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Zainb I. Mohammed

*Al-Qadisiya University, Al-Qadisiya, Iraq, Zainabi.mohammed@alayen.edu.iq*

Lina M. Shaker

*University Kebangsaan Malaysia, Bangi 43600, Selangor, Malaysia, p109960@siswa.ukm.edu.my*

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## ORIGINAL STUDY

# From Face-to-Face to Interface: A Critical Review of Human Relationships in the Digital Era

Zainb I. Mohammed <sup>a</sup>, Lina M. Shaker <sup>b,\*</sup>

<sup>a</sup> Al-Qadisiya University, Al-Qadisiya, Iraq

<sup>b</sup> University Kebangsaan Malaysia, Bangi 43600, Selangor, Malaysia

## ABSTRACT

The rise of digital technologies has significantly transformed the nature, structure, and experience of human relationships across multiple domains. This review critically examines how digital platforms such as social media, messaging applications, online dating sites, and AI-driven interfaces have reshaped interpersonal connections, including friendships, romantic relationships, and family dynamics. Drawing on interdisciplinary literature from psychology, communication studies, sociology, and media theory, the review explores themes such as digital intimacy, parasocial interactions, performative relationships, remote caregiving, and the ethics of AI-mediated emotional engagement. Special attention is given to underrepresented populations (e.g., older adults, neurodiverse individuals), as well as longitudinal and developmental gaps in current research. The article identifies both opportunities and challenges presented by digital relationship technologies, emphasizing the importance of contextual factors such as platform design, user intention, and communication norms in shaping relational outcomes. The review concludes by calling for more inclusive, long-term, and ethically guided research to inform future developments in digital relational technologies and ensure they support rather than undermine human connection.

**Keywords:** Digital relationships, Social media and intimacy, Human-technology interaction, Online communication, AI and emotional ethics

## 1. Introduction

The 21st century has witnessed an unprecedented digital revolution that fundamentally altered the landscape of human communication and relationships. The interactive nature of social media fosters meaningful connections, facilitates real-time interactions, marking a paradigm shift from traditional face-to-face encounters to interface-mediated exchanges [1]. This transformation extends beyond mere technological adoption; it represents a profound reconfiguration of how humans connect, communicate, and construct meaningful relationships across temporal and spatial boundaries [2, 3]. The proliferation of digital platforms has created new modalities of social interaction, where physical presence is no

longer a prerequisite for intimate connection. Mobile technologies, social networking sites, virtual reality environments, and instant messaging applications have collectively established what scholars term the “digital social sphere” – a complex ecosystem where human relationships unfold through algorithmically mediated interfaces [4, 5]. 67% of teens favoring communication with friends via these platforms serves as a testament to the digital age’s transformative effects on human connection [6], illustrating how younger generations increasingly prefer digital communication channels over traditional interpersonal methods. This digital metamorphosis has catalyzed both opportunities and challenges for human relationship formation and maintenance. While technology enables unprecedented global connectivity,

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\* Corresponding author.  
E-mail address: p109960@siswa.ukm.edu.my (L. M. Shaker).

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facilitating relationships that transcend geographical limitations, it simultaneously introduces new complexities regarding authenticity, intimacy, and social presence [7, 8]. The interface becomes not merely a tool but an active mediator that shapes the very nature of human interaction, influencing everything from emotional expression to conflict resolution patterns [9].

The actual and conceptual awareness of relationships through digital thinking has become a must for several interlinked reasons. First, the enormity of digital communication in today's culture demands some sort of separate academic consideration. Current data point to the fact that worldwide, upward of 4.9 billion people actively use social networks and spend some 2.5 hours daily interacting socially on the Internet [10]. Such a huge behavioral shift is probably the greatest change in recorded history in terms of human social behavior since the last few centuries. Second, COVID-19 also expedited relationship formation and maintenance in the digital world, thereby, lending to a natural experiment in tech-mediated human connection [11]. That time period gave insights into the resilience of human social bonds and the incapacity of digital platforms to truly capture the nuances of face-to-face interactions [12]. It forced upon us the need to understand if primarily digital relationships are sustainable, deep, and capable of generating psychological wellbeing. Third, emerging technologies continue to further cross-cut the boundaries of social spaces, physical and digital alike. Augmented reality, virtual reality, and artificial intelligence are now just about forging the most cutting-edge platform for human interaction [13]. Understanding how relationships evolve within these emerging digital environments is crucial for predicting future social dynamics and addressing potential societal challenges. Fourth, the psychological and sociological implications of interface-mediated relationships extend beyond individual experiences to influence broader social structures, including family dynamics, workplace relationships, educational interactions, and civic engagement [14]. The quality and nature of digital relationships directly impact mental health, social cohesion, and democratic participation [15]. Fig. 1 summarizes the key thematic areas explored in the review, illustrating how digital technologies intersect with diverse aspects of human relational life. It highlights the major domains of analysis including romantic relationships, friendships and parasocial interactions, family relationships and digital parenting, long-distance relationships, AI companions and emotional interfaces, ethical considerations for vulnerable populations, longitudinal research gaps, and the ongoing debate between digital detox and integration approaches.

This critical review adopts a comprehensive framework to explore the evolving nature of human relationships as they transition from traditional face-to-face interactions to technologically mediated connections. The review is structured around four key dimensions to ensure a nuanced and interdisciplinary analysis. Temporally, the review concentrates on research conducted between 2010 and 2024, a period marked by the rapid global proliferation of social media, the widespread adoption of smartphones, and the significant acceleration of digital communication practices during the COVID-19 pandemic. Foundational theoretical works published prior to 2010 are also incorporated to provide essential conceptual grounding. Technologically, the analysis encompasses a broad spectrum of digital platforms and tools that facilitate mediated interactions. These include social networking sites such as Facebook, Instagram, Twitter (now X), and TikTok; messaging applications like WhatsApp, Telegram, and Signal; professional networking platforms such as LinkedIn; online dating applications including Tinder, Bumble, and Hinge; as well as interactive environments such as online gaming communities, virtual reality spaces, and emerging metaverse platforms. Relationally, the review addresses a diverse array of interpersonal connections. It examines the impact of digital mediation on romantic relationships, friendships, familial bonds, professional collaborations, educational interactions, and community-oriented affiliations, highlighting the varied ways in which technology influences the dynamics within each relational context. Theoretically, this review draws from multiple academic disciplines to provide a holistic and critical perspective. Insights from communication studies, psychology, sociology, human-computer interaction, media studies, and anthropology are synthesized to deepen the understanding of how digital technologies are reshaping human relational experiences in contemporary society. The primary objectives of this review are to:

1. Synthesize existing research on the transformation of human relationships in digital environments
2. Identify key differences between face-to-face and interface-mediated relationship formation, development, and maintenance
3. Analyze the psychological, social, and cultural implications of digital relationship mediation
4. Examine the role of platform design and algorithmic mediation in shaping relationship dynamics
5. Assess the quality, depth, and authenticity of relationships formed and maintained through digital interfaces

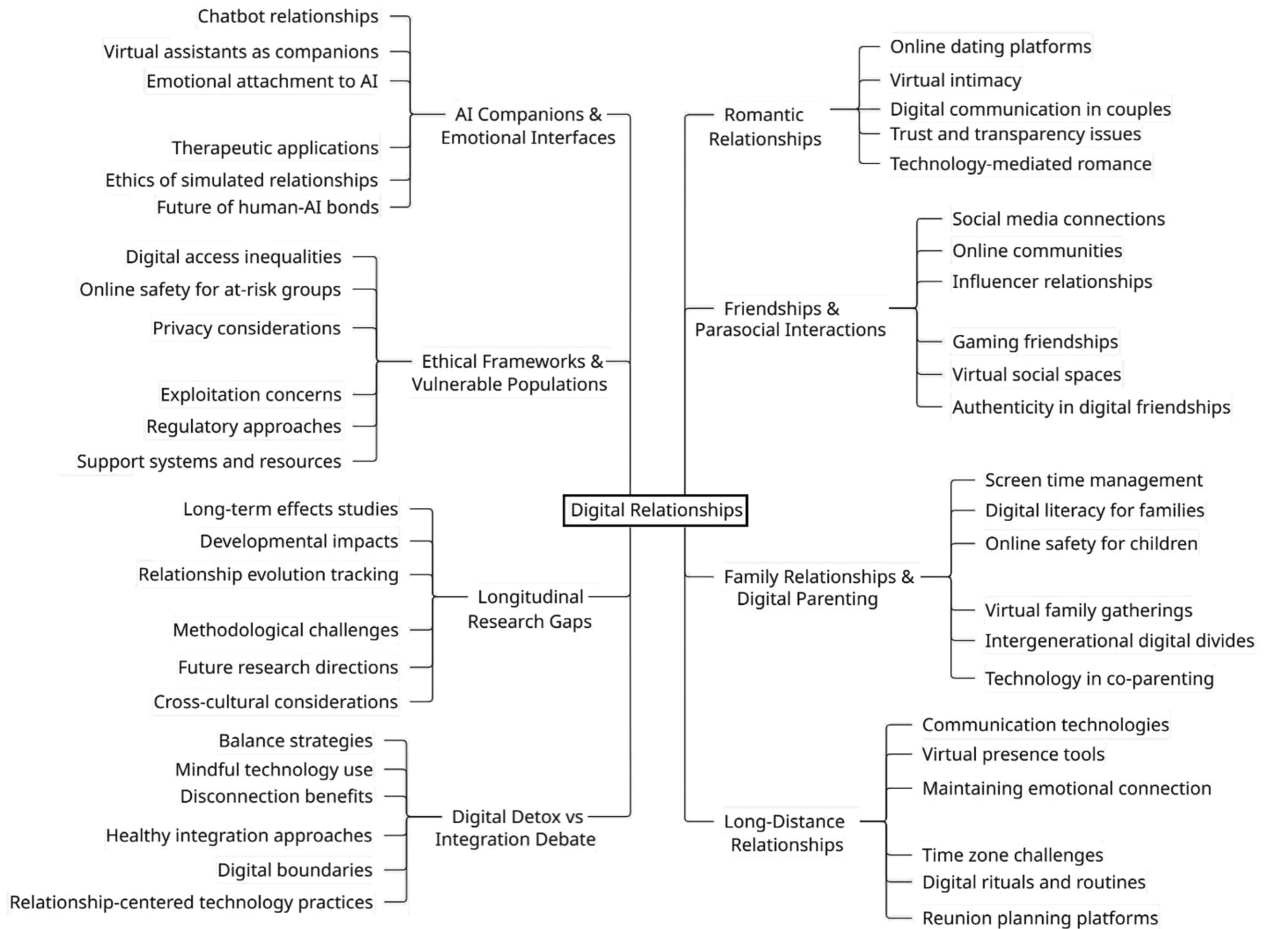


Fig. 1. Mind map of digital relationships: Themes and dimensions in the digital era.

6. Identify gaps in current research and propose directions for future investigation
7. Provide evidence-based insights for individuals, educators, policymakers, and technology designers

This exhaustive, systematic review employed a rigorous, comprehensive search strategy across various academic databases to ensure adequate coverage of literature related to the topic of transformation of human relationships in this digital era. This methodology followed the criteria set by PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to warrant transparency, consistency, and reproducibility in the research process [16]. The search took place in the following databases: PubMed/MEDLINE, PsycINFO, Web of Science Core Collection, IEEE Xplore Digital Library, ACM Digital Library, Google Scholar, JSTOR, ScienceDirect, Communication & Mass Media Complete, and the Sociology Database. To maximize sensitivity and specificity, the search strategy combined controlled

vocabulary (e.g., MeSH terms) and free-text keywords using Boolean operators. Some key terms included were “digital relationships,” “online relationships,” “virtual relationships,” “computer-mediated communication,” and “internet relationships.” These were paired with secondary terms such as “social media,” “social networking,” “mobile communication,” “smartphone,” “digital communication,” “online dating,” and “virtual reality.” To capture the full relational context, additional terms such as “interpersonal relationships,” “romantic relationships,” “friendship,” “family relationships,” “social connections,” “intimacy,” and “social support” were incorporated. Outcome-related terms included “relationship quality,” “relationship satisfaction,” “social presence,” “authenticity,” “trust,” and “emotional connection.” Methodological keywords such as “face-to-face,” “in-person,” “offline,” “comparison,” and “hybrid relationships” were used to identify comparative and integrative studies. The inclusion criteria encompassed peer-reviewed articles published in English between January 2010 and December 2024,

with a focus on human relationships mediated by digital technology. Eligible studies included empirical research, theoretical papers, and systematic reviews addressing relationship formation, development, maintenance, or dissolution, specifically in adult populations (aged 18 and older). Studies were included if they explored the interplay between digital and face-to-face relational aspects. Exclusion criteria comprised non-peer-reviewed sources (with the exception of seminal books and institutional reports), studies focused solely on technology adoption without relational outcomes, research involving children under the age of 18 (unless addressing digital natives), non-English publications, articles focused exclusively on internet addiction or pathological use, conference abstracts lacking full texts, and duplicate publications. The systematic search process initially identified 2,847 potentially relevant articles. After removing duplicates ( $n = 623$ ), a total of 2,224 articles were screened based on titles and abstracts by two independent reviewers. Of these, 487 articles met the preliminary inclusion criteria and were subjected to full-text review. Following the application of exclusion criteria and a quality appraisal, 156 studies were deemed eligible and included in the final synthesis. To assess methodological quality, appropriate tools were applied depending on study design: the Newcastle-Ottawa Scale was used for observational studies, the Cochrane Risk of Bias tool for experimental research, and the Critical Appraisal Skills Programme (CASP) checklist for qualitative studies. Only those studies that met or exceeded minimum quality thresholds were retained for inclusion in the final review. This rigorous methodological approach ensured a comprehensive and unbiased survey of the current scholarly landscape relating to the shift from face-to-face to interface-mediated human relationships, upon which evidence-based interpretations, theoretical insights, and future research directions could be founded.

## 2. Theoretical foundations

### 2.1. Classical theories of human relationships

Classical theories provide a conceptual framework on which contemporary research in digital relationships rests. These classical approaches lay the theoretical framework needed to examine transformations of relationships in digital contexts. Symbolic Interactionism was proposed from the works of G.H. Mead and H. Blumer to explain that human relationships are the result of symbolic exchanges that are continuously evolving and being redefined [17]. This perspective suggests that persons develop

self-concept and perceptions of others through an interaction process whereby symbols or gestures, and more importantly language, become vehicles of relationship formation [18]. In digital contexts, symbolic interactionism explains how individuals construe meaning through the use of emojis, profile curation, digital gestures, and text communication, where the absence of physical cues calls for new symbols to substitute for them [19]. The processes of role-taking and perspective-taking within symbolic interactionism become very relevant to interface-mediated relationships where digital signals must be decoded and social contexts reconstructed in the absence of traditional embodied cues. These digital platforms become the stages on which individuals perform identity work and negotiate meanings through carefully curated representations [20]. Social Constructionism, based on the works of Berger and Luckmann, posits that reality and relationships are socially constructed through countless ongoing interactions and mutually shared understandings of the world [21]. This perspective sheds light on how digital relationships do not merely stand as technological phenomena but are socially constructed realities emerging from collective processes of making sense. Digital platforms thus enact spaces where new norms for relationships, expectations, and practices are collectively negotiated and legitimized [22]. The social constructionist perspective is specifically useful in explaining how varying digital communities forge different cultures of relationships, communication standards, and intimacy practices. The construction of digital reality of relationships thus involves elements of individual agency as well as structural limitations imposed by platform architectures and algorithmic mediation [23]. Attachment Theory was initially nurtured by John Bowlby and Mary Ainsworth in understanding how early relational experiences may mold adult relational patterns [24]. The normally four attachment styles of fearful, anxious-preoccupied, dismissive-avoidant, and disorganized provide suitable frameworks in understanding how individuals approach digital relationships. There is evidence that attachment styles affect the behavior of online relationships, mainly social media use, underlying approaches to digital communication, and dealings with relationship uncertainty in the mediated environment [25]. Digital environments can serve to reinforce or provide an outlet for attachment behaviors. For instance, an individual with an anxious attachment may become obsessed with monitoring the digital activities of their significant other, whereas an individual with an avoidant attachment will probably appreciate the inherent emotional distancing of digital communication [26]. Consequently, while in the eyes of

some and on paper (synchronous vs. asynchronous) and many digital platforms cater to neurotic anxieties sparked by the attachment on the other side of it, the same platforms act as a cushion for others, depending on the orientation of the attachment [27].

## 2.2. Contemporary digital theories

Barry Wellman has been particularly influential in theoretically framing networked individualism as a paradigmatic shift from group-centered social organization to network-centered social organization [28]. Essentially, networked individualism characterizes the Internet-fueled transformation from traditional group structures into dispersed, individually-focused networks where people may customize their own social support systems. The theory also gives that digital technologies permit an individual to have larger, more varied, and more dispersed-in-place networks and allow such an individual to decide when and to what extent he or she invests in certain social relationships [29]. Wellman's concept of networked individualism provides an especially powerful paradigm for interpreting the social changes taking place around us. Understanding how communities moved away from bounded groups to fluid networks places individuals in a much better position in handling the challenges and opportunities of the digital world. Essentially, the theory suggests that individuals constitute the centers of their own network, picking and maintaining relations based on personal preference rather than location or institutional affiliation [30]. This shift fundamentally affects the quality of relationships, social support, and community formation. Networked individualism permits greater rejection and customization of relationships, but on the other hand, it may well cause a large degree of superficiality in social connections and considerable fragmentation in society [31]. Mediated Intimacy theories, with Sherry Turkle and Nancy Baym among their architects, describe evolving paradigms of intimacy between human beings occasioned by digital technologies. Turkle's notion of the "technological self" looks at identity formation and relationship expectations in light of digital interactions [32]. Her thesis is that digital communication creates new forms of intimacy marked by continuous partial attention, with individuals maintaining two or more simultaneous connections albeit sometimes at the expense of depth in favor of breadth [33]. Baym, conversely, stresses mediated intimacy by arguing that digital technologies do not simply emulate offline relationships; rather, they engender new forms of connection with distinctive traits [34]. Digital intimacy embodies the

ongoing presence of awareness, asynchronous emotional exchanges, and multimodal communications capable of either complementing or substituting for face-to-face interaction: this is to say that while mediated intimacy can indeed be real and meaningful, it inhabits a space with definite unique attributes and limitations [35]. Posthuman and Cyborg Identity Perspectives, following in the wake of Donna Haraway and Rosi Braidotti, grant the most radical reconceptualizations of human subjectivity in digital environments. Haraway's cyborg feminism forges beyond traditional dichotomies between human and machine, positing that the dominance of digital technologies renders hybrid human-machine assemblages through which identity and relationship are reconstructed [36]. Within digital relationship contexts, this perspective theorizes human connections as being increasingly mediated through technological interfaces that develop into an inherent part of the relational experience itself [37]. Building on this line of thought is Braidotti's posthuman theory by opening further insights into how digital technologies allow for new forms of becoming and relating that surpass conventional humanistic categories [38]. These perspectives conceptualize digital relationships as evolutionarily new forms of connection that cannot fit into paradigms of traditional human relationships. While accentuating the transformative potentialities offered by technology, they simultaneously raise pertinent inquiries concerning agency, authenticity, and what it constitutes to be human in digital milieus [39].

## 3. Evolution of social interaction: From physical to digital

The transformation of human social interaction from primarily physical to increasingly digital modalities represents one of the most significant shifts in human communication history. This evolution has unfolded through distinct technological phases, each introducing new possibilities and constraints for relationship formation and maintenance.

### 3.1. Historical shift from physical community spaces to virtual platforms

Traditional human societies worked around physical community spaces—century squares, religious institutions, neighborhood gatherings, and local meeting centers—efficient for face-to-face socialization [40]. These spatial contexts presented natural opportunities for relationships to form on the basis of proximity, sharing activities, and repeated encounters.

Community membership was largely determined by physical location and institutional affiliation, thus making bounded social groups with clear membership criteria [41]. Beginning with the industrial revolution and urbanization, traditional community structures were perturbed, bringing in what has been metaphorically referred to by sociologists as the “eclipse of community” [42]. Geographic exodus, workplace specialization, and suburbanization tend to debilitate neighborhood social networks, all of which would later lay a historic attraction for online social platforms [43]. The demise of the geographical community gave rise to the virtual community, which aims to help community-building processes transcend geographical constraints. Early online communities, such as bulletin board systems (BBS) and Usenet Groups, demonstrated that meaningful relationships can be formed around shared interests rather than shared physical spaces [44]. These early digital communities laid the foundational principles for virtual relationship formation: asynchronous communication, affinity based on interests, and pseudonymous interaction [45]. This movement away from location-based community-space dynamics bears a profound effect on interpersonal relationships. Therefore, virtual platforms permitted gatherings across vast distances, access to multiple points of view, and maintenance of relationships that would not have been possible in a pure physical setting. Yet, these new transitions brought forth a host of challenges-cum-caveats in the digital relationship experience-anyways pertaining to trust, authenticity, and social presence [46].

### 3.2. Influence of communication technologies: Email → SMS → social media → AI chatbots

The evolution of digital relationship technology has proceeded through distinct technological generations, each expanding the possibilities for mediated human connection.

**Email Era (1970s–1990s):** Electronic mail introduced asynchronous digital communication, enabling individuals to maintain relationships across time zones and geographical distances. Email relationships were characterized by textual intimacy, thoughtful composition, and delayed response patterns that created unique rhythms of digital connection [47]. Research from this period established that email relationships could achieve high levels of intimacy and emotional connection despite the absence of visual and auditory cues [48].

**SMS and Mobile Messaging Era (1990s–2000s):** The introduction of Short Message Service (SMS) and later mobile instant messaging created more

immediate and frequent communication possibilities. The brevity and immediacy of SMS communication encouraged the development of new linguistic conventions, including abbreviations, emoticons, and abbreviated expression styles that influenced digital communication culture [49]. Mobile messaging made digital communication more accessible and integrated into daily life patterns [50].

**Social Media Era (2000s–present):** Social networking platforms like Facebook, Instagram, Twitter, and TikTok transformed digital relationships by introducing persistent profile-based identity, visual communication, and network broadcasting capabilities. Social media enabled new forms of relationship maintenance through continuous presence awareness, social validation through likes and comments, and parasocial relationship formation with public figures and influencers [51]. The visual nature of many social media platforms introduced new dimensions of self-presentation and relationship performance [52].

**AI Chatbot and Virtual Assistant Era (2010s–present):** The emergence of sophisticated AI chatbots and virtual assistants has introduced possibilities for human-AI relationships that challenge traditional relationship categories. While these systems don’t represent genuine interpersonal relationships, they demonstrate human capacity for emotional attachment to digital entities and preview possibilities for future AI-mediated relationship experiences [53].

### 3.3. Key turning points: Smartphones, social media platforms, video conferencing

Several technological developments have served as pivotal moments in the evolution of digital relationships.

**Smartphone Revolution (2007–present):** The introduction of smartphones, particularly the iPhone in 2007, fundamentally transformed digital relationship possibilities by making internet-connected communication devices ubiquitous and constantly accessible [54]. Smartphones enabled continuous connection, location-based services, and multimedia communication that dramatically expanded digital relationship possibilities. The “always-on” nature of smartphone communication created new expectations for responsiveness and availability in digital relationships [55].

**Social Media Platform Proliferation (2004–present):** The launch of Facebook (2004), Twitter (2006), Instagram (2010), and subsequent platforms created ecosystems for relationship formation, maintenance, and performance that became central to contemporary social life. These platforms introduced features like friend networks, content sharing, and algorithmic content curation that shaped how

individuals discover, connect with, and maintain relationships with others [56].

**Video Conferencing Normalization (2020–present):** The COVID-19 pandemic accelerated adoption of video conferencing technologies for both professional and personal relationship maintenance. Platforms like Zoom, Skype, and FaceTime became essential tools for maintaining intimate relationships, conducting family gatherings, and enabling romantic connections during physical distancing requirements [57]. This period demonstrated both the possibilities and limitations of video-mediated intimacy while normalizing virtual presence as a relationship maintenance strategy [58].

## 4. Impacts on intimacy, friendship, and family dynamics

### 4.1. Digital intimacy and romantic relationships

Digital technologies have fundamentally transformed the ways romantic relationships are formed, developed, and maintained, offering new pathways to intimacy while simultaneously challenging traditional romantic scripts. A prominent aspect of this transformation is the online dating revolution, which has rapidly moved from a niche activity to a mainstream method of romantic partner selection. According to recent data, 37% of U.S. adults have used an online dating site or app, with usage particularly concentrated among younger adults 56% of those aged 18–29 report having used such platforms [59]. Online dating shifts mate selection away from serendipitous encounters or social introductions toward algorithm-mediated matching, guided by metrics of compatibility, shared interests, and physical attraction [60]. These platforms expand partner pools beyond geographic and social constraints, offering broader opportunities for connection [61]. However, the abundance of choice can lead to “choice overload,” where users feel overwhelmed by options, potentially undermining relationship commitment and satisfaction [62]. Moreover, scholarly critiques suggest that dating apps have commodified romantic connection, reframing dating as a de-romanticized, reputation-driven social practice embedded within a broader digital lifestyle logic [63]. Beyond initial partner selection, digital technologies have also reshaped the experience of long-distance romantic relationships. Tools such as video calling, instant messaging, shared streaming, and social media enable couples to remain emotionally connected despite geographic separation [64]. Research suggests that these relationships often foster strong communication skills and intentional intimacy, as couples must rely on

verbal and emotional clarity to sustain their connection [65]. Nevertheless, challenges persist, including time zone differences, trust issues, the emotional toll of physical absence, and the stress of navigating digital-only intimacy [66]. The success of long-distance digital relationships often hinges on communication quality, shared goals, and the creation of meaningful shared experiences through digital media [67]. The widespread integration of technology into romantic life has also prompted the emergence of digital love languages, adapting traditional concepts of romantic expression for online contexts [68]. In place of or alongside physical affection and in-person gestures, romantic partners now express love through thoughtful text messaging, social media acknowledgment, digital gift-giving, and shared virtual experiences [69]. These practices include curated playlists, collaborative photo albums, virtual dates, and passive forms of “presence awareness” such as location sharing or online status updates. While these forms of digital intimacy can enrich romantic bonds, they also introduce new relational norms and expectations that may reinforce or challenge established patterns of romantic behavior [70].

### 4.2. Friendship in the age of social media

Social media portals have altered the operational dynamics of the formation and sustenance of friendships and their very conceptualizations, thus breaking away from what have traditionally been deemed for interpersonal interactions and giving rise to new classes of social relationships. One such class includes parasocial interactions, wherein an individual may build an emotional bond with any celebrity, influencer, or content creator who remains oblivious to that audience member’s existence [71]. These one-way relationships with no reciprocal back end may sometimes yield social and emotional benefits such as companionship, identity exploration, or entertainment, especially for persons with insufficient access to the life social network [72]. The research suggests that the parasocial relationship may at best complement the reciprocal intrinsic relationships and provide a sense of connection and social support for users [73]. Intensifying even more as platforms further promote interactivity and intimacy in engagements between creators and audiences, thereby almost washing out the confines from the real versus virtually social interaction [74]. Parallely, social media has seeded niche-friendship digital grounds for building micro-communities organized around specific interests, identities, or life experiences [75]. These communities offer a chance to create valuable interpersonal relationships that would otherwise

**Table 1.** Emerging forms of digital friendship.

Type	Description	Platforms/Examples
Parasocial Relationships	One-sided relationships with public figures	YouTube, Instagram, TikTok
Micro-Community Friendships	Friendships based on niche interests or identities	Reddit, Discord, niche forums
Performative Friendships	Public displays of social connection for validation or status	Facebook, Instagram Stories

be difficult in their direct physical environment. If rare interests, marginalized identities, or very distinct experiences are involved, micro-communities become crucial providers of social validation, companionship, and support [76]. The searchable nature and asynchronous communication style of many platforms empower users with a search mechanism that allows them to find others with very particular traits or interests, building connections that would probably never occur geographically [77]. Another factor making the definition of social media friendship unique is its performative side. Friendship acts on social media are curated and broadcasted to public audiences, thus converting relational gestures into public performance, sometimes even strategically so [78]. Publicity of all sorts, like tagging, liking, commenting, and sharing, influences how people promote and display their friendships [79]. The visibility of such interactions could strengthen relational ties by providing public affirmation and acknowledgment, yet it also places social expectations that can sometimes contradict the private reality of these relationships [80]. Such conflict between the sincere and the stage continues to drown digital circles while questioning what friendship means and entails today with social media [81]. Table 1 shows categorized friendships that have appeared in the digital environments like parasocial relationships, micro-communities, and performative friendships. Such types share different traits, platforms of occurrence, and social implications. Together, categories present how social networking and digital technologies frame the new definition and experience of friendship in this digital era.

#### 4.3. Family structures and communication

Digital technologies have profoundly reshaped family relationships, communication patterns, and caregiving practices, generating both new opportunities for connection and challenges to traditional family dynamics. One major area of transformation is digital parenting, which now requires navigating increasingly complex digital environments. Parents must manage their children's screen time, ensure online safety, teach digital literacy, and model healthy digital behaviors [82]. This involves balancing the use of digital tools for communication, monitoring, and family coordination, while simultaneously

managing issues such as social media usage, cyberbullying, digital citizenship education, and the integration of virtual and physical family life [83]. Many parents report difficulty in setting and enforcing boundaries around family digital media use, often while struggling to meet their own digital communication and relationship needs [84]. These challenges were particularly exacerbated during the COVID-19 pandemic, which intensified family reliance on digital platforms for schooling, work, and social connection [85]. Another key issue concerns multi-generational technology gaps within families. Different age groups often have distinct levels of digital literacy, preferred platforms, and communication norms. For instance, older family members may rely more on phone calls or emails, while younger members often prefer text messaging, social media, or video conferencing [86]. These differences require families to navigate multiple digital channels to maintain relational continuity [87]. While such diversity can foster intergenerational learning, with younger members helping elders adopt new technologies and older members offering guidance on relational stability and communication skills [88], it can also generate miscommunication, frustration, and reduced family interaction if left unaddressed [89]. Digital technologies have also expanded the scope of remote caregiving within families. Tools such as video calls, health monitoring apps, messaging platforms, and social media now enable families to provide emotional support, coordinate medical care, and maintain consistent contact with aging relatives or members experiencing health challenges across geographic distances [90, 91]. However, digital caregiving often serves as a supplement rather than a substitute for in-person care. Its effectiveness hinges on the digital competence of all involved parties and the availability of reliable technological infrastructure [92, 93]. In addition to individual relational functions, family-wide communication and decision-making processes have also evolved. Group messaging, shared digital calendars, and collaborative platforms now support real-time coordination of family schedules, responsibilities, and social interactions, helping to maintain cohesion across spatially distributed family units [94]. While these tools can enhance organization and connection, they may also foster unrealistic expectations of constant availability

and rapid responsiveness, potentially placing undue stress on family relationships [95].

## 5. Social identity and the self in virtual spaces

### 5.1. Digital identity construction: Avatars, handles, profiles

Digital identity construction has emerged as a fundamental aspect of contemporary social interaction, with individuals creating and maintaining multiple digital personas across various platforms. Recent research indicates that digital media is ubiquitous in adolescence and young adulthood, key developmental periods when people explore who they are and who they want to become [96]. This exploration increasingly occurs through carefully curated digital representations that may diverge significantly from offline identities. The construction of digital identity involves multiple components including usernames, profile photographs, biographical information, post histories, and interaction patterns that collectively create a digital persona [97]. These elements function as identity markers that communicate social status, interests, values, and personality traits to other users [98]. The process of digital identity construction is inherently performative, requiring individuals to make conscious choices about self-presentation that may enhance, alter, or fragment their sense of self [99]. Avatar creation in gaming and virtual environments represents a particularly complex form of digital identity construction, enabling users to embody alternative identities with different physical characteristics, personalities, or social roles [100]. Research indicates that avatar creation can facilitate identity exploration, self-expression, and emotional regulation, particularly for individuals exploring gender identity, social roles, or psychological aspects of self [101]. Platform-specific identity construction creates additional complexity, as individuals must navigate different affordances, norms, and audiences across multiple digital spaces. Professional networking platforms like LinkedIn encourage different identity presentations than social platforms like Instagram or TikTok, requiring users to maintain multiple, sometimes contradictory digital personas [102].

### 5.2. Social comparison, self-presentation, and authenticity

Digital environments intensify social comparison processes by providing continuous access to others' curated self-presentations, achievements, and

lifestyle representations [103]. Social media platforms facilitate upward social comparison, where individuals compare themselves to others who appear more successful, attractive, or fulfilled, potentially contributing to decreased life satisfaction and increased psychological distress [104]. The concept of “compare and despair” has become particularly relevant in digital contexts, where algorithmic feeds prioritize engaging content that may not represent typical experiences [105]. Users frequently compare their internal experiences with others' external presentations, creating unrealistic standards and expectations for their own lives [106]. Self-presentation in digital spaces involves strategic curation of content, timing, and interaction patterns to create desired impressions [107]. This curation process can enhance self-esteem and social connection when successful, but may also create pressure to maintain false or exaggerated personas [108]. The performative nature of digital self-presentation raises questions about authenticity and the psychological costs of maintaining idealized digital identities [109]. Digital authenticity represents a complex negotiation between genuine self-expression and strategic impression management. Some scholars argue that digital spaces enable more authentic self-expression by providing opportunities to explore aspects of identity that may be constrained in offline contexts [110]. Others contend that the performative demands of digital platforms inherently compromise authenticity [111].

### 5.3. Role of algorithms in shaping identity and belonging

Algorithmic systems increasingly mediate digital identity formation by determining which content users encounter, which connections are suggested, and which aspects of identity receive social validation [112]. Algorithms can improve digital-media platforms in two ways: by using different optimization metrics to rank content, or by prompting interventions upon detecting problematic content [113], but they also shape identity development in ways users may not recognize. Recommendation algorithms create “filter bubbles” that can reinforce existing identity aspects while limiting exposure to alternative perspectives or identity possibilities [114]. These algorithmic influences on identity formation are particularly concerning during adolescence and young adulthood when identity exploration is most active [115]. Social media algorithms often prioritize content that generates engagement, which may favor controversial, emotional, or extreme content over nuanced self-expression [116]. This algorithmic bias can influence users toward more polarized or

performative identity presentations to maintain visibility and social validation [117]. The opacity of algorithmic systems means that users have limited understanding of how their digital identities are being shaped by technological mediation [118]. This lack of algorithmic transparency raises concerns about user agency in identity formation and the potential for manipulation of identity development processes [119].

## 6. Psychological and social consequences

### 6.1. *Loneliness vs. Connectedness paradox*

Contemporary digital communication creates a fundamental paradox where increased connectivity coexists with rising rates of loneliness and social isolation [120]. Despite having access to vast social networks and communication tools, many individuals report feeling more lonely and disconnected than previous generations [121]. This paradox emerges from several factors including the substitution of digital communication for face-to-face interaction, the superficial nature of many digital connections, and the psychological effects of constant comparison with others' curated presentations [122]. Digital connections may provide the illusion of social support without the depth and reciprocity characteristic of meaningful relationships [123]. Research indicates that the quality rather than quantity of digital connections determines their impact on loneliness and well-being [124]. Passive social media consumption, where users observe others' content without active engagement, is particularly associated with increased loneliness and decreased well-being [125]. Active engagement, including direct communication and meaningful interaction, shows more positive associations with psychological outcomes [126]. The loneliness-connectivity paradox is exacerbated by the "always available" expectation in digital communication, where constant connectivity can create pressure for immediate responsiveness while paradoxically reducing the quality of individual interactions [127].

### 6.2. *Mental health concerns: FOMO, social anxiety, cyberbullying*

Digital relationship environments have generated new categories of mental health concerns that reflect the unique stressors of mediated social interaction. Fear of Missing Out (FOMO) represents a pervasive anxiety about missing social experiences, opportunities, or information that others may be experiencing [128]. Social media platforms exacerbate FOMO by providing continuous streams of others' activities

and achievements, creating persistent anxiety about one's own social experiences [129]. FOMO is associated with decreased life satisfaction, increased social media use, and difficulty with present-moment awareness [130]. Digital Social Anxiety manifests as anxiety specifically related to digital communication and online social interaction [131]. This may include anxiety about response timing, message interpretation, online self-presentation, and digital social performance [132]. Digital social anxiety can be particularly challenging because it affects communication in spaces that are increasingly essential for social and professional functioning [133]. Cyberbullying represents a severe form of digital relationship dysfunction involving intentional, repeated harm through digital communication platforms [134]. Cyberbullying differs from traditional bullying in its potential for anonymity, viral spread, permanent documentation, and 24/7 accessibility [135]. The psychological impacts of cyberbullying can be severe and long-lasting, including increased risks of depression, anxiety, and suicidal ideation [136]. Research indicates that cyberbullying victimization is associated with both immediate and long-term mental health consequences, including decreased academic performance, social withdrawal, and increased risk for substance abuse [137]. The persistent nature of digital harassment means that victims may have difficulty escaping or recovering from cyberbullying experiences [138].

### 6.3. *The "always-on" culture and attention fragmentation*

Digital communication technologies have created an "always-on" cultural expectation where individuals are expected to be continuously available for digital interaction [139]. This constant connectivity can fragment attention, disrupt deep relationships, and create chronic stress related to managing multiple simultaneous digital relationships [140]. Attention fragmentation occurs when individuals attempt to maintain awareness of multiple digital communication streams simultaneously, reducing the quality and depth of individual interactions [141]. This fragmentation can undermine relationship satisfaction and emotional intimacy by preventing the focused attention necessary for meaningful connection [142]. The always-on culture creates pressure for immediate responsiveness that can stress both individuals and relationships [143]. Delayed responses to digital messages may be interpreted as social rejection or relationship degradation, creating anxiety and conflict [144]. This pressure is particularly intense for younger generations who have developed social

expectations around immediate digital responsiveness [145]. Research indicates that constant digital connectivity can interfere with crucial psychological processes including reflection, solitude, and deep thinking that are necessary for healthy identity development and relationship functioning [146].

## 7. Cultural and ethical considerations

### 7.1. Cultural variations in digital relationship norms

The conventions of practicing digital relationships hold diverse etymological meanings in various culture spheres, with subsequent variation accruing from differences in values, modes of communication, and social structures [147]. It may be so that collectivistic cultures emphasize aspects of digital relationship maintenance quite differently from individualistic ones in terms of privacy expectations and family involvement, or group instead of dyadic communication preferences [148]. Cross-cultural research revealed certain cross-cultural differences in digital self-presentation, some leaning toward modesty in self-representation while others encouraging more self-promotion and display of individual achievements [149]. These cultural differences may hinder cross-cultural digital relationships and consequently affect the manner in which digital communication platforms are designed and adopted [150]. Another example is power distance and hierarchy orientations affecting digital relationship norms: for some cultures, the high formal communication style maintains clear distinctions of status even in so-called informal digital spaces [151]. Appreciating these cultural differences is imperative for building inclusive digital relationship platforms and for the people who have to engage in cross-cultural digital relationships [152].

### 7.2. Issues of digital consent, surveillance, and data privacy

Digital relationships raise complex questions about consent, privacy, and surveillance that have no clear precedent in offline relationship contexts [153]. The persistent, searchable, and shareable nature of digital communication creates new vulnerabilities and power dynamics in relationships [154]. Digital surveillance within relationships, including monitoring partners' social media activity, location tracking, and message surveillance, represents a growing concern that can undermine trust and autonomy [155]. The ease of digital surveillance may encourage controlling behaviors that would be more difficult to implement in offline relationships [156]. Data privacy concerns extend beyond individual relationships

to include platform collection, analysis, and potential sharing of intimate relationship data [157]. The commercial interests of digital platforms may conflict with user privacy and relationship autonomy, creating ethical dilemmas about the commodification of intimate data [158]. Consent in digital relationships becomes complicated when considering issues like screenshot sharing, viral content distribution, and the permanent nature of digital communication [159]. Traditional consent models may be inadequate for digital contexts where information can be easily copied, shared, and preserved indefinitely [160].

### 7.3. The ethics of intimacy in mediated environments

Mediated intimacy raises ethical questions about authenticity, manipulation, and the responsibilities of both individuals and platforms in facilitating healthy relationships [161]. The design of digital platforms can encourage or discourage certain relationship behaviors, creating ethical responsibilities for technology companies [162]. The potential for deception in digital relationships creates ethical dilemmas about identity representation and relationship honesty [163]. The ease of creating false or misleading digital personas may undermine trust and authenticity in digital relationship formation [164]. Platform design decisions, including algorithmic choices and feature implementations, have ethical implications for relationship formation and maintenance [165]. Features that encourage addiction, comparison, or superficial interaction may harm user well-being and relationship quality [166]. The commercialization of digital relationships through dating apps, social media advertising, and data collection raises questions about whether intimate relationships should be subject to market forces and commercial manipulation [167].

## 8. The role of AI and emerging technologies

### 8.1. AI companions and social robots: Replika, Alexa, and beyond

The emergence of AI companions and social robots represents a fundamental shift in the landscape of social interaction, introducing the possibility of meaningful relationships with artificial entities. Companion robots enhanced with artificial intelligence may one day help alleviate the loneliness epidemic [168], though their integration into human social life raises complex questions about the nature of relationships and social connection. Chatbots are now able to engage in sophisticated conversations with consumers in the domain of relationships, providing a potential coping solution to widescale loneliness [169].

Platforms like Replika have demonstrated that users can form emotional attachments to AI entities, with some users reporting meaningful benefits including emotional support, reduced loneliness, and improved mental health [170]. Many used Replika in multiple, overlapping ways as a friend, a therapist, and an intellectual mirror. Many also held overlapping and often conflicting beliefs about Replika [171], indicating the complex and ambivalent nature of human-AI relationships. Users simultaneously recognize the artificial nature of AI companions while experiencing genuine emotional benefits from the interactions. Research indicates that AI companions may be particularly beneficial for individuals with social anxiety, autism spectrum disorders, or limited access to human social support [172]. However, concerns exist about the potential for AI relationships to substitute for human connections, potentially reducing motivation for human relationship formation and maintenance [173]. The “Companion Robot Impact Scale” (Co-Bot-I-7) has been developed to measure the effects of companion robots on physical health and loneliness, with early results suggesting that well-designed companion systems may indeed provide measurable benefits [174]. Fig. 2 illustrates key ethical considerations in AI-mediated relationships, focusing on privacy, bias, transparency, and user dependency. It highlights the decision pathways for ensuring adequate privacy protections, mitigating algorithmic bias, promoting transparent decision-making, and preventing over-dependence on AI systems. The framework emphasizes the importance of human intervention and regulatory oversight to safeguard user autonomy and psychological well-being, ultimately ensuring ethical AI-mediated relational practices.

## 8.2. Virtual reality and metaverse environments

Virtual Reality (VR) and metaverse platforms are creating new possibilities for immersive digital relationships that more closely approximate physical presence and embodied interaction [175]. These environments enable shared experiences, spatial interaction, and nonverbal communication that may overcome some limitations of traditional digital communication [176]. VR relationships may enable new forms of intimacy through shared virtual experiences, collaborative activities, and embodied presence that feels more “real” than screen-based interaction [177]. The ability to create and inhabit virtual spaces together may facilitate deeper emotional connection and shared meaning-making [178]. However, VR relationships also introduce new challenges including the potential for harassment in immersive environments, questions about consent in virtual physical

interaction, and the psychological effects of spending significant time in alternative realities [179]. The embodied nature of VR interaction may intensify both positive and negative relationship experiences [180]. Metaverse platforms are experimenting with persistent virtual relationships where individuals maintain ongoing connections and shared virtual spaces that exist independently of their physical presence [181]. These persistent virtual relationships may represent new categories of social connection that blend aspects of physical and digital interaction [182].

## 8.3. Implications of generative AI in relationship dynamics

Generative AI technologies are beginning to influence relationship dynamics in multiple ways, from AI-assisted communication to the creation of synthetic relationship content [183]. These technologies may enhance relationship communication by providing suggestion, translation, and mediation services, but also raise concerns about authenticity and human agency [184]. AI-generated content, including synthetic text, images, and videos, may increasingly appear in relationship contexts, potentially undermining trust and creating new forms of deception [185]. The ability to create convincing fake communications, photos, or videos may necessitate new approaches to verification and trust in digital relationships [186]. Generative AI may also influence relationship formation by providing personalized matching, conversation starters, and compatibility analysis based on large datasets of relationship patterns [187]. While these capabilities may improve relationship outcomes, they also raise questions about privacy, agency, and the role of serendipity in human connection [188].

The integration of generative AI into social media platforms may alter relationship dynamics by enabling users to enhance their self-presentation, communication style, or emotional expression beyond their natural capabilities [189]. This AI augmentation of human relationship behavior may fundamentally change what it means to be authentic in digital relationship contexts [190].

## 9. Critical perspectives and debates

### 9.1. Is digital interaction inherently shallow or contextually rich?

A central debate in the field of digital relationship research revolves around whether technology-mediated interaction is inherently limited in its capacity to foster meaningful connections, or whether,

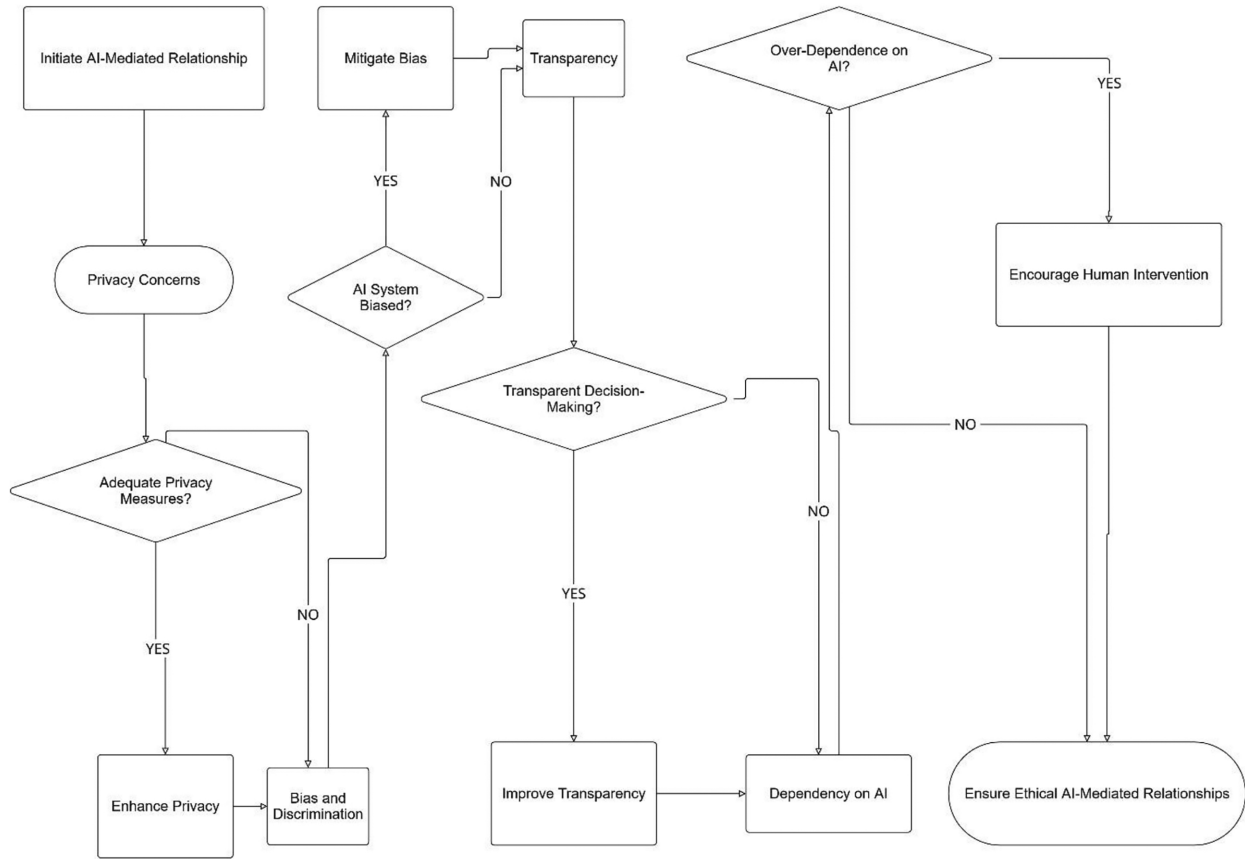


Fig. 2. Ethical decision-making framework for AI-mediated relationships.

under appropriate conditions, digital media can support relationships that are as rich and emotionally satisfying as those formed through face-to-face interaction [191]. On one side of the debate, critics argue that digital communication is fundamentally shallow. They assert that the absence of key elements such as nonverbal cues, physical presence, synchronous timing, and embodied experience limits the emotional depth and authenticity of digital interactions [192]. From this perspective, digital relationships are viewed as inherently superficial, incapable of replicating the nuanced complexity of in-person exchanges [193]. Furthermore, the ease and convenience of digital communication may promote breadth over depth encouraging users to maintain many weak social ties at the expense of fewer, more meaningful bonds [194]. Conversely, proponents of digital relational richness contend that digital relationships can attain comparable levels of intimacy and satisfaction to face-to-face ones, provided that users engage intentionally and invest sufficient time [195]. They argue that digital media afford unique relational advantages, such as the opportunity for more thoughtful self-disclosure, asynchronous

communication that allows for reflection, and the ability to connect across geographical, social, or cultural barriers [196]. Empirical studies have shown that with consistent communication and mutual investment, digitally mediated relationships can cultivate deep emotional bonds, even rivaling those formed in physical settings [197]. Increasingly, contextual factors are recognized as critical in shaping the quality of digital relationships. Emerging research highlights that the perceived richness or shallowness of digital interaction depends on multiple variables, including the design of the communication platform, the users' intentions and relational goals, the duration and stage of the relationship, and individual personality traits or communication preferences [198]. Furthermore, the integration of diverse digital channels such as combining video, text, and shared online experiences as well as the eventual transition to face-to-face meetings, can significantly enhance the depth and authenticity of digital relationships [199]. Table 2 contrasts key characteristics of traditional face-to-face relationships with those mediated by digital technologies. It highlights differences in communication modes, physical proximity,

**Table 2.** Comparison of traditional vs. digital relationships.

Feature	Traditional (Face-to-Face)	Digital (Interface-Mediated)
Nonverbal Cues	Present	Often Absent or Filtered
Communication Timing	Synchronous	Both synchronous & asynchronous
Physical Proximity	Required	Not required
Social Boundaries	Clear	Blurred
Relationship Formation	Serendipitous, social circles	Algorithmic, interest-based
Emotional Expression	Embodied	Textual, visual, symbolic
Privacy Expectations	Higher	Often reduced

social boundaries, emotional expression, and relational expectations, illustrating how digital platforms reshape interpersonal dynamics.

### 9.2. Technological determinism vs. social shaping of technology

The relationship between technology and social behavior in digital relationships reflects broader debates about technological determinism versus social construction of technology [200]. Technological Determinism suggests that digital technologies fundamentally shape and constrain human relationship possibilities, determining how individuals connect, communicate, and relate to one another [201]. From this perspective, platform features, algorithmic decisions, and technological affordances are primary drivers of relationship patterns [202]. Social Shaping Perspective argues that humans actively adapt, resist, and reshape technologies to serve their relationship needs, with social and cultural factors being primary determinants of how technologies are used [203]. Users may subvert intended platform uses, create workarounds for technological limitations, and develop new social practices that transform technology meanings [204]. Co-construction Views propose that technology and social behavior mutually influence each other through ongoing interaction, with neither being fully deterministic [205]. Digital relationship patterns emerge through the ongoing negotiation between technological possibilities and human social needs [206].

### 9.3. Arguments for digital detox vs. digital integration

Contemporary discourse surrounding digital relationships is marked by contrasting perspectives on whether individuals should limit or embrace digital communication technologies. On one side of the debate, digital detox advocates argue that constant connectivity undermines mental health, relationship quality, and overall human well-being [207]. Proponents of this view recommend periodic or sustained disconnection from digital platforms as a strategy to reestablish meaningful face-to-face

interactions, improve emotional resilience, and regain autonomy over one's attention and time [208]. Empirical research supporting this position indicates that reduced use of social media and other digital communication tools is associated with improved mood, lower anxiety levels, and increased life satisfaction [209]. Furthermore, some studies suggest that digital communication may foster addictive behaviors, leading to emotional dysregulation and a diminished capacity for presence in offline relationships, thereby reinforcing the need for intentional disengagement [210]. In contrast, digital integration proponents argue that digital technologies have become indispensable tools for contemporary social connection, and that the challenges they pose should be addressed through improved usage practices rather than avoidance [211]. From this perspective, the solution lies not in retreating from technology, but in cultivating digital literacy, setting healthy boundaries, and using digital platforms with intention and awareness to support, rather than supplant, in-person interactions [212]. Integration-based approaches emphasize the development of skills for maintaining relational health in digital environments, promoting thoughtful engagement, and aligning technology use with one's social and emotional needs [213]. Rather than framing digital communication as inherently harmful, this view sees it as a powerful extension of human relational capacities when guided by conscious and informed practice.

## 10. Future directions and research gaps

### 10.1. Underexplored populations: Elderly, neurodiverse individuals

Contemporary research on digital relationships has disproportionately focused on young, neurotypical populations, leaving substantial gaps in our understanding of how diverse groups engage with and benefit from digital communication technologies [214]. One such underrepresented group is the elderly. Despite increasing rates of digital technology adoption among older adults, scholarly attention to their experiences in forming and maintaining digital

relationships remains limited [215]. This population often encounters unique challenges, including technological barriers, divergent communication preferences, and age-related physical or cognitive changes that can affect their digital engagement [216]. Nonetheless, digital technologies offer crucial opportunities for social connection, particularly for older adults facing mobility limitations, geographic isolation, or the loss of traditional social networks [217]. Future research should explore how older adults adapt to digital relational environments, identify the platforms and features that best support their social needs, and investigate strategies to promote intergenerational digital engagement [218]. Similarly, neurodiverse individuals including those with autism spectrum disorders, attention-deficit/hyperactivity disorder (ADHD), social anxiety, and other neurological differences face distinct opportunities and obstacles in digital relational contexts [219]. While mediated communication may alleviate some interpersonal pressures by offering asynchronous and less sensory-intensive modes of interaction, it may also introduce novel cognitive, emotional, or social challenges [220]. For many neurodivergent users, digital spaces can foster meaningful social connections that might be difficult to establish in face-to-face settings. However, the design of these platforms may inadvertently exclude or frustrate users due to lack of accessibility, inclusive features, or sensitivity to neurodiverse communication styles [221]. Greater attention to these experiences is vital for developing digital relationship technologies that are inclusive, equitable, and responsive to the needs of all users [222].

### *10.2. Longitudinal effects of sustained digital interaction*

Most existing research on digital relationships has relied on cross-sectional designs or short-term investigations, leaving critical questions about their long-term effects insufficiently addressed [223]. A comprehensive understanding of the sustained impacts of digital relationship engagement is essential to evaluating both the potential benefits and risks associated with these technologies over time [224]. One area requiring deeper investigation is the developmental impact of prolonged digital relationship use during formative life stages. Specifically, there is a need for longitudinal studies examining how extensive exposure to digital communication in childhood and adolescence influences adult relationship competencies, expectations, and satisfaction [225]. It remains unclear whether digital-native generations will continue to exhibit distinct relational behaviors

into adulthood or whether they will eventually conform to more traditional patterns of interpersonal interaction as they age [226]. Another crucial but underexplored area is relationship trajectory research. There is limited evidence on how digital relationships evolve over time, including the factors that contribute to their longevity, dissolution, or transition from online to offline settings [227]. Understanding these dynamics is essential for informing both individual decision-making in relationships and the development of platform features that support healthy and enduring connections [228]. Additionally, while short-term studies have highlighted a range of mental health outcomes both positive and negative related to digital relationship participation, the long-term psychological effects remain largely unknown [229]. Future longitudinal research should explore cumulative emotional impacts, individual adaptation mechanisms, and interindividual differences to better understand how digital relationship practices shape mental health across the life course [230].

### *10.3. Ethical AI and emotionally intelligent interfaces*

As artificial intelligence systems become increasingly sophisticated and emotionally responsive, there is a growing need for robust ethical frameworks to guide their design, implementation, and integration into human relational life [231]. The emergence of emotional AI systems capable of recognizing, responding to, and potentially influencing human emotions raises complex ethical concerns surrounding informed consent, user autonomy, and psychological safety [232]. This is particularly salient for AI technologies that provide emotional support, engage in romantic or companionship roles, or offer therapeutic interactions. In such contexts, ethical guidelines must be established to ensure that users are protected from manipulation, overdependence, or emotional harm [233]. One critical area of concern is transparency and user agency. Individuals engaging with AI companions or emotionally intelligent systems must have a clear understanding of the capabilities, boundaries, and artificial nature of these entities in order to make informed decisions about their emotional investment and relational expectations [234]. Research is needed to determine how best to communicate these limitations without undermining the potentially beneficial aspects of human-AI interaction, such as emotional comfort, companionship, or support in times of loneliness [235]. Moreover, the long-term ethical implications of emotional relationships with AI warrant deeper exploration. As AI companions become more personalized and integrated into daily life, ethical questions arise around the

potential for emotional dependency, the commodification of emotional labor, and the consequences of system discontinuation or modification by developers or commercial providers [236]. Frameworks must be developed to address how users' emotional investments in AI relationships can be acknowledged and protected [237].

Vulnerable populations including children, elderly individuals, and people with mental health challenges require particular ethical attention in this evolving landscape [238]. These groups may derive meaningful benefits from emotionally supportive AI systems, yet they are also at higher risk of exploitation, misunderstanding, or harm. Targeted research is necessary to evaluate the specific risks and advantages for these users, and to develop protective measures that ensure ethical implementation of AI relationship technologies in sensitive contexts [239]. Looking forward, the future of digital relationships is poised to involve not only AI-mediated communication but also immersive virtual environments and novel forms of emotional engagement between humans and machines. Addressing these developments will require interdisciplinary collaboration that integrates psychological insight, technological innovation, sociocultural understanding, and ethical reflection to support the responsible evolution of human relationships in digital contexts [240].

## 11. Conclusion

Digital technologies have ushered in a paradigm shift in how humans initiate, maintain, and conceptualize their relationships. While these tools offer powerful means of enhancing social connection transcending geographic, temporal, and social boundaries they also introduce complex challenges related to authenticity, intimacy, mental health, and ethical design. The review reveals that digital relationships are not inherently shallow or enriching; rather, their quality and impact are contingent upon individual, contextual, and technological factors. As platforms increasingly mediate human interaction, it becomes imperative to consider how design choices, social norms, and user education shape relational experiences. Importantly, the voices and experiences of underrepresented groups such as older adults, neurodiverse individuals, and those in long-distance relationships must be better integrated into research agendas. Furthermore, with the rapid rise of emotionally responsive AI systems, ethical frameworks must evolve to protect user autonomy, emotional well-being, and relational integrity. Ultimately, understanding and guiding the digital evolution of

human relationships requires sustained interdisciplinary collaboration, critical inquiry, and a commitment to prioritizing human needs in technological innovation.

## Conflict of interest

The authors have no relevant financial or non-financial interests to disclose.

## Author contribution

Zainb I. Mohammed and Lina M. Shaker contributed equally to this work.

Conceptualization: Zainb I. Mohammed, Lina M. Shaker

Literature Review: Lina M. Shaker

Thematic Analysis & Synthesis: Zainb I. Mohammed  
Writing — Original Draft: Zainb I. Mohammed

Writing — Review & Editing: Lina M. Shaker

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Both authors contributed substantially to the development of the manuscript and approved the final version for submission.

## Data availability

No datasets were generated or analyzed during the current study.

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