of these findings and recommendations for future research are provided.

Keywords: online dating, profile photo, self-presentation, impression formation, attributional confidence, attractiveness

Introduction

Online dating has become a popular tool for meeting new people, with 30% of American adults having used an online dating app or website in 2019 (Anderson et al., 2020). Online dating apps and websites “enable users to discover other people who may potentially help them meet their romantic goals such as long-term relationships or casual sexual encounters” (Zytka et al., 2016). Most online dating apps, such as Bumble, Hinge, and Tinder, ask users to set up a profile that includes one to a maximum of six or nine photos, some demographics such as name and age, and optionally a short profile text to present themselves (Lutz & Ranzini, 2017). Online daters form impressions about the profile owners based on their photos and textual cues and decide whether they are interested in getting to know them or not.

Photos play a prominent role in dating apps since most dating apps and websites are predominantly photo-based, and textual cues are (initially) usually less visible or even absent (Lutz & Ranzini, 2017). Some photo types that are commonly used on dating apps include selfies, informative photos portraying hobbies or lifestyles, and photos that look spontaneous and unposed (Degen & Kleeberg-Niepage, 2021). Photos on dating profiles usually attract attention earlier than textual cues (Van der Zanden et al., 2021) and play an important role in impression formation in online dating (e.g., Fiore et al., 2008; Stecher & Counts, 2008; Steele et al., 2009; Willis & Todorov, 2006). They make it possible to predict someone’s personality with only minimal information available and even when people have less than a second to form an impression (e.g., Stecher & Counts, 2008; Steele et al., 2009; Willis & Todorov, 2006). In turn, having an appealing photo increases the overall attractiveness of people’s online dating profiles (Fiore et al., 2008). Therefore, they are vital elements for self-presentation and impression formation in online dating.

Different contrasting theories can play a role in impression formation in computer-mediated communication (CMC), specifically the hyperpersonal model (Walther, 1996) and the Uncertainty Reduction Theory (URT; Berger & Calabrese, 1975). The hyperpersonal model suggests that asynchronous communication and the lack of cues in CMC make it possible for people to portray themselves more favorably, which can lead to people creating an idealized version of someone else. This would mean that having limited photos on an online dating profile could enhance people's impressions about others because they form a romanticized image of them. On the other hand, the URT (Berger & Calabrese, 1975) proposes that when a dating profile contains limited information, people are more likely to experience low levels of attributional confidence (i.e., the degree to which people experience certainty). This uncertainty can make people feel uncomfortable and, as a result, it might negatively impact their impressions about someone.

Even though social media and online dating have become popular communication tools on which photos play an important role in presenting oneself online (e.g., Lutz & Ranzini, 2017; Fiore et al., 2008; Stecher & Counts, 2008; Steele et al., 2009), there is currently little research on the number of visual cues in relation to impression formation and attributional confidence in CMC. Previous research (Baruh & Cemalcılar, 2018) has found that a higher breadth (i.e., the quantity and variety) of textual cues on social media profiles leads to higher levels of attributional confidence, which, in turn, leads to more interpersonal attraction. It can be assumed that a similar effect will occur in the case of online dating. Since attributional confidence is likely to be desired, considering that online daters may have the intention to meet face-to-face and want to avoid awkward encounters or deception. However, whether differences in the number of profile photos presented on one's profile will lead to attributional confidence and higher levels of perceived attraction is unclear, as it seems that this relationship has not been studied before.

To investigate whether the number of photos on online dating profiles influences perceived attraction and attributional confidence, this study aims to answer the following research question: *“What is the relation between the number of photos on an online dating profile and perceived attraction, and to what extent does attributional confidence mediate this effect?”*. To answer this research question, a between-subjects experiment will be conducted in which participants will see and evaluate dating profiles with either one, four, or seven photos and answer questions about their experienced level of attributional confidence and their perceptions regarding the profile owners social and physical-romantic attractiveness.

Theoretical framework

Impression formation

People form impressions about other people on a daily basis and can already do so after seeing a person’s face for one-tenth of a second (Willis & Todorov, 2006). Impression formation is “a process by which individuals perceive, organize and ultimately integrate information to form unified and coherent situated impressions of others” (Moore, 2015, p. 1). People judge others and assign personality traits, such as trustworthiness and competence, based on other people’s facial features (e.g., Olivola et al., 2014; Willis & Todorov, 2006). These judgments influence people’s decisions, behaviors, and future actions towards the other person (Olivola et al., 2014). This means that, for instance, these judgments can influence whether people vote for someone (Lenz & Lawson, 2011), whether someone gets employed (Rule & Ambady, 2008) or whether people have the intention to go on a date with someone (McGloin & Denes, 2016).

Even though there is little information on how photo quantity influences impression formation, other studies have focused on how differences in the number of cues in profile texts and conversations affect impression formation (e.g., Antheunis et al., 2007; Baruh & Cemalcılar, 2015; Baruh & Cemalcılar, 2018; Tidwell & Walther, 2002). Previous research

(e.g., Baruh & Cemalcılar, 2015; Baruh & Cemalcılar, 2018) has found that social media profiles that contained more textual cues increased their impressions about the profile owner. In terms of text-only two-way communication, for example, communication through social media, email, or other messaging apps, it has been found that exchanging more information benefits impressions about others (e.g., Tidwell & Walther, 2002; Antheunis et al., 2007). Generally, it seems that disclosing more textual information, whether it be on a profile or in conversations, seems to increase impressions.

In online dating, impression formation happens in an online environment in which people communicate with the use of technology, also known as computer-mediated communication (CMC). In the first stages of online dating, impression formation happens merely based on a dating profile curated by its profile owner, which usually contains photos and (possibly) textual cues (Lutz & Ranzini, 2017). Seeing a photo provides less information than seeing someone face-to-face because of the lack of nonverbal cues in static images. Nonverbal cues usually play an essential role in offline dating (McKenna & Bargh, 2000) since nonverbal cues such as facial expressions, body language, and intonation provide conversational partners with additional information that cannot be retrieved from a profile (DeLamater et al., 2014). This makes impression formation based on a profile different from impression formation in a face-to-face setting.

Photos are often prominent features on online dating profiles, which, together with textual cues, allow online daters to present themselves online. Most dating apps, such as Tinder, Bumble, and Hinge, give users the freedom to upload one to nine photos, but profile owners can decide the exact number of photos they want to include on their profile. Many of these popular online dating apps and websites are photo-based, meaning that photos usually cover more space on a profile and stand out more than textual cues (Lutz & Ranzini, 2017). Not only are profile photos notable features, research also shows that photos attract attention

earlier than textual cues when online daters look at other peoples' profiles cues (Van der Zanden et al., 2021).

Apart from the initial attention that photos receive on a dating profile, photos are also known to play an integral part in impression formation in online environments (e.g., Stecher & Counts, 2008; Steele et al., 2009; Willis & Todorov, 2006), including in the online dating setting (e.g., Fiore et al., 2008; Van der Zanden et al., 2021). Considering that people can already create an impression after seeing someone for less than a second (Willis & Todorov, 2006), it is essential for online daters that their photos leave a positive first impression. Profile photos help to predict someone's personality, even when only limited cues are available (Stecher & Counts, 2008; Steele et al., 2009; Willis & Todorov, 2006). Moreover, photos are usually influential cues to determine someone's attractiveness (e.g., Fiore et al., 2008; Van der Zanden et al., 2021). Especially since photos on dating profiles influence the overall attractiveness of someone's profile (Fiore et al., 2008), which is beneficial when one wants to attract others on such an app.

Hyperpersonal Model

Online daters usually depend on limited and self-selected information to form an impression about other online daters since profile owners get to carefully choose what photos and texts they want to disclose on their profile. As a result, profile owners can communicate an overly positive version of themselves. This effect can be attributed to the hyperpersonal model of interpersonal communication (Walther, 1996). According to this theory, communication channels that allow fewer cues and asynchronous communication, such as text-only compared to face-to-face interaction, give users more control over their communication which can benefit them in terms of a more favorable impression (Walther, 1996).

Studies show that text-based CMC can benefit impressions and relationships between people who have never met before, which is likely to be attributed to the hyperpersonal model (e.g., Ramirez & Zhang, 2007; Antheunis et al., 2020). A study by Ramirez and Zhang (2007) on modality switching in CMC and face-to-face communication found that people who collaborated solely online through textual communication experienced more social attraction (i.e., when someone is considered to be friendly and could potentially become a friend) and intimacy than people who met face-to-face or switched from one communication form to another. They also experienced more certainty, which can be attributed to people in CMC environments actively looking for information to decrease uncertainty and being more aware of whether they can benefit from a relationship with that person (Ramirez & Zhang, 2007).

Furthermore, in the online dating context, people experience more social attraction when communicating through text messages compared to video calls in the first stages of online dating, which is likely to be caused by the ideal conditions for self-presentation (Antheunis et al., 2020). When the daters meet face-to-face after their first interactions in a CMC environment, romantic attraction decreases, whereas social attraction remains the same. This decrease in romantic attraction can likely be attributed to the optimal settings for online daters to create a romanticized version of the profile owner because of the lack of physical cues (Antheunis et al., 2020). As a result, these expectations can often not be met when meeting face-to-face, leading to disappointment and lower perceived romantic attraction (Finkel et al., 2012). Likely, this effect was only found for physical attraction and not for social attraction since physical attraction often influences romantic attraction but not necessarily social attraction (e.g., Antheunis et al., 2020; Finkel et al., 2012).

Based on the previously discussed findings supporting the hyperpersonal model (Ramirez & Zhang, 2007; Antheunis et al., 2020), it might be expected that online daters who see a profile with only one photo are more likely to idealize someone and form a more

favorable impression than when they would see more photos, for example, four or seven. However, there are reasons to believe that the hyperpersonal model does not hold when it comes to forming first impressions based on dating profiles with one or more photos. First, in the case of forming impressions based on a dating profile, online daters form an impression based on one or more photos without any possibilities for interaction with the profile owner (one-way communication). In this case, it is likely that people would prefer to obtain more information about someone to form a good impression which is difficult since dating profiles often contain limited information.

In addition, physical attraction will likely play a more significant role when people are forming impressions based on a profile on which photos are prominent features, since perceptions of physical attractiveness are known to influence romantic attraction (e.g., Eastwick et al., 2011; Finkel et al., 2012). This is different from the situations in the studies by Ramirez and Zhang (2007) and Antheunis et al. (2020), who focus on impression formation based on conversations between two people (two-way communication) and differences in written text-only versus audio and visual cues such as face-to-face and video calling. Online daters probably prefer having more information than just one photo when they are forming a first impression, since limited information might cause uncertainty and people have an aversion to uncertainty (Berger & Calabrese, 1975). Uncertainty might cause uncomfortable feelings, especially, as is the case for online dating, when people might have the intention to meet face-to-face (Berger & Calabrese, 1975).

Attributional confidence

In the context of online dating (profiles), people may experience feelings of uncertainty because they feel that others do not always portray themselves accurately on their profiles (e.g., Ellison et al., 2006; Gibbs et al., 2006; Toma et al., 2008). For instance, profile owners sometimes use photos in which they look younger (e.g., Ellison et al., 2006; Whitty,

2008) or manipulate information on their profile such as weight, height, or age (e.g., Ellison et al., 2006; Toma et al., 2008). They do this to present themselves more favorably or because they want to look like a younger version of themselves again, for example, when they gained weight (Ellison et al., 2006). In other words, people try to present their ideal self instead of their authentic self. The selectively chosen content and lack of cues on an online dating profile can make online daters more cautious about interpreting information presented on these profiles.

People likely want to obtain more information about other online daters to form an accurate impression and feel more certain about their impressions, for instance, to avoid deception, awkward conversations, or rejection, especially when people intend to meet up face-to-face. Attributional confidence refers to the degree of certainty that people feel about their perception of somebody else, in this case, other profile owners (Clatterbuck, 1979). While attributional confidence is generally divided into retroactive (how actions that have already taken place can be explained) and proactive confidence (the predictability of someone's future actions; Clatterbuck, 1979), it is the latter that is of particular importance in the context of first impression formation based on the information provided on online dating profiles.

The degree to which people experience attributional confidence concerning their impressions about someone can play an important role in their perceptions about another online dater. Social networking profiles with a higher breadth of information (i.e., the number of various cues giving insights into the profile owner's personal details and interests) lead to participants experiencing more attributional confidence, which in turn enhances the profile owner's attractiveness (Baruh & Cemalcılar, 2018). In this case, attributional confidence plays a mediating role between breadth of information and interpersonal attraction (Baruh & Cemalcılar, 2018). People experience more certainty about their impression when they have

more information is available, which gives them a comfortable feeling and enhances impressions (Berger & Calabrese, 1975).

Uncertainty Reduction Theory

According to the Uncertainty Reduction Theory (URT; Berger & Calabrese, 1975), people are motivated to carefully examine the available information to understand someone's attitudes, beliefs, and behaviors to better understand this person and to reduce any feelings of uncertainty since uncertainty is considered to be an uncomfortable feeling. URT claims that it is beneficial when people experience attributional confidence, as this means that their uncertainty has been reduced, which may positively reflect in people's perceptions of someone (Berger & Calabrese, 1975). When people experience attributional confidence, it benefits their relationships with others, in this case, other online daters (Clatterbuck, 1979). Since online daters might be looking for a (romantic) relationship and might have the intention to meet up face-to-face and probably want to avoid deceptions and awkward situations, it is highly likely that uncertainty is perceived as uncomfortable. Therefore, it is likely that online daters want to reduce this feeling of uncertainty as much as possible and prefer to create an impression after seeing multiple photos of someone instead of one photo.

Based on the previously discussed literature, four hypotheses were constructed. The hypotheses are constructed for the contrast between one versus multiple (four and seven) photos (see Figure 1) and are as follows:

H1: When dating profiles contain four or seven photos, the scores for attributional confidence are higher than scores for dating profiles with only one photo.

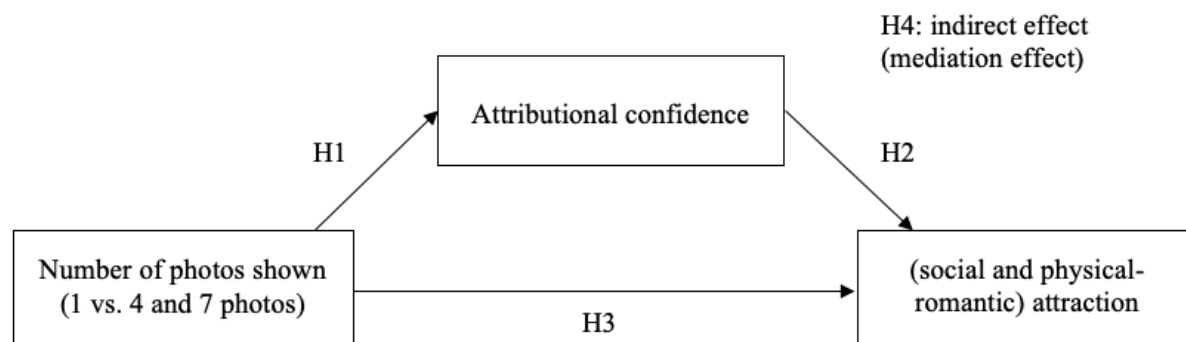
H2: Higher levels of attributional confidence will lead to higher levels of perceived social and physical-romantic attraction.

H3: When dating profiles contain four or seven photos, the scores for perceived social and physical-romantic attraction are higher than scores for dating profiles with only one photo.

H4: The relationship between the number of profile photos on perceived social and physical-romantic attraction is mediated by attributional confidence.

Figure 1

Conceptual Framework with Visualization of the Four Hypotheses



In addition to the hypotheses, an additional research question is formulated to explore the differences in perceived attraction scores and attributional confidence for profiles with four compared to seven profile photos. This research question is created to examine whether there is a saturation point of the number of photos people need to see to reduce uncertainty and experience attributional confidence. Based on existing literature, it is unclear whether more photos will continue to enhance perceived attraction and attributional confidence or that there is a point at which people feel that additional information does not affect their impressions and attributional confidence.

On the one hand, it could be expected that more information would lead to more positive evaluations of perceived attraction and attributional confidence compared to profiles with fewer photos. Profiles with more photos would provide people with more information about a profile owner, and therefore likely lead to more certainty. As previously discussed, studies on self-presentation and self-disclosure suggest that more textual cues benefits impression formation (e.g., Antheunis et al., 2007; Baruh & Cemalcılar, 2015; Baruh & Cemalcılar, 2018; Tidwell & Walther, 2002). This effect can be attributed to trust and attributional confidence, which give people a more secure and comfortable feeling. Therefore,

it is likely that similar effects will occur in the case of more photos on an online dating profile since this will provide people with more information.

On the other hand, there may be a point where people feel that the additional cues do not influence their impression anymore. Existing literature (Willis & Todorov, 2006; Ambady & Rosenthal, 1993) on how long participants were exposed to visual materials and its influence on impression formation have shown that looking at a material longer does not lead to more accurate impressions. More specifically, a study by Willis and Todorov (2006) shows that judgments about someone's character traits generally do not change when people look at a photo of someone's face for 500 milliseconds or 1000 milliseconds, although generally, confidence concerning their judgments improved (Willis & Todorov, 2006). In addition, similar results have been found for a study that looked at differences in impressions based on still images and video materials of varying lengths. Judgments did not change when people watched a video of two seconds, five seconds, or ten seconds (Ambady & Rosenthal, 1993). However, they also found that judgments were more accurate when participants saw a two-second video compared to a still image, which implies that judgments improved initially but that at some point, people were saturated in terms of the information obtained.

Since one of these two scenarios does not seem more likely than the other in the present study, this study proposes a second research question to investigate this difference: *“Do dating profiles with seven photos lead to more perceived attraction and attributional confidence than profiles with four photos, and in the case of a difference in attraction, does attributional confidence mediate this effect?”*

Method

Design

An experiment was conducted to examine the influence of number of photos on an online dating profile on perceived attraction and whether this relationship is mediated by

attributional confidence. The experiment had a between-subjects design, in which participants would randomly see either one, four, or seven photos of two male or two female profile owners (depending on their indicated sexual preference). The number of profile photos is thus the independent variable, attributional confidence the mediating variable, and perceived social attraction and physical-romantic attraction the dependent variables.

Materials

The photos were obtained through the researcher's network, considering this would allow more control over the type of photos and create genuine online dating profiles with authentic photos instead of stock photos. Two male and two female profile owners were recruited, who gave consent for their photos to be used for this study. However, it was taken into consideration that it would be unlikely that people in the researcher's network would know the profile owners since the participants would also be recruited from the personal network. The researcher considered the profile owners to be moderately attractive (neither highly attractive nor highly unattractive) and about equally attractive, to avoid that the profile owners' attractiveness would influence the results too heavily. Moreover, it was expected that participants considered the profile owners not to belong to strong stereotypical groups (e.g., gothics, skaters, or people covered in tattoos) but instead had a more neutral appearance.

A total of 28 photos were selected for the experimental stimuli, which were seven photos from each of the four profile owners. The photos featured on the profiles represented the three types of photos that generally occur most on dating apps, such as snapshots (photos in which it seems that the person was not aware that the photo would be taken), selfies, and posed informative photos in which the profile owners displayed their hobbies or lifestyle (Degen & Kleeberg-Niepage, 2021). All profiles included the same types of photos: two selfies, two snapshots, and three posed photos. It was attempted to give participants an impression about people's hobbies through the photos to provide participants with more

information about the profile owners. Photos with friends were not included, as the physical attractiveness of someone's friends is likely to influence the profile owner's perceived attractiveness (Walther et al., 2008) and because of privacy concerns. The profile owners gave consent for the use of their photos in the experiment and could select their own photos as long as these photos met the photo type requirements.

There were a few requirements for the first photo specifically to avoid that seeing an unclear photo would affect the results since one-third of the participants would only see one photo of the profile owners. The profile owner's body and face were clearly visible in the first photo to ensure that the participants in the 1-photo condition could also get a clear impression of how the profile owner looks. This also means that profile owners did not wear sunglasses or headgear that covered their faces in the first photo. In addition, their first photo was never a selfie but a photo taken by someone else, as selfies seem to be linked to more narcissistic traits (Krämer et al., 2017).

The order of the photos was presented as follows. The first photo of every profile owner was always a posed photo. The profiles shown to participants in the four-photo condition included the posed photo from the one-photo condition, a selfie, posed photo, and a snapshot. The seven-photo condition contained the same four photos with an additional selfie, posed photo, and snapshot. Participants who would see a profile with seven photos would see the first four photos in exactly the same order as those in the 4-photo condition (plus the three additional photos). However, the types of photos had a different order within these conditions between the two male or female profile owners to avoid that the order would become evident to participants when they saw the second profile. This means that the second, third, and fourth photo within the 4-photo condition would be in a different order compared to the order of the other profile that the participants would see, although the photo types remained the same within the condition.

The photos were incorporated in a frame that looks similar to the layout of the existing dating app Tinder. No textual cues were included on the profiles from this study to avoid that these textual cues would influence participants' impressions. However, not having a profile text does not necessarily impact a profile's authenticity since dating apps often first show someone's photos before showing a profile text, and not everyone includes such a text on their profile (Lutz & Ranzini, 2017). An example of this can be found in Figure 2.

Figure 2

Example of a Photo Incorporated in the Tinder Layout



Note. This example is not one of the profiles used for the main experiment, as the (fictive) profile owners did not give consent for their photos to be included in the paper.

Procedure

The participants were recruited from the researcher's network by contacting them directly and through friends, also known as convenience sampling. The participants received a link to a questionnaire in Qualtrics. They were first redirected to a page with general information about the survey. After reading this introduction, they were asked for their consent before starting the questionnaire. Although the profile owner's age was not specified

on the fictive profile, there was still an age limit for the participants to avoid participants judging someone much older or younger, as this could (negatively) affect perceived attraction. Since the profile owners were between 24 and 27, participants had to be 18 through 35 to participate in the study. This age limit was mentioned explicitly in the introduction of the survey. If participants indicated to be older or younger, they would be redirected to the end of the survey.

The first part of the questionnaire consisted of demographic questions and other general questions related to dating (behavior). The participants were asked about their gender, age, education level, nationality, whether they preferred men or women, their current relationship status, and whether they had experience with dating apps or websites. Then, they were randomly (but equally) assigned to one of the three conditions in which they saw two male or two female profiles based on their indicated sexual preference. If they indicated not to have a preference for either men or women, they were randomly assigned to either two male or two female profiles.

Participants would first see the profile photos before they could fill in the statements about the profile owner. Participants who were in a relationship were asked to imagine that they were single when viewing and evaluating the profiles. They could not go back to the photo(s), so their first impression would be measured, and they could not re-evaluate their impressions based on the statements. After looking at the photo(s), they received thirteen statements about the profile owner's (social and physical-romantic) attractiveness and attributional confidence (to what extent they felt confident about their impressions about this person after seeing their profile). First, the statements of the different attractiveness dimensions were presented in a mixed order, followed by the four items on attributional confidence. Before the end of the experiment, participants were asked to indicate whether

they knew one or both profile owners. If this was the case, they could click on the photo of the person(s) they knew. Finally, participants were debriefed and thanked for their time.

Participants

In total, 180 participants participated in this study, of which 83 (46.1%) identified as male and 97 (53.9%) as female. All participants were between 20 and 33 years old, with an average age of 25.62 ($SD = 2.25$). Concerning sexual preference, 92 participants (51.1%) indicated that they were most interested in men, 78 participants (40.3%) indicated to be most interested in women, and another 10 participants (5.6%) indicated not to have a preference for either men or women. When asked about their current relationship status, 111 participants indicated to be in a relationship (of which three were married, and two had a registered partnership), 60 were single, and nine were dating someone seriously without being in an official relationship or were in an open relationship.

Measures

Participants answered a total of thirteen statements per participant, containing items that measured social attraction, physical attraction, romantic attraction, and attributional confidence. Participants indicated to what extent they agreed with the statements on a 7-point Likert scale ($1 = \text{strongly disagree}$, $7 = \text{strongly agree}$).

Attractiveness

Social attraction was measured based on statements from McCroskey and McCain's (1974) measurement of interpersonal attraction, which measures whether someone thinks that another person is friendly and could become a friend. An example of such a statement is: "This person would fit into my circle of friends." Physical attraction was also measured based on McCroskey and McCain's (1974) measurement of interpersonal attraction and focuses on the physical aspects of one's appearance and whether someone is good-looking. An example statement measuring physical attraction would be "I think this person is physically attractive."

In addition, statements from Campbell (1999) were used to measure romantic attraction, which measures whether someone would be interested in going on a date and being romantically involved with someone. An example statement of romantic attraction is “I would like to go on a date with this person.”

Attributional confidence

Attributional confidence was measured to see how confident people felt with regard to their impressions about the profile owner after seeing their photo(s). Attributional confidence was measured based on four items from Antheunis et al. (2010), although they were rephrased to suit the context better. Most of these items were derived from the CL7 Attributional Confidence Scale of Clatterbuck (1979), which is commonly used in other studies related to impression forming (e.g., Baruh and Cemalcılar, 2018; Sharabi & Caughlin, 2017; Tidwell & Walther, 2002). An example of such a statement is: “I am confident about my general ability to predict how this person will behave.” Even though Antheunis et al. (2010) use a 5-point scale, this study used a 7-point Likert scale so participants have more nuanced options to choose from (Dawes, 2008; Finstad, 2010) and the answer options are in line with the other statements measuring perceived attraction. An overview of the statements can be found in Appendix A.

Analyses

Factor analysis

Before interpreting the results of the factor analysis, it was checked whether the factor analysis was an appropriate technique for clustering the data. Bartlett’s test of Sphericity was significant ($p < .001$), indicating that the variables in the dataset are indeed related. Moreover, with a value of .84, KMO’s measure for sampling adequacy was well above the 0.5 minimum value, which means that a substantial proportion of the variance can be accounted for by the factors, and the factor structure could be interpreted.

The factor structure was assessed by performing a principal component analysis with Varimax rotation. The analysis revealed three factors that together explained 68.22% of the variance and partially matched the predetermined factor structure. The three items that were supposed to measure social attraction clustered together well and had good reliability, Cronbach's $\alpha = .77$ ($M = 4.79$; $SD = 1.07$). However, the items that were expected to be related to romantic attraction seemed to cluster together with the items measuring physical attraction (Cronbach's $\alpha = .89$; $M = 3.93$, $SD = 1.24$). This can likely be explained by the influence that physical attraction has on romantic attraction, since people are often more romantically interested in someone when they consider the other person to be physically attractive (Eastwick et al., 2011; Finkel et al., 2012). Hence one's personal evaluation of romantic and physical attraction can be seen as similar and, therefore, were combined to resemble one construct. Lastly, the set of four questions that were supposed to measure attributional confidence clustered together well (Cronbach's $\alpha = .83$; $M = 3.97$, $SD = 1.11$) and could thus also be considered as one factor. The specific factor loadings can be found in Appendix B.

Statistical analysis

Before conducting the analysis, the dataset was restructured so that both profile observations from one participant would be individual cases in the dataset. This means that, in total, there were initially 360 data points from 180 participants. However, seven cases were eventually removed from the dataset, because the participant indicated to know one of the profile owners ($n = 3$), did not fill in four or more attraction and attributional confidence statements ($n = 2$), or showed straight-lining behavior since they answered all 13 statements using the same answer option ($n = 2$). After cleaning the data, a total of 353 data points remained.

Before conducting the mediation analysis to test the hypotheses, assumptions were tested¹ and multicategorical mediation analyses using a Helmert contrast were conducted using the PROCESS model v4.0 by Andrew F. Hayes (Hayes, 2017; model 4), with a bootstrapping approach of 10,000 samples with 95% bias-corrected bootstrapped confidence intervals and participant ID as a covariate. By doing so, the two different contrasts (Contrast 1: one versus four and seven profile photos and contrast 2: four versus seven profile photos) of this study could be tested.

Results

Explorative analyses

Before conducting the multicategorical mediation analyses, a multivariate ANOVA analysis was conducted using Helmert contrast, which showed that there were no significant main effects of photo number condition on social attraction, $F(2, 350) = 1.61, p = .201$, physical-romantic attraction, $F(2, 350) = 1.02, p = .363$, and attributional confidence, $F(2, 350) = 1.69, p = .187$. This indicates that people did not differ in their social attraction, physical-romantic attraction, and attributional confidence scores depending on how many photos they saw on a dating profile. The mean scores for the mediator and dependent variables for all three conditions can be found in Table 1 below.

¹ The assumptions were all met for the mediation analyses. Details can be found in Appendix C.

Table 1*Mean Scores and Standard Deviations per Photo Condition*

Variables	1 photo (<i>n</i> = 118)		4 photos (<i>n</i> = 119)		7 photos (<i>n</i> = 116)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Social attraction	4.67	1.11	4.78	1.09	4.92	1.00
Physical-romantic attraction	3.80	1.25	4.00	1.18	4.00	1.30
Attributional confidence	3.85	1.16	4.11	1.05	3.94	1.11

Note. Social attractiveness, physical-romantic attractiveness, and attributional confidence were measured on a 7-point Likert scale (*1 = strongly disagree, 7 = strongly agree*)

Mediation analyses

Mediation analyses were performed using the PROCESS 4.0 model by Andrew F. Hayes, to investigate whether there is a relationship between the number of profile photos (one, four, or seven photos), perceptions of social and physical-romantic attraction, and to whether these attractiveness perceptions are mediated by attributional confidence. A multicategorical mediation analysis with Helmert contrast was used to test the two different contrasts for both perceived social and physical-romantic attraction. The first contrast, to test online dating profiles with one photo against four and seven photos, was used to answer the hypotheses. The second contrast was used to answer the additional research question to investigate (potential) differences between online dating profiles with four versus seven photos.

Participant ID was added as a covariate to control for the fact that there were two cases per participant and that the data was not completely independent². The analyses showed that different participants gave similar scores to attributional confidence, $b = .002$, $t(349) = 1.89$, $p = .060$, 95% BCa CI [- 0.0001, 0.004], and social attraction, $b = - 0.001$, $t(348) = 2.65$, $p = .004$, 95% BCa CI [- 0.003, 0.002]. However, they differed to some extent in their physical-romantic attraction scores, $b = - 0.005$, $t(348) = - 3.72$, $p < .001$, 95% BCa CI [- 0.007, - 0.002].

The first hypothesis (H1) stated that when an online dating profile contains multiple (four or seven) photos, it would lead to higher attributional confidence scores than a dating profile with only one photo. Results show that having four ($M = 4.11$, $SD = 1.05$) or seven ($M = 3.94$, $SD = 1.11$) profile photos does not lead to higher scores on attributional confidence compared to a profile with one photo ($M = 3.85$, $SD = 1.16$), $b = 0.18$, $t(349) = 1.48$, $p = .141$, 95% BCa CI [- 0.06, 0.43]. This means the results do not support H1. Moreover, there was also no significant difference in attributional confidence scores between four and seven photos, $b = - 0.18$, $t(349) = -1.23$, $p = .218$, 95% BCa CI [- 0.46, 0.11].

The second hypothesis (H2) posed that when people would experience higher levels of attributional confidence, this would lead to higher scores on perceived attraction. Results indicate that there is indeed a significant positive effect between attributional confidence and perceived social attraction, $b = 0.14$, $t(348) = 2.65$, $p = .008$, 95% BCa CI [0.04, 0.24], and physical-romantic attraction, $b = 0.14$, $t(348) = 2.33$, $p = .021$, 95% BCa CI [0.02, 0.25]. For both variables, this means that when attributional scores go up by one point, perceived social

² The analyses without participant ID as a covariate revealed that attributional confidence did then not predict perceived physical-romantic attraction, although the p-value was close to the threshold value, $b = .11$, $t(349) = 1.93$, $p = .055$, 95% BCa CI [- 0.002, 0.23]. Other than that, there were no considerable differences found compared to the mediation analyses with participant ID as a covariate. Therefore, I report the results the results with participant ID as a covariate.

attraction and physical-romantic attraction scores go up by 0.14 point (on a 7-point scale).

Therefore, H2 is supported.

The third hypothesis (H3) stated that seeing an online dating profile with four and seven photos would lead to higher attraction scores than seeing a profile with one photo. Results show no significant difference between perceived social attraction scores for online dating profiles with one photo ($M = 4.67$, $SD = 1.11$) compared to profiles with four ($M = 4.78$, $SD = 1.09$) and seven photos ($M = 4.92$, $SD = 1.00$), $b = 0.16$, $t(348) = 1.30$, $p = .195$, 95% BCa CI [- 0.08, 0.39]. Results for perceived physical-romantic attraction also reveal similar scores for profiles with one photo ($M = 3.80$, $SD = 1.25$) compared to those with four ($M = 4.00$, $SD = 1.18$) and seven photos ($M = 4.00$, $SD = 1.30$), $b = 0.15$, $t(348) = 1.08$, $p = .283$, 95% BCa CI [- 0.12, 0.42]. Thus, H3 is rejected. Furthermore, there is no significant effect on perceived social and physical-romantic attraction between four versus seven photos (social attraction: $b = 0.16$, $t(348) = 1.15$, $p = .249$, 95% BCa CI [-0.11, 0.43]; physical-romantic attraction scores: $b = 0.04$, $t(348) = 0.23$, $p = .822$, 95% BCa CI [-0.28, 0.35]).

Hypothesis 4 posed that the relationship between the number of profile photos and perceived attraction would be mediated by attributional confidence. As expected, based on the presented findings, results show that attributional confidence did not mediate the relationship for perceived social attraction in the case of profiles with four and seven photos compared to profiles with one photo, $b = 0.03$, $SE = 0.02$, 95% BCa CI [-0.01, 0.08]. Similarly, attributional confidence did not mediate the relationship for perceived physical-romantic attraction for the contrast between one photo and four and seven profile photos, $b = 0.03$, $SE = 0.02$, 95% BCa CI [-0.09, 0.08]. Therefore, the data do not support hypothesis 4.

Furthermore, there was no significant mediation effect for perceived social attraction in the case of four compared to seven photos, $b = - 0.02$, $SE = 0.02$, 95% BCa CI [-0.08, 0.01], nor for perceived physical-romantic attractiveness, $b = - 0.02$, $SE = 0.02$, 95% BCa CI

[-0.08, 0.01]. In all, this shows that attributional confidence did not mediate the relationship between the number of profile photos on an online dating app and perceived attraction scores, more specifically social and physical-romantic attraction.

In conclusion, only one hypothesis (out of four hypotheses) was confirmed since only hypothesis 2 was supported by the results. The results for the first contrast (one vs. four and seven photos) can be found in Figure 3. Results also show that there are no differences in attributional confidence and perceived social and physical-romantic attraction scores when comparing profiles with four and seven photos (see Figure 4).

Figure 3

Summary of the Outcomes for the Social Attraction and Physical-Romantic Attraction Scores for Contrast 1 (1 vs. 4 & 7 Profile Photos)

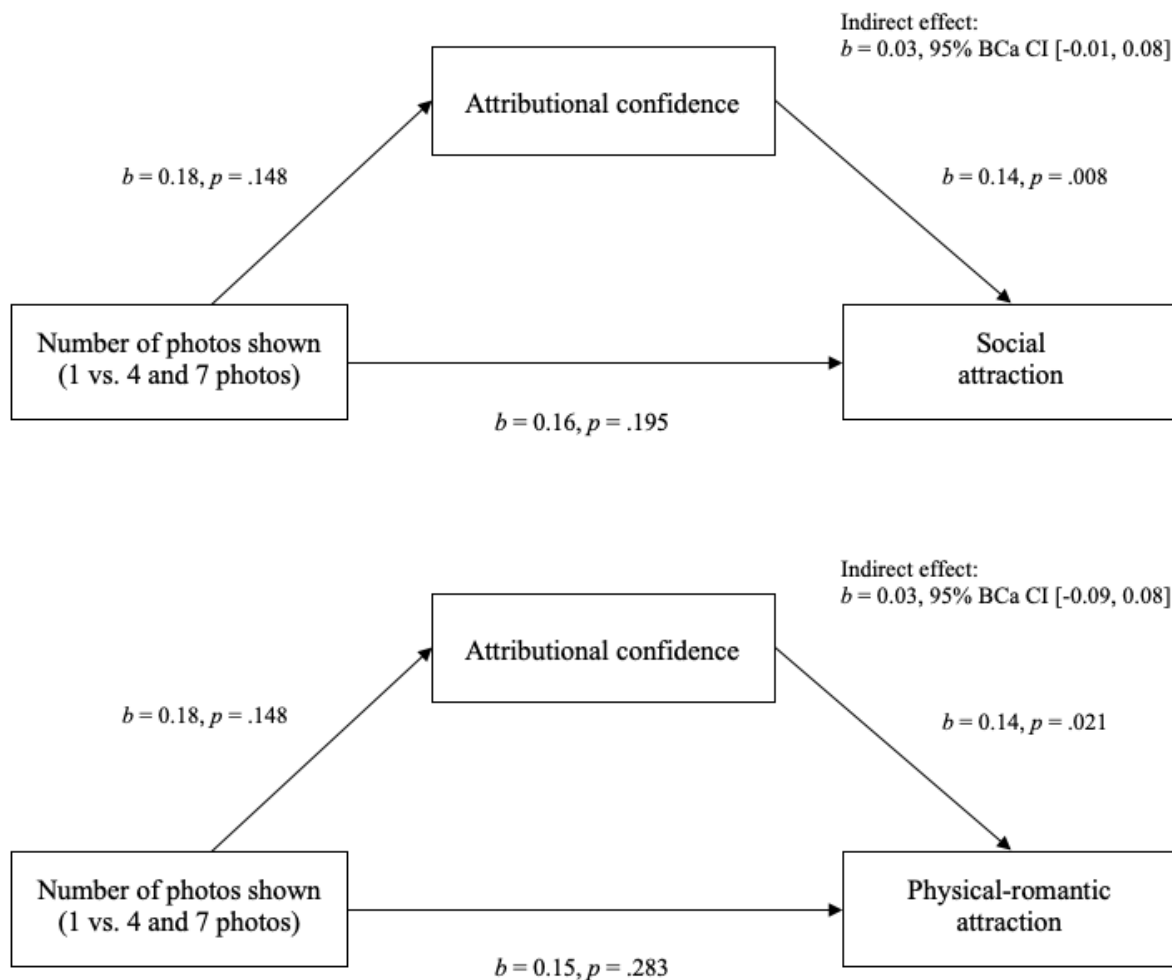
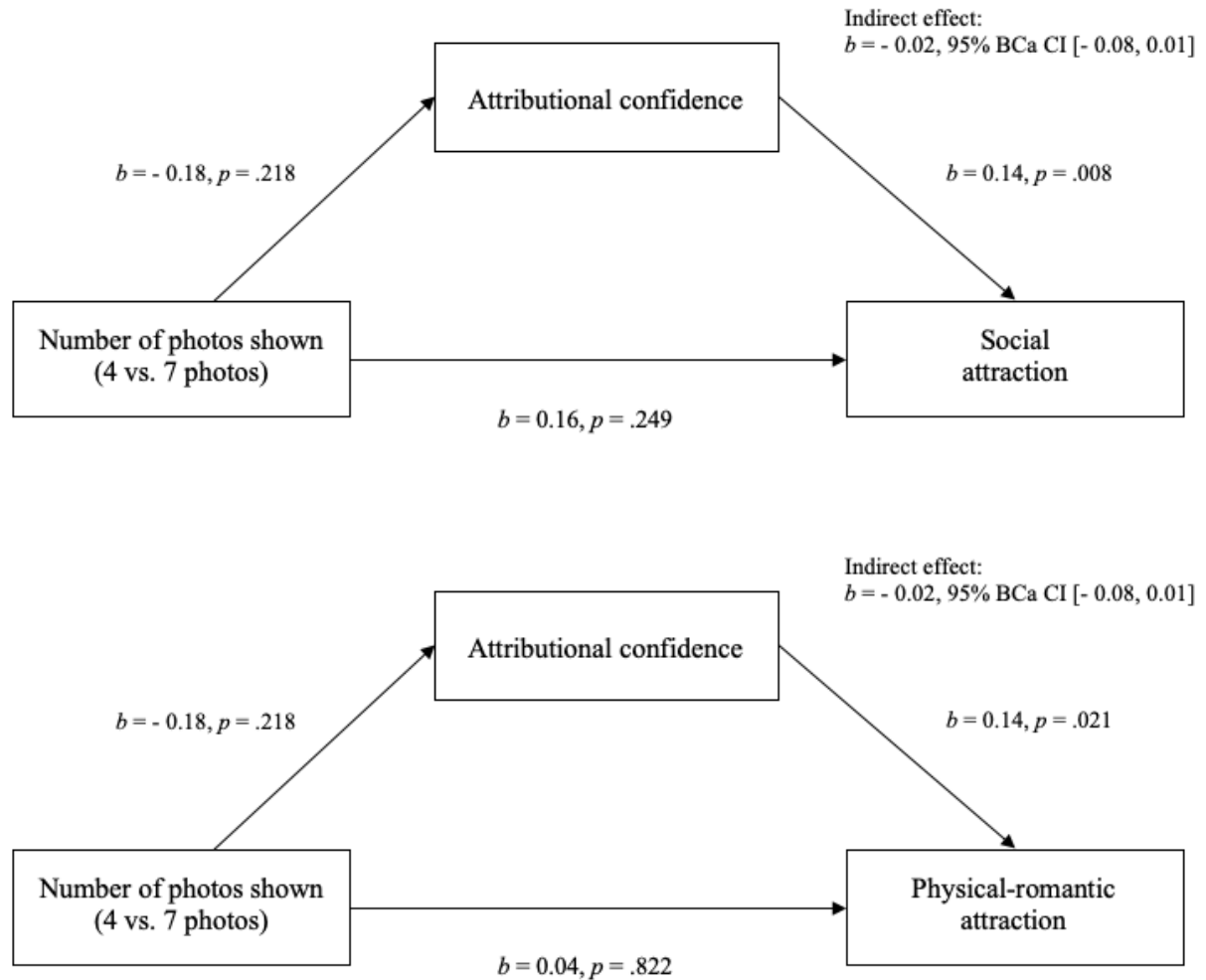


Figure 4

Summary of the Outcomes for the Social Attraction and Physical-Romantic Attraction Scores for Contrast 2 (4 vs. 7 Profile Photos)



Additional exploratory analyses

In order to assess whether the two profile owners with the same gender were evaluated differently on physical attraction, a one-way ANOVA was performed with physical attraction as the dependent variable. Physical attraction was analyzed separately from the other attraction variables because physical attraction is often a predictor of romantic attraction and may also influence perceptions of social attraction (Dion et al., 1972; Eastwick et al., 2011; Finkel et al., 2012). Findings show that there were differences between both male profile owners and both female profile owners. More specifically, male profile owner 1 ($M = 4.77$,

$SD = 1.22$) was perceived to be more physically attractive than male profile owner 2 ($M = 3.78$, $SD = 1.34$), $F(1, 191) = 28.93$, $p < .001$, $\eta_p^2 = .13$. Findings also showed significant main effects for the differences between both females, with higher scores for female profile owner 2 ($M = 5.67$, $SD = 0.68$) than female profile owner 1 ($M = 4.30$, $SD = 1.30$), $F(1, 158) = 70.42$, $p < .001$, $\eta_p^2 = .31$. These results indicate that (without taking the different conditions into account) one of the profile owners was generally perceived to be more physically attractive than the other profile owner of the same gender.³

Discussion

General discussion

This study aimed to investigate the relationship between the number of photos on online dating profiles and perceived (social and physical-romantic) attraction and the mediating role of attributional confidence. These relationships were investigated for one photo versus multiple (four or seven) photos as well four versus seven photos.

Inconsistent with the hypotheses, results revealed no significant direct effects between the number of profile photos and attributional confidence (H1) and the number of photos and

³ An additional multivariate ANOVA was conducted to see whether there was an interaction effect between the photo conditions and male and female profiles, which was only the case for romantic attraction, $F(2, 347) = 4.66$, $p = .010$, $\eta_p^2 = .03$. No interaction effects were found for the other three variables (with all F 's < 0.86 and p 's $> .426$). For profiles containing one photo, the average perceptions of romantic attraction did not differ for the male ($M = 3.18$, $SD = 0.16$) and female profiles ($M = 3.12$, $SD = 0.18$), $F(1, 347) = .07$, $p = .786$, $\eta_p^2 = .00$, nor were there any differences between romantic attraction scores for the male ($SD = 3.06$, $M = 0.16$) and female profiles ($SD = 3.48$, $M = 0.18$) in the case of four photos, $F(1, 347) = 2.99$, $p = .085$, $\eta_p^2 = .01$. Results show that romantic attraction scores for male profiles and female profiles did differ when they contained seven photos. More specifically, when female profiles ($M = 3.93$, $SD = 0.18$) were seen by participants they received higher scores on romantic attraction than the male profiles ($M = 2.94$, $SD = 0.17$), $F(1, 347) = 16.29$, $p < .001$, $\eta_p^2 = .05$.

perceived social and physical-romantic attraction (H3). Thus, these findings suggest that the number of profile photos does not influence attributional confidence nor (directly) influence perceived attraction scores. These findings are not in line with URT (Berger & Calabrese, 1975), which suggests that having more cues would lead to higher levels of attributional confidence and perceived attraction.

Even though the data did not confirm H1 and H3, results revealed that attributional confidence positively influences perceived social attraction and physical-romantic attraction scores, consistent with H2. These findings are in line with URT (Berger & Calabrese, 1975) and previous studies on attributional confidence in relation to impression formation (e.g., Baruh & Cemalcı, 2015; Baruh & Cemalcı, 2018) that found that when people experience attributional confidence, this also enhances their impressions about a profile owner. It is likely that when people experience attributional confidence, they can (somewhat) understand and predict someone's attitudes and behaviors, which can give them a comfortable feeling. This comfort positively benefits people's impressions, in this case, perceived attraction.

Not surprisingly, given the insignificant results of the number of photos on attributional confidence and perceived social and physical-romantic attraction, attributional confidence did not mediate the relationship between the number of photos and perceived attraction. Therefore, this finding is inconsistent with H4. While attributional confidence was found to positively influence perceived social and physical-romantic attraction, this effect does not seem to be caused by the number of profile photos. This finding is inconsistent with URT (Berger & Calabrese, 1975) and previous findings by Baruh and Cemalcı (2018), who found that social media profiles with more textual cues positively influence levels of attributional confidence, with higher perceptions of attraction as a result.

Implications

Theoretical implications

This study has several theoretical implications. First, this study adds to the existing literature on the hyperpersonal model (Walther, 1996) and URT (Berger & Calabrese, 1975), as results showed that the number of photos does not impact perceived social and physical-romantic attraction. Whereas other studies on impression formation in CMC found that fewer cues enhance impression formation (supporting the hyperpersonal model; e.g., Antheunis et al., 2020; Ramirez & Zhang, 2007) or that more cues benefit attributional confidence and enhance impression formation (supporting URT; e.g., Baruh & Cemalcılar, 2015 Baruh & Cemalcılar, 2018), this study implies that the number of photos did not have a significant impact on perceived attraction or attributional confidence. Thus, the number of cues does not always affect impression formation.

Second, this study found that attributional confidence enhanced perceived social and physical-romantic attraction, although, surprisingly, it was not the number of profile photos that caused attributional confidence. Results suggest that something other than the number of profile photos affects attributional confidence. This finding adds to the literature on attributional confidence in the context of initial impression formation. What sets this study apart from previous studies on attributional confidence is that this study focused on the number of photos instead of the number of textual cues (e.g., Baruh & Cemalcılar, 2015 Baruh & Cemalcılar, 2018). The question raised by this study is whether there are differences with regard to photos (visual cues) and textual cues, such as profile texts or demographics presented on profiles, and how they affect attributional confidence. Future research might explore these differences, for which a suggestion will be made later in this chapter.

Furthermore, the findings of this study add to the existing literature about first impressions and attributional confidence in one-way communication, in which one person

presents information to others. Many studies on impression formation focus on conversations, in which case it is possible to incorporate different uncertainty reduction strategies, such as asking questions (e.g., Antheunis et al., 2010) or looking up information online (e.g., Carr & Walther, 2014). This is fundamentally different from the present study on first impressions, in which people have to rely on the given (visual) cues and cannot contact someone or obtain extra information from the Internet.

Practical implications

This study also yields practical implications. The layout of most dating apps and websites is designed to initially show only one photo of someone. Based on this photo, users have to decide whether they want to click on that profile and see or read more about them or that they continue browsing the app or website to see other people. Findings imply that this design choice makes sense, as it does not seem to negatively impact impression formation on online dating apps. In addition, these results also suggest that online daters do not necessarily have to adhere to a certain number of profile photos to enhance attractiveness, since results seem to indicate that there is no ideal number of profile photos to improve attractiveness or attributional confidence.

Moreover, online daters can benefit from giving other online daters the impression that they can predict the profile owners' attitudes, behaviors, values, and emotions to enhance perceived attraction. In other words, profile owners could incorporate visual cues to give other online daters the impression that they can somewhat predict their attitudes and behaviors. They can try to do this, for example, by clearly incorporating hobbies or lifestyles that represent their attitudes, behaviors, and values, so other online daters get the feeling that they can somewhat predict these. Therefore, it could be beneficial to keep this in mind when making a selection of photos for a dating profile.

Limitations and suggestions for future research

Even though this study aimed to recruit profile owners that were equally (physically) attractive, the additional exploratory analysis showed significant differences between the physical attractiveness of the two male and two female profile owners. Nonetheless, these attraction scores did not reach extreme values, it still means that some of the profile owners were considered to be more physically attractive than others. Therefore, a suggestion for future research would be to do a pre-test to measure the attractiveness of the profile owners. Even though it can be challenging to find profile owners who are perceived to be equally attractive, doing a pre-test might help to find profile owners that score similarly on perceived physical attraction. This could avoid that differences in attractiveness influence the effects since physical attractiveness can positively influence judgments and often increases romantic attraction (Dion et al., 1972; Eastwick et al., 2011; Finkel et al., 2012).

While it was a well-considered choice to expose the participants of this study to profiles with the same number of photos to avoid that they would become aware of the manipulation, it could have made participants unaware of how differences in the number of profile photos influence their impressions and how much certainty they experience in this regard. Future research could conduct a similar study but with a within-subjects design, so the participants are exposed to multiple profiles containing various numbers of photos. Being aware of these differences might also make participants more aware of how much information they can obtain from a profile, depending on the number of photos. This awareness might give participants a preference for a certain number of photos, as they experienced how the number of photos affects their impressions and attributional confidence.

To investigate the potential interplay of quality and quantity of profile photos on attributional confidence and impression formation, future research could also examine whether (different) effects occur when manipulating the number and the quality of the photos.

Previous studies on photos and first impression formation in CMC (e.g., Van der Zanden et al., 2020; Van der Zanden et al., 2021; Wang et al., 2010) looked at the quality of the photos, such as the attractiveness of the profile owners. These studies found that the attractiveness of the profile owner impacted their impressions about them (e.g., Van der Zanden et al., 2020; Van der Zanden et al., 2021; Wang et al., 2010). As this study shows no effects of the number of profile photos on attributional confidence and perceived attraction, it seems that the number of photos on dating profiles does not necessarily impact impression formation. As such, the quality of photos possibly plays a more important role than the quantity. Future research could investigate whether results are different when manipulating the number of photos (e.g., one, four, and seven photos) and the quality (e.g., unattractive, moderately attractive, and highly attractive).

A final suggestion for future research would be to examine whether different effects occur for impression formation and attributional confidence when participants are presented with visual and textual cues. To do so, one could construct a study with a 3x2 design in which differences in impression formation and attributional confidence are measured based on the number of photos (e.g., a profile with one, four, or seven photos) and the number of textual cues on a profile (e.g., profile texts containing little, an average amount, or a lot of information about the profile owner). If these are constructed in such a way that the number and content of the cues from the photos match those of the cues in the profile texts, it could be possible to see if the effects on impression formation and attributional confidence differ between visual and textual cues.

Conclusion

This study investigated whether the number of photos on an online dating profile (one, four, or seven) influences perceived social and physical-romantic attraction and whether attributional confidence plays a mediating role. Results suggest that the number of profile

photos does not influence attributional confidence and perceived attraction. While higher attributional confidence scores enhance perceptions of social and physical-romantic attraction, it is not the number of profile photos that affects attributional confidence. This shows that profiles with more photos do not necessarily lead to more certainty and perceived attraction and that future research is needed to examine whether the quality and the quantity of cues have different effects on impression formation and attributional confidence.

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Appendix A

Overview of statements

Table A1

Statements Measuring Social Attraction

Statement
1. I think this person would be pleasant to get along with.
2. I think that this person could be a friend of mine.
3. I think this person would fit well in my circle of friends.

Table A2

Statements Measuring Physical Attraction

Statement
1. I think this person is good looking.
2. I think this person is physically attractive.
3. I like the way this person looks.

Table A3

Statements Measuring Romantic Attraction

Statement
1. I do not see myself in a relationship with this person.*
2. I feel romantically attracted to this person.
3. I would like to go on a date with this person.

Note. * This statement was later recoded.

Table A4*Statements Measuring Attributional Confidence*

Statement
1. I am confident about my general ability to predict how this person will behave.
2. I have the feeling that I can predict what this person finds important.
3. I have the feeling that I can predict this person's attitudes.
4. I have the feeling that I can predict this person's feelings and emotions.

Appendix B

Factor loadings factor analysis

Overview of Factor Loadings of the Rotated Component Matrix with Varimax Rotation

Variable	Factor 1: physical- romantic attraction*	Factor 2: attributional confidence	Factor 3: social attraction
Social_pleasant			.78
Social_friend			.86
Social_circle_of_friends			.73
Physical_good_looking	.81		.34
Physical_physically_attractive	.84		
Physical_looks	.71		.48
Romantic_relationship	.67		
Romantic_attracted	.83		
Romantic_date	.81		
AttrConf_behave		.75	
AttrConf_important		.83	
AttrConf_attitudes		.86	
AttrConf_emotions		.80	

Note. Only factor loadings > .25 are included in the table; loadings higher than .50 have been

boldfaced. * renamed after factor analysis

Appendix C

Assumptions

The correlations seem good for both dependent variables. For social attraction, the correlations between the IVs are low ($r < .14$), so there is no concern for multicollinearity based on correlations. There also do not seem to be any concerns for the means or standard deviations, as there are no ceiling or floor effects. There are also no very large SDs nor is there very little variation. Concerning physical-romantic attraction, the correlations are again low between the IVs ($r < .11$). For physical-romantic attraction, there does seem to be any concerns for the mean and standard deviation, as there is no ceiling or floor effect. There is also no very large SD.

The Durbin-Watson value is 2.2 for social attraction, and 2.25 in the case of physical-romantic attraction. Both values are close to 2 and this indicates that errors are uncorrelated.

The indicators of multicollinearity did not show concerning values for both dependent variables as the values were the same; all VIFS were smaller than 1.01, with an average VIF = 1.00, and Tolerance = 1.00.

There were 14 cases with standardized residuals larger than 2 for social attraction, and there were only 4 standardized residuals larger than 3, which is no great cause for concern. For physical-romantic attraction there were 11 cases with standardized residuals larger than 2, and no standardized residuals larger than 3. Therefore, there is no cause for concern.

The histogram and normal P-P plots show that the data is normally distributed for both dependent variables, although the data for physical-romantic attraction is more negatively skewed. Moreover, the inspection of standardized residuals and predicted scores in the regression plots did not indicate heteroscedasticity or non-linearity for either dependent variable.

The potential influential cases for both variables are as follows. The largest Cook's distance was 0.08 for social attraction, and 0.04 for physical-romantic attraction, which is no cause for concern. The largest leverage value and Mahalanobis distance were the same for both dependent variables. The largest leverage value was 0.024, which is also no cause for concern. With regard to Mahalanobis distance, there were five cases with cause for concern for both variables since these cases crossed the critical value of 5.99. However, these cases did not have concerning Cook's distance or leverage values.

In conclusion, this means that all assumptions were met.