



The Influence of Interaction Design on Relation Making: A Scoping Review

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Abstract. Dating applications and dating sites are designed interventions that can change behaviour and influence user wellbeing. However, research from the design perspective around relation-making interventions is still scarce. This paper presents findings of a scoping review that aimed to collect current published knowledge on the influence of online communication on user behaviour, to understand its implications for relation-making. The study gathered findings from across disciplines to provide a holistic understanding of the various influences that online environment and interactions can have on user behaviour. Keyword combinations were run through five databases with a priori criteria and produced 1651 results published from the date range of 2016 to 2020. From the results, 717 abstracts were screened, and 82 papers were selected for full screening, out of which 46 were included for thematic analysis. The findings of the review show how interaction design and the online environment can influence user behaviour and thus impact how users form relationships. This scoping review is an initial study to provide an overview in a currently under-researched area. Its contribution is in presenting the needs and opportunities for future research and summarises the practical implications for interaction design that nurtures relationships.

Keywords: Online communication · Romantic relationships · User experience

1 Introduction

Today, there are more than 1500 dating applications that allow people to connect with a single swipe [1]. Dating platforms are replacing the traditional forms of meeting one's partner, such as through friends, family, work, or church [2–6]. However, there is a concern about the behaviours encouraged and created through these digital forms of interactions in relation to user wellbeing. In recent times, there have been reports of antisocial behaviour such as bullying, harassment, and racism experienced in the online environment [7–9]. The features of online environments have, furthermore, enabled creation of new forms of behaviour that are becoming a common feature of an online experience, yet are abusive and can cause distress [8, 11–13]. Haynes [10] describes some of these behaviours as following: *slow fading* – in which someone becomes less and less available for the other; *breadcrumbing* – receiving little and random attention; *haunting* – stalking with the help of social media; *catfishing* – purposefully misrepresenting oneself

when communicating with others; and *ghosting* – the act of sudden disappearance of a potential partner. Since the development of dating sites and applications (apps), research has found an increase in depression and lowering of one's self-image, especially with extended usage [14–17]. Experts worry about the long-term effect of usage of dating applications and sites, even more as they change the entry to relationships and disable users' ability to practice the interactions that are required for long-term relationships, such as practicing intimacy, vulnerability, conflict or reconciliation [18–22].

Finkel and colleagues [23] stated that dating interventions are capable of changing user behaviour. As it is not clear what causes changes in behaviour and to what extent the design of the digital interaction influences behaviour, which is an imperative to explore. So far, there is a lack of published studies on the impacts of the design of computer-mediated communication (CMC) on relationship outcomes, nor specifically on relationship initiation. With the great usage of online communication and dating platforms [6], there is a need for a more focused analysis of the user experience and specifically the design features and their impact on behaviour and well-being [24]. Figure 1 visualises some of these elements that were identified through previous exploratory studies with the aim to understand the experience of users within online platforms and the influence of interaction design on behaviour.

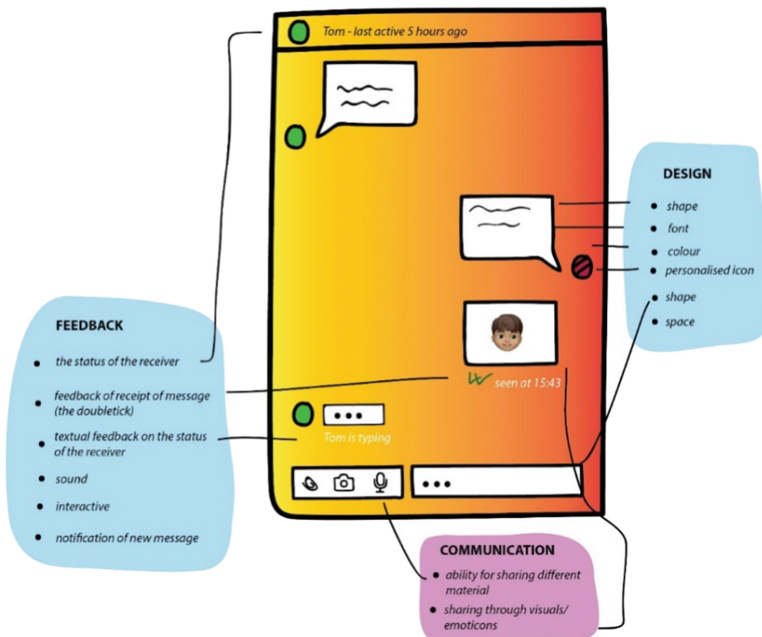


Fig. 1. The aspects of interaction design (feedback, communication, and design features) that are aimed to be investigated to understand the influence on behaviour (authors visual)

To address the gap in knowledge, this scoping review aims to provide an overview of current knowledge on the influence of design features of online communication on human

behaviour, and further translate these behaviours to relationship initiation in the online environment. These findings will not only help in understanding the role that design plays in relationship making but also how design can positively influence the wellbeing of users. Relationships greatly influence one's health and overall wellbeing. There is a clear connection of one's stable relationships with disease recovery, disease development, longevity of life, and overall happiness [23, 25–29]. Therefore, understanding the way dating applications are constructed is not only important for the romantic outcome of users but also to their overall health and wellbeing.

2 Method

A scoping review, also known as 'mapping' [30–32], is a rigorous and transparent method for mapping areas of research on a broad topic, and represents the findings based on the terms of nature, specific features, and characteristics of primary data [33]. Scoping reviews aim to rapidly map key aspects on a broader topic, especially in the areas that have not been reviewed before [32–36] or on which there is little evidence, such as in emerging areas [31, 35, 36]. For this reason, using a scoping review in the area of online communication technologies, with its rapid development, was considered appropriate [30, 33, 37].

This study followed five stages, drawing upon Joanna Briggs Institute guidance [32], and a framework originally developed by Arksey and O'Malley [33] with the recommendations from Levac, Colquhoun and O'Brien [31]: 1. Identifying the research question, 2. Identifying relevant studies, 3. Study selection, 4. Charting the data, 5. Collating, summarizing, and reporting results. The study did not conduct the sixth and optional stage – *consultation* or *the interview with experts* - due to the time limitation.

This scoping study was conducted by the first researcher and aimed to answer the following research question:

How do elements of the design of computer-mediated communication (CMC) influence behaviour? in order to understand how these elements could influence the relationship initiation.

Twelve keyword combinations were created out of four different categories – society, behaviour, language, marketing, and design. These categories were formed based on the findings from a previous unpublished literature review and the findings from an autoethnographic study conducted from the perspective of the first author [38] that aimed to encompass elements that influence user's behaviour in the online environment. General keywords that were used for developing the keyword combinations were following: *online communication, intimacy, online dating, romantic relationships, interface design, user experience*.

The purpose of the keyword combinations were to explore two elements:

- 1) to what extent do the **external elements, (that of the user such** as society, culture, or marketing) influence the behaviour of the user and how?
- 2) to what extent, and how do **the internal elements of online communication** (construction and interactions elements) influence the behaviour of the user?

The databases were used to gather a perspective from a range of areas that could provide an understanding on the behaviour in online communication, beyond just the design elements (Table 1). The databases and the keyword combinations were discussed among researchers, colleagues, and with the academic librarian prior to the execution.

Table 1. Databases and selection criteria.

Category	Database	Reasoning
General search	Web of Science Scopus	<i>Provision of peer reviewed articles</i>
Psychology	PsychInfo	<i>Information on psychology or influence of elements of CMC on behaviour and wellbeing</i>
Wider search	Google Scholar	<i>When believed more data required and for a wider search</i>
Computing	ACM	<i>For retrieving articles strong in HCI and CMC</i>

In order to include relevant papers and exclude those that did not answer the research question, inclusion and exclusion criteria was used [33] and implemented from the start of the research as presented in the Table 2.

Table 2. Inclusion criteria.

Criteria	Reasoning
Year limitation	Year 2016 was chosen as the starting point as it was believed to provide sufficient and relevant recent finding. Furthermore, it was found that only from 2015 has the usage of smartphones started to become steady [39, 40]. Since the study was conducted in the year of 2021, the year of 2020 was chosen as the final year of inclusion as not all databases allowed inclusion of months within the search, and thus the year 2020 allowed a closed circle of papers
Sorting	By relevance (where possible)
Language	English
Type	Full peer reviewed and fully published; Where possible, journal articles only as it was believed to provide stricter and rigorous data than in other forms

Papers that met the inclusion criteria were those that referred to the following:

1. Papers that discussed *behaviour in the online environment influenced by the experience of interaction or features*
2. Papers that discussed *elements of design of the online environment that can have an influence on behaviour*

Post hoc Exclusion. The search resulted in many papers on the topic of privacy. While certain issues of privacy could be dealt with design and can influence a behaviour, these

papers were excluded from the screening as it was believed to be a topic of a great breadth that includes elements that are not relevant to the researched topic (e.g. company policies or privacy rights). Furthermore, a decision was made to screen only the first fifty results of the papers on Google scholar. As discussed by Stevinson and Lawlor [41], further screening of the papers sorted by relevance does not necessarily mean bringing more relevant information and can lose time of the study.

Post hoc Inclusion. As many papers included for thematic analysis have used scoping or literature review as a method, the inclusion year criteria was stretched to include the papers (total of 12) that was believed answered the posed research questions.

Inclusion of Other Material. As the reasoning for conducting the scoping review is to provide a comprehensive overview of the researched area [30, 31, 33, 42, 43] rather than to provide a ‘critically appraised or synthesised answer to a particular question’ [34, p. 3], personal knowledge of certain sources or specialists was included, especially as it was believed that the results in stage two were lacking in certain areas [ibid]. The included material were books, and research papers from two researchers who specialise in topics relevant to the study – language and HCI. Even though the materials have not followed the same criteria aside from being written in English, they were included as they were believed to provide relevant information to the topic that were not caught in the search.

The selected papers for full screening were recorded and charted in a form of a Microsoft excel spreadsheet [33, 37, 44] by noting the author(s), year of publication, study populations, aims of the study, methodology, important results.

3 Findings

The scoping review collected a total of 1651 papers, out of which 717 abstracts were screened, 81 papers were fully screened, and a total of 46 papers were taken for a thematic analysis (Fig. 2). The findings from papers were then clustered, coded and analysed by hand to be further summarised and reported. Greater number of papers (12) originated from the ACM proceedings, and the most used journal was Computers in Human behaviour (5). Interestingly yet not surprisingly due to the topic of behaviour, the greater category aside from HCI and CMC came from (10). Only one paper originated from a design journal, thus showing the lack of published research from the design perspective in this area.

While the aim was to explore only the influence of the features of CMC on user behaviour, it was found that the behaviour of the user in the online environment cannot be taken alone but is mutually dependent on (1) one’s experience in the online environment, (2) the interaction they make with others, and the (3) context the user comes from. To maximise the usefulness of the findings for use by interaction designers, they are structured into three categories – 1) the influence of the environment, 2) the influence of interaction design, 3) and the influence of the user identity on the behaviour and communication with others.

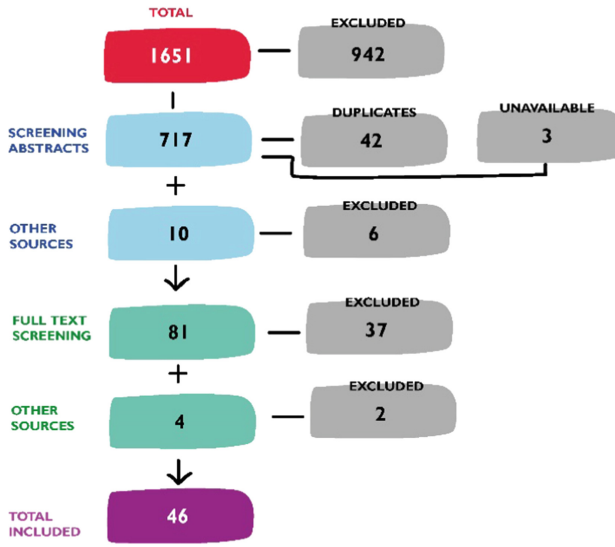


Fig. 2. Prisma diagram of the conducted scoping review (own visual, 2021)

3.1 The Influence of the Designed Environment on Behaviour and Interaction

When designing for online communication it is important to think about the environment where communication takes place as it can create an impact on the further engagement user makes with others. These are elements such as the background colour, layout, graphical elements, chat bubbles, and type choice (Table 3).

Table 3. Elements of the online environment on behaviour and interaction.

Category	Findings	References
Layout	Early perception. One of the most influential factors in early perception; users first focus on hedonic qualities (graphical and visual elements), and only then practical	[45–47]
	Engagement. The <i>appeal of the elements</i> (colour, light, and texture information) and <i>geometry of the elements</i> (posture, shape, and movement) are important as they influence the aesthetics, that was further connected to trustworthiness, performance, and evaluation of content. It also dictates further engagement and positive involvement if the content is found to be aesthetically pleasing. The engagement of users was also found to be influenced by warmth of the background	[45–48]
Design Elements	Curvature typeface. Round typefaces are associated with smooth and soft, thus it can create a comfortable feeling and trustworthiness (Fig. 3) Colour. Coloured chat bubbles were found to be intuitive and unobtrusive (Fig. 3) and can support conveying of emotions	[49, 50]

3.2 The Influence of the Interaction Design on Behaviour and Interactions with Others

The features of online communication can influence behaviour in the ways users behave towards others, how they perceive others, and how they portray themselves [38]. Table 4 shows how the way interaction and communication is designed influences behaviour, communication and interaction with others.

Table 4. Influence of interaction design and design features on behaviour and interaction with others.

Category	Findings	References
Self-representation	Selective self-presentation. People can present and create their ideal selves online, which is not possible in face-to-face communication (FtF)	[51]
Selective usage	Different mediums for different purpose. Features of interaction can create selected usage, such as Snapchat was reported to be used for flirting because the content disappears	[52, 53]
Colour	Emotions. Colour has a systematic effect on the emotional state of the person viewing the colour; it was found that brighter and more saturated colours were matched to joy expressions, and pleasant and happy atmosphere was associated with bright and lively colours	[54]
	Trust. Colour, being one of the elements of visual design, was found to influence trust in users. However, a choice of colour should be contextual, and if the colour is perceived 'appropriate', it could support engagement in a user	[55, 56]
Lack of non-verbal features	Miscommunication. Bringing any element of non-verbal communication was shown to support communication by clarifying the message or emphasizing, and by bringing understanding, validation, and care to the conversational partners. The inclusion of voice notes was found to help in conveying tone and emotions, and illustration (like emoji) were found to work better than other visual symbols as they are similar to real-life-non-verbal behaviour. Supporting messages with added visuals (such as a combination of text with a sticker) can produce an intimate experience rather than only text based or sticker based response (Fig. 3)	[57–61]
	Social presence. The elements that resemble ftf communication (rich modality cues, video profiles, reality stickers and similar) contribute to the feeling of social presence. Social presence, the feeling of presence of the conversational partner when using a communicational medium, was found to alleviate fear and distrust and increase one's willingness to meet in real life. The experience of bonding with another person was found to be primarily achieved in the in-person interaction, followed by video, audio, and lastly instant messaging	[62, 63]

(continued)

Table 4. (continued)

Category	Findings	References
	Support. Receiving support in-person or over the phone was experienced with high oxytocin production, while instant messaging as to those who have not received support	[64]
Feedback design	Processing information. People are found to more easily process visual information that is supported with sonification as it reduces visual clutter and is supportive in conveying information and meaning to the user Anxiety. The feeling of the ‘response pressure’, where the person is aware that their activity (such as ‘seen’ or ‘delivered’ like in Messenger or the double blue tick in Whatsapp) (as shown in Fig. 3) or their status (online/offline) can bring them to feel that they are required to answer and react immediately	[50, 65]
Communication design	Asynchronous communication. Online communication is asynchronous and thus is not related to a sense of connection. It can be less engaging than Ftf communication which is instantaneous and facilitated with non-verbal features. Therefore, Skype and video chatting in general was favoured in long-term relationships, but also in the initiation phase. Skype and video was found to facilitate a healthy amount of disclosure as in-person, and was specifically good for sensitive topics. Furthermore, inclusion of the history of the chat was found to influence user engagement as it resembles the synchronicity of Ftf communication. Similarly, text messaging can often seem like a never-ending conversation and can therefore bring to a feeling of connected presence	[59, 61, 66–69]
Design of interaction	Anthropomorphism. People apply the same behaviour towards computers as they do to humans. Therefore, including elements of anthropomorphism (such as the Microsoft Words Clippy; or with the personalised sticker that resembles the identity of the user) can increase trust resilience	[70]
	Human presence. Creating the feeling of human presence increases engagement. In a study no difference was found in interaction of a user with a human or a machine due to the enhancement of non-verbal features. The feeling of human presence can also be created by sharing information through the UI (the change of environment and colour, or a status change)	[71, 72]
	Arousal. The arousal a design creates can influence the experience and further interaction. Unlike the initial belief that high-arousal design could bring higher irritation in the future, it was found that the low-arousal designs decrease liking in the long-run	[73]
	Customisation. The ability to customise one’s expression and communication with selected conversational partners was found to reinforce intimacy. Customisation can be individualised, shared, or have a customisable ecosystem, such as that of Facebook Messenger (as shown in Fig. 3)	[69]

(continued)

Table 4. (continued)

Category	Findings	References
Negative behaviours	Lower wellbeing. Online communication has allowed creation of a number of negative behaviours. Ghosting can cause physical pain by activating the pain network in the brain, even in the early stages of relationships like partner selection and initiation of interaction. Aside from lowering of one's self esteem and negatively influencing one's wellbeing, ghosting can have a long term effect - distrust in others, depression and panic attack	[53, 74]
	Sanctioning. Online communication allows different forms of sanctioning. Sanctioning can be performed as <i>invisible</i> (where the other person is often unaware that they have been sanctioned, such as unfollowing the user, but the other one may still be following them), or it can be <i>visible</i> (directly blocking or unfriending). Sanctioning is often conducted without direct confrontation, and the other person is often left unaware of what they have done to deserve such action	[13, 53]

3.3 The Influence of the User Identity on Interaction and Behaviour

Culture and norms guide beliefs which in turn guides the behaviour on platforms and in the online environment [52]. It is important to consider the visible and the invisible cultural characteristics to increase acceptance of the services, but also to avoid miscommunication in the online environment. If the design is not in alliance with the cultural background of the users it can result in rejection [75] (Table 5).

Table 5. Culture and identity and its influence on behaviour.

Category	Findings	References
Culture and colour	Colour influences satisfaction, trust, and perception. However, colour also holds meaning depending on the country – e.g. red is happiness for east Asian countries, while for western countries it signifies alertness. Readability of the content was also found to depend on cultural background, among the experience, motivation, and the optical properties of the eye	[46, 76–78]
Culture and interaction	The way the elements are used, processed or interpreted is based on one's cultural context and the exposure to its visual expression. A great influence on one's behaviour is whether the person originates from a collectivistic or individualistic background – such as in use of selfies. In UK, it was found that selfie usage is more connected to showing of the 'ideal self', while in China, which is more collectivistic, it serves as an 'online avatar', or a digital representation of the self. Culture was also found to influence the perception of others' behaviour. This was researched through the lens of content sharing - a shared content can be experienced as excessive or intense and to be 'getting into our one's own space', depending on the culture and norms	[53, 79]

(continued)

Table 5. (continued)

Category	Findings	References
Culture and Language	Gender that is ascribed to objects through one's language was found to control the qualities that are ascribed to these same objects – a bridge in Germany is of feminine gender and is thus described as elegant, beautiful, fragile or slender, while in Spain, being of male gender, is correlated to big, long, strong and sturdy	[80–82]
Online culture	The existing online culture directs behaviours in the online environment. Language used in the online world is continuously changing and exists within its own realm. Users often use abbreviations, they interchange capital letters and spaces, with different font usage, thickness, italics etc., and these elements hold meaning when sharing information. Furthermore, the present ghosting culture is taken as a normal and prominent behaviour to be experienced when interacting online. Its existence impacts how one behaves or interacts with others, such as in what information one shares, or how one will guard themselves to prevent it from happening to them	[13, 80, 83, 84]

3.4 Implications for Relationship Initiation

Considering the influence of design on trust and engagement is important, especially when designing for interactions that aim to achieve a relationship among users. In dating apps particularly, encountering miscommunication in the initiation phase could more quickly result in dissolution as there was no commitment yet formed.

Moreover, the online environment with its strong visual affordances, gaming and haptic interactions (such as swiping) can enhance treatment of others like objects rather than people, resulting in emotional distancing and superficial interactions [13, 85].

It is therefore believed that enabling and enhancing the non-verbal elements in online communication is beneficial for a steady formation and healthy intimacy formation [67]. Furthermore, enabling video was shown to be a good supporter in disclosure without excess, and for vulnerable topics [67]. Furthermore, customisation can reinforce intimacy, and history of the chat can support engagement. Finally, colour coding such as with chat bubbles and providing a good set of emojis can allow better communication and avoid miscommunication.

4 Discussion

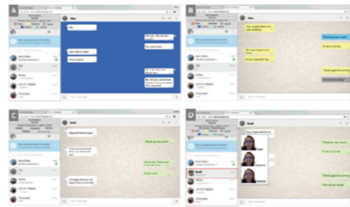
This scoping review has shown that the design of interaction can influence how users experience the online environment, how they behave, and how they interact with others.

The scoping review highlights the influence of design in dealing with two major issues of the online environment – (dis)trust and (dis)engagement. The study shows that the inclusion of non-verbal features, either through direct access (such as a video call) or through visual symbols (GIF, emoji, emoticon, meme) brings a feeling of social

3.1. The influence of the designed environment on behaviour and interaction

apple apple apple apple

Typefaces of different curvature with the same point size (fonts from left to right: AvantGarde, Helvetica Neue Lt Pro, Calibri, Verdana)

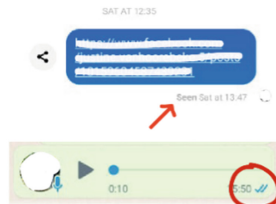


The investigated four changes within the WhatsApp interface – (A) the colour of the back-ground, (B) the coloured chat bubbles, (C) font changes, and (D) profile picture changes with emotions [49]

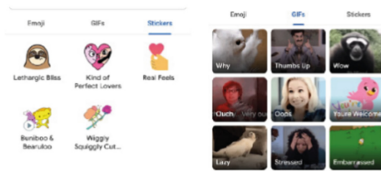
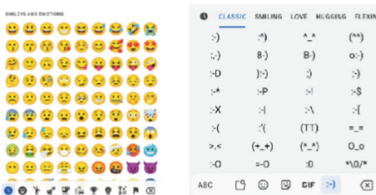
3.2. The influence of the interaction design on behaviour and interactions with others



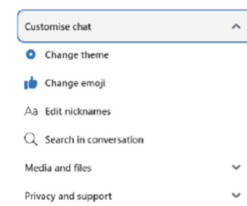
Three levels of modality of CMC – text messaging, phone call, and video call (own visual, 2022)



Anxiety in users - the 'seen' feedback and the double tick



Non-verbal features - (top left to right) emoji, emoticon, stickers, GIFs



Customisation in Messenger - theme options, emoji and nicknames of users

Fig. 3. Examples of visuals and influences discussed in findings.

presence, and enables the users to better express themselves which helps in avoiding miscommunication and provides better understanding and trust [57–64, 86]. It was also shown that enhancing the feeling of social presence, either with non-verbal features or through other elements of design information (such as including the location of the user or their activity status) [72] was correlated to the users willingness to meet in real life [62]. Finally, the study highlights the importance of the layout and the environment, as they are the first interactions user makes with the design and can set the experience and direct further engagement (or disengagement) [45–48].

The scoping review also showed the importance of understanding the other aspects besides the design - the cultural background of the users. Having the understanding of users language [82, 84] and culture [53], how different cultures experience colour [76,

79] or knowing their visual literacy and whether they come from an individualistic or collectivistic context [79] provides designers with the tools to create successful interactions and to avoid miscommunication of users.

However, personal devices cannot be seen merely as tools, but as mediators and even influencers to one's communication and relationships with others [38]. The way that the communication within our personal devices is constructed is important for the today's 'always online' culture [87] with the smartphone usage only increasing by year [39]. Furthermore, search for a partner is increasingly made through the internet and dating sites [6], therefore, the way these platforms operate also influences how we initiate and what are the grounds we build new relationships on.

The design industry and design research are still lacking in understanding of how the designed interactions influence relationship formation and what that means for the long term wellbeing, both of the individuals and the couple. This scoping review thus provides the starting point in understanding the influence design elements can make on the important elements of online communication for relationship formation – trust and disengagement. The study also posits questions over the aspects that are still missing and are important to be answered and therefore creating implications for further research.

Limitations. While some researchers state the importance of two or more researchers to review the papers to ensure an objective perspective on picking and inclusion and exclusion of papers [31], others are not as strict on this matter [33]. However, it is important to acknowledge that this study was conducted by the first author due to pragmatic reasons and time limitations, and therefore, a single view and judgement may influence the results. Furthermore, better preparation would have contributed in conducting the study by including more relevant results, such as a priori screening trial to have an understanding of the time required for conducting the study.

Further Recommendations. More research is needed from the design perspective to understand the influence of CMC and online environment on relationship formation and wellbeing of users. This could include analysing experiences over different platforms. As was found, people use different platforms for different purposes, however, it is not known whether the design of these platforms influences these preferences. Furthermore, while it is found that language can influence understanding of objects and surroundings, it is not yet understood whether language used in the design of the platforms can influence interactions and relationships.

5 Conclusion

This scoping review provides an overview of the influence of interaction design and online environment on user behaviour and relationship formation. The paper shows the importance of including non-verbal features – such as video possibilities, voice, different types of emojis, and gifs, to allow easier expression and customisation of communication to allow truthful expression, but also to ensure that certain obstacles in the online environment such as trust and disengagement are alleviated. The scoping review is one of the first in the area of design for relation making and contributes to

an overview of the influence of interaction design on wellbeing. Therefore it provides a foundation for future studies, which consequently will have practical implications for the design of online interaction to ensure wellbeing of users.

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