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24.1 Introduction

Technology alters how people feel, creates outlets for people to express their emotions, and provides social scientists with new tools and data on emotions. Because both emotions and technology are studied from a variety of disciplines, their intersection, likewise, can be examined from different viewpoints. This chapter presents a sociological approach to technology and emotions, relying not only on sociology literature and theory but also a wider sample of social science research.

There are many different definitions of technology, and here I leave it broadly defined as my purpose is to survey a range of scholarship which purports different interpretations and definitions. Given the limited space in this chapter, I neglect certain topics, such as emotions in cultural movements brought about by technology (e.g., fear of new weapons), emotions surrounding a philosophic position about technology (e.g., social construction of technology), or affective outcomes due to long-term economic and demographic changes undergirded by technology (e.g., modern sewage, highway, or aviation systems). Instead of pre-electric, specialized, industrial, or military technology, I concentrate primarily on the widely-available, modern, digital, information and communication technology.

First however, I frame the context of emotions and technology by briefly noting the historical

and cultural progression of emotion is concurrent with the world's technological developments. Emotions allowed early humans to interact with larger numbers of potentially unknown others (Turner 2000) setting the stage for the development of more complex societies, which simultaneously required developments in production, organizational, and survival technologies (Nolan and Lenski 1996). As humans evolved, rational thought developed and was reinforced by the culture of advanced technologies.

Human neurological developments, however, preferred emotion first and rationality later, leading to an asymmetrical relationship between the two (Massey 2002): emotions often influence, overwhelm, or bypass rational thinking, whereas rational thinking is slower, more systematic, and less influential over emotions (Damasio 1994; Goleman 2006; Turner 2000). This is why in a modernist culture that elevates rationality, science, and technology above emotion, social scientists continue to argue that socioemotional bonds guide much human thought and behavior (Frank 1988; Heise 2007; Illouz 2007; Lawler et al. 2009; Massey 2002). This distinction also provides a major division between the capacities of humans and the digital computer technology I focus on in this chapter. While modern computer technology often surpasses humans in rational tasks based on calculations, memory, and algorithms, machines currently do comparatively worse on what I would call emotion-centered tasks: those involving the mind (Wolfe 1991), emotional and social intelligence (Goleman 2006), sociolinguistic interaction (Christian

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2011), aesthetic judgments, creativity, and humor (Kurzweil 2000).

I develop the chapter in four sections, generally progressing from broader, macrosociological issues to more specific microsociological topics. First, I overview the contemporary social structure of technology, including how both emotions lead to technology use and technology use influences emotions. In this section I also consider the case of how youth use technology, particularly within the context of families. Second, I examine how affective processes manifest and change when interacting with others over communication technologies, especially the Internet. This discussion includes how mediated interactions through technologies exist in a variety of forms that impact affective processes. Within this section I focus on the substantive transformations in the areas of mediated work, virtual worlds, and online romance as three contexts where mediation technology has greatly affected the social and relational landscape.

Third, I turn to emotions in human-computer interaction including the cultural and affective consequences when human sociality is directed toward machines. This section incorporates social theories of emotion when interacting with computers and robots, and how those theories can be incorporated in the design of machines. Fourth, I break from topical and substantive coverage of the chapter to consider technologically innovative methodologies such as big data analysis, new Internet methodologies, non-invasive emotion measurement, and experiential sampling. These methods are important and timely as advances in emotions research often utilize cutting-edge methodological developments to obtain more precise or novel data. I conclude with ideas for future research, with a specific emphasis on how sociology of emotion theories can be extended and applied to research on technology.

24.2 Emotions and the Use of Technology

The use of technologies can be intricately tied to affective processes, both with emotions altering technology use patterns and technology

use altering one's emotional state. I begin with an argument that the culture built around modern technologies has increased people's negative emotions and pathologies (Stivers 2004). This argument suggests that people experience increased anxiety from the abundance of stimuli, stress from the always-on nature of information and communication technology, and fear from the media's information soundbites of worldwide events. Some empirical studies correspond to this assessment, finding, for example, that media multitasking is associated with anxiety, depression and lack of well-being (Becker et al. 2013). Similarly, heavy gaming increases multiple forms of anxiety (Mehroof and Griffiths 2010) while decreasing the quality of interpersonal relationships (Lo et al. 2005).

In contrast, others find opposite trends. Using the Internet for gaming and entertainment can be associated with greater happiness (Mitchell et al. 2011). For older adults, using the Internet can increase well-being and reduce depression (Cotten et al. 2012), while for distressed adolescents, communicating online can increase emotional well-being (Dolev-Cohen and Barak 2013). Using the Internet for health purposes is associated with decreased psychological distress, however Internet users engaging in a greater number of online health behaviors have increased levels of distress (Cotten et al. 2011). Overall, as these few studies indicate, technology use can lead to both positive and negative emotions, conditioned on how often people use technology and for what purposes. The overarching trend is for moderate technology use to produce positive outcomes, whereas extremely high, obsessive, or addictive use typically leads to negative affective consequences.

Evidence also indicates support for the reverse causal direction: emotions, both positive and negative, can be the catalyst for increased technology use. Lonely people go online more than the non-lonely and they go online when they feel depressed, anxious, or desire emotional support (Morahan-Martin and Schumacher 2003), allowing for the positive experience of engaging in social interaction in the online context (Bonetti et al. 2010). Those reporting high anxiety in fact benefit the most from using mediated, online

communication compared to traditional face-to-face communication (Yen et al. 2012). One example of the complexity of emotions leading to differential technology use involves bank managers. Bank managers' experiences of happiness increased their levels of information technology use, whereas their anger and anxiety had mixed—both positive and negative—direct and indirect effects on information technology use (Beaudry and Pinsonneault 2010). Based on the circumstances, it is reasonable that both positive and negative emotions could increase (or decrease) technology use. This is because emotions are often catalysts to take action—fighting, withdrawing, and seeking information, social contact, and support—which can lead to changes in needs or desires to access different technologies depending on the specific situation.

Technology use is a particularly affect-laden issue within the family. Parents often guide and oversee their children's technology use, while those same children may possess superior knowledge on how to use digital technologies. Parents frequently use technology to enable or restrict relational, education, and socioeconomic goals, enhanced by their worrying about issues such as Internet addiction, bullying, cyberstalking, violent video games, and their children's online encounters. One perspective on this is parental mediation theory, which traditionally considers how parents restricted media, especially television, in order to reduce the negative effects of prolonged exposure (Clark 2011). More recent scholarship reveals that parents engage in emotion work for a variety of purposes: to restrict media, to monitor or keep in touch with their children, and to promote values of trust, independence, or family. This follows from not only their values and experience with digital technologies, but from socioeconomic status and resources (Clark 2013).

It is not surprising that parents respond to technology in multiple, sometimes contradictory, ways given the trends in technology and media use among youth. Children and teenagers consistently report the highest levels of technology and media usage including mobile phone use, computer and Internet use, video game playing, and accessing of social media (Lenhart et al. 2010).

Video games, a particularly salient concern for parents, can produce antisocial behavior and negative emotions in children. Heavy video game use produces long-term aggression in all children (Anderson et al. 2010), especially boys (Hofferth 2010), and is associated with negative emotions such as social anxiety (Mehroof and Griffiths 2010). Even with high levels of technology use on average, the “digital natives” generation is not monolithic in their use of technology (Hargittai and Hinnant 2008). Not only are family values and resources incredibly influential in technology use (Clark 2013), but social networks and personal interests in technology and media subcultures shape youth's technology and media engagement (Ito 2010). Therefore, youth's emotions involved in issues of technology use depend on a range of interpersonal, family, cultural, and personality factors as well as the particular use of the technology. Next, I examine one of the most important uses of technology for both youth and adults: communicating and interacting with others.

24.3 The Mediation of Emotion via Technology

Individuals often use computers and computerized devices to mediate and thereby influence their emotions in communication and social interaction. These mediated interactions both replicate and expand traditional forms of offline communication as well as creating new possibilities and new areas for interaction. I focus on those that have been most transformative, that are heavily associated with traditional social institutions, and that illuminate the greatest use of emotions and affect: work, virtual worlds, and online relationships. Before exploring those domains, it is important to understand the different forms of affective mediation.

24.3.1 Forms of Affective Mediation

Similar to face-to-face interaction, technologically mediated communication can be both task-oriented and socioemotionally-oriented,

although much research will focus on one to the exclusion of the other (see Lui 2002 for an overview and comparison). How emotions can be conveyed through technology depends primarily on the number of channels, synchronization, and directionality of that technology. The number of channels concerns the presence and amount of visual and auditory information, and how similar or distant this is from face-to-face interaction. This suggests that if fully immersed in a realistic virtual environment, one's emotions should operate similarly to face-to-face settings, whereas simple one-channel mediation such as text (e.g., letters, instant messages, text messages, emails) or audio (e.g., phones) restricts the amount of information conveyed (Menchik and Tian 2008).

In face-to-face interaction, facial cues convey a great deal of information including affective information (Ekman and Friesen 2003). In mediated communications, people may identify different emotions using one's mouth and eyes based on their cultural orientation toward which part of the face is most dominant for expressing emotion. In both real faces and emoticons, Americans perceive more information about emotions through observing the mouth, whereas Japanese conclude more based on the eyes (Yuki et al. 2007). A relatively new channel present in some advanced technologies is affective haptics or mediated social touch (Levy 2007; Tsetserukou and Neviarouskaya 2012). Affective haptics enable people to hug, feel, and experience sensory perception from other people at a distance, for example people in the virtual world *Second Life*. The haptic technologies include belts which can simulate hugs, warming and cooling devices, ticking devices, and simulated heartbeat devices, which in specific combinations can artificially enhance the wearer's feelings or simulate the emotions of another (Tsetserukou and Neviarouskaya 2012).

Greater numbers of communication channels can convey greater amounts of affective information, yet minimal channel interaction is often used to express or interpret emotion. Humans are especially good at filling in information and making social judgments with only minimal information, and the attributions made in this process

are fundamental to emotions (Weiner 1986). In both minimal-channel mediated and face-to-face interaction, people must engage in cognitive processing to interpret the intentions, motivations, and beliefs of others. Nonverbal communication serves, among other things, to display one's emotions, and when these display signals are not present in mediated communication, people often compensate with detailed cognitive explanations and other forms of emphasis (Menchik and Tian 2008). These schema and explicit emotional emphasis evoke questions about how emotions in mediated interaction might not parallel emotional processes in face-to-face interaction. One might ask: to what degree does a lack of channels lead to more cognitive stereotyping of others as the exemplars of their social groups, therefore changing one's emotional reaction? Or, does the flow of emotion, its expression, and its management in conversation become disrupted in mediated interaction in such a way as to enhance or diminish particular emotions? Both of these are important questions for researchers.

While the number of information channels determines the type and amount of information conveyed, a second factor in mediated interaction is synchrony—whether communication is simultaneous or not. Synchronous communication includes instant messages, interacting in a virtual environment, or talking on the phone, whereas asynchronous communication includes email, blogs, and profiles such as on a dating site. While this division is important for considering technological mediation, it applies equally to the less technological conversation forms, such as talking in person and written letters. It is no surprise that synchrony could be important for emotions, which are ephemeral. However, specific predictions about the effect of synchrony on emotions may depend on one's theoretical assumptions. Following a Durkheimian perspective on emotion, both asynchrony and restricted channels suggest that mediated communication lacks the co-presence necessary in order to facilitate emotional energy. In contrast, from the perspective of symbolic interactionism, emotion can ensue from any interaction, real or imagined (McCall 2006)—a wide berth that could encompass mini-

mal or more extensive channel interactions that are either synchronous or asynchronous.

While a great deal of technology-mediated communication is two way, technology also allows for more restrictive directionalities: one-way, primarily one-way, or one-to-many communication. Blogs, newsletters, websites, and webcams enable one to communicate with an audience not defined in advance by time and place. At one extreme is video surveillance where the parties often do not know each other, do not meet, and most often are not intentionally communicating. Surveillance workers observe a wide range of human behaviors without direct communication or interactive responses. Surveillance workers experience mixed emotions as they negotiate the boundaries between being professionally dispassionate while observing and interpreting acts such as violence, vandalism, and in general nonnormative behavior (Smith 2012). This often leads to longer-term fear, stress, and distrust and a distorted view of the world referred to as a “damaged subjectivity” (Smith 2012).

At the other extreme might be one-to-many posting for which one hopes to elicit responses from others. Whether posting a microblog update (e.g., Twitter), a blog, a news story, or a video, the poster typically controls the content or moderates the responses to the mediated communication. Within social movements, posting and communication on social networking sites, websites, and to mobile devices can be used to carefully facilitate an emotional tenure of a group. For example, one regional chapter of the Tea Party used Facebook to coordinate in person rallies and build up support by carefully monitoring and shaping online comments to focus people on the Tea Party’s message (Rohlinger and Klein 2014). Technological platforms both enabled Tea Party members to individually post and communicate, while at the same time allowing the group’s leaders to refocus the emotional energy through carefully crafting, controlling, and monitoring the posted content. Forms of affective mediation manifest themselves differently in different substantive contexts, so now I consider three such contexts that have been transformed by digital interaction over the Internet.

24.3.2 Areas of Affective Mediation: Work, Worlds, and Romance

A major context of affective mediation is paid labor, where telecommuting and Internet-based communication have become quite common. Emotions are central to work, especially service oriented work, which often involves emotional labor, that is an effort to control, express, and manage ones’ emotions to conform to the job’s rules and requirements. Technology can shape emotional labor as well as the culture of the workplace by enabling new arrangements between work and personal time and space.

Melissa Gregg in her book *Work’s Intimacy* (2011) finds that technology-enabled arrangements, such as home and mobile offices, being on call, and being able to monitor and check work-related information away from the office, are hailed as solutions to utilize wasted time and to keep abreast of important projects. In reality, she finds these often backfire, breaking down traditional barriers between work and home, occupation and intimacy, and personal and professional. Workers often spend additional hours checking email or doing other work-related tasks in order to keep up with the demands of their job, usually without additional compensation. Further they engage in impression management and emotional expression management through technological communication in order to insure that lack of face time is not equated with lack of commitment to work (Gregg 2011). This is especially prominent in those companies that still hold to the traditional work values of a nine-to-five work day.

Workers in some jobs, such as on-call personnel and traveling journalists, find it difficult to separate work from personal lives as the time and space is not clearly designated for one or the other. In her conclusion, Gregg cautions the reader regarding the dominance of work by comparing it with a Marxian perspective. Exploited workers in poor countries often have a “loveless” relationship with their work, displayed in coercion, lack of autonomy, and alienation. Modern white-collar workers—empowered by technology—are “lovers” in their relationship to their

work, giving and sacrificing emotion labor, personal time and space, and other intimate relationships for a possibility of a satisfying career or job (Gregg 2011).

In contrast to the demands of paid labor, people often choose to spend their leisure time online or engaged with technology. Perhaps the most immersive social environments are massively multiplayer online games and virtual worlds. Online games and indeed all games can be important for relaxation, entertainment, communication and connection, and solving real world problems (McGonigal 2011). Massively multiplayer online games (including massively multiplayer online role playing games) are an especially fascinating sociological phenomena because of their scope: millions of players are registered and actively play. Some have argued that online gaming has profound implications for the real world if people are drawn in mass to the pleasures of the virtual worlds (Castronova 2007), whereas others analyze how gaming worlds have their own cultures which reproduce some elements of real world cultures while also transforming them (Bainbridge 2013).

Virtual worlds and online game worlds are similar, but virtual worlds tend to have fewer rules and instead reproduce more mundane life activities. *Second Life*, currently one of the most popular virtual worlds, allows people to reproduce real world objects, places, and activities such as building houses, selling wares, interacting with others, exploring, creating, and learning (Boellstorff 2008). The emphasis is that it is “Your World. Your Imagination” (*Second Life’s* slogan) instead of an imposed environment for a particular purpose.

Aside from reproducing actual world activities, *Second Life* expands people’s ability to engage in activities within it that cannot be accomplished in the actual world: flying without equipment, existing as an animal, extensively changing one’s body, teleporting, and engaging in side conversations without any bodily manifestations of communicating. Despite these capabilities, most people using *Second Life* focus their time on interactions with other people such as buying, selling, conversations, classes, sexual encoun-

ters, and celebratory or commemorative events (Boellstorff 2008). It is no surprise that many report a range of emotions that go along with these fairly typical social interactions. One major difference is that these activities are sped up both in time and emotional intensity in comparison to the actual world activities (Boellstorff 2008). People make friends, date, invite people to their *Second Life* houses, attend events with strangers, and more quickly express opinions and beliefs than is typical of actual world activities. One resident commented that “it is very intense here. The emotions and feelings are magnified...The time you spend with someone here is more, and you can feel it” (Boellstorff 2008, p. 159). Time speed-up is not surprising both because people feel less inhibited to engage in conversation or particular behaviors in an online environment (Joinson 2007) and because different environments and emotional situations lead individuals to experience time differently (Flaherty 1999). A similar speed-up process commonly occurs in other mediated online interactions with strangers such as online dating.

Websites for finding dates and romantic partners are tied to emotions, perhaps more than any other mediated form of interaction. When one first signs up, he or she may be first overwhelmed, excited, or nervous, then, as contact with potential matches are made, ambivalent, fearful, or blissful (Bridges 2012). Fear and distrust are common feelings throughout the online dating process, especially for those that have had negative experiences with relationships, on or offline. Many of the feelings present in online relationship seeking are similar to their offline counterpart: fear of intimacy, attraction and rejection, and dealing with emotional baggage (Bridges 2012).

While one difference between online and offline dating is the speed and intensity in the online dating context, other processes are specific to the structure of online relationship sites. Due to the competition over potential matches, romance-seekers want to make their own profile as desirable as possible leading them to both selectively disclose and lie outright about themselves (Bridges 2012). Profiles are the part of the dating

website where one displays personal information and often a photograph in order to facilitate finding potential matches, and are therefore the first, and often last, point of contact for potential suitors. Profile creators balance their desire to present an authentic version of their self with a more desirable, attractive version of their self (Whitty 2007). Sometimes their profile projects the self they would like to become or reflects the cultural scripts of what is desirable (Illouz 2007), instead of a more authentic self-reflection. Though the data indicates that most people are not completely honest in their profiles (Bridges 2012; Whitty 2007), this critique is countered with evidence for similar levels of lying to a romantic partner for relationships begun both online and offline (Albright 2007).

Lying also occurs to compensate for the mismatch of online daters' objectives which range from one time or short term relationship sexual partners to longer term relationships with the hopes of marriage. Still others join the dating websites to boost their self-esteem and emotional health through the positive attention of others' responses, comments, and emails (Bridges 2012). Many sign up because prior relationships, including marriages, have ended, leaving them desperate to find someone to fill the void, while others are simply curious about who they might meet. With such a range of motivations, life goals, and emotional needs among individuals populating dating sites, it is no surprise that many relationships do not work out, often because one person determines they are in a "different place" in their life in regards to romantic attachment (Bridges 2012). It also becomes easier for those seeking romance online to disregard others. The sites lure individuals into a capitalist mindset when they codify their personality and preferences into standard formats, market themselves as a product, and implicitly enter in to competition with thousands of others (Illouz 2007). To best accomplish these goals people often routinize and standardize their profile, criteria, first emails, get-to-know-you questions, and even first dates (Illouz 2007) in a Weberian process of rationalization of the traditionally affective and intimate. As markets develop around

the intimate, people turn to professionals to manage aspects of their relational and intimate life, such as "love coaches" who assist people in marketing themselves on dating websites and guide them through the process of dating (Hochschild 2012).

This rationalization and commercialism does not mean that emotion is absent from the entire process. On the contrary, most people experience the actual communication between potential matches as exhilarating, meaningful, and emotion-filled. At the beginning of a budding relationship, these emotions are expressed through the frequent and intense written conversations, all the while replacing the nonverbal cues of face-to-face interaction (Baker 2007). These written communications regularly disclose large amounts of personal, affect-laden information due to the mask of mediated communication, access to personal profile information, and the targeted, rather than a naturally-forming, relationship situation (Bridges 2012). Because of the heightened emotions associated with initial contact and the lack of experiential information on the other person, people often imagine and fantasize about the other by filling in the gaps in their knowledge. A Goffmanian approach suggests that the lack of bodily copresence explains why the in-person meeting is disappointing for so many. One's self-presentation, centered in the body, cannot be captured in the categorical and disembodied profile information, but requires a give and take of fluid affective conversation and nonverbal signaling (Illouz 2007).

Although online dating websites provide outlets for many, technology-mediated romance is not limited to those dating websites. Sometimes people who briefly meet or even just notice someone in the actual world attempt to connect with this stranger through the means of technology. On Craigslist's Missed Connections individuals leave messages for people they encountered offline, but have no way to contact. By leaving a message for a romantic interest that is a practical stranger and unlikely to find the message, these posters engage in cultural scripts about love, evoking both the possibility of love and the failure of love (Forstie 2013). While not a two-way

mediation, television too is a potent transmitter of romance, intimacy, and emotion. While romance on television is not new, some argue that there is a stronger affective draw of reality television compared to other programming (Kavka 2008). This stems from its amplification of the form of intimacy that television delivers: one-to-many public communication of the most private and intimate of situations.

Humans engage with technology to pursue romance or intimacy, hoping it will bring them happiness, but technology has a negative side when it comes to ending relationships or unwanted romantic interest. While there is a strong norm against breaking up through communication technology, it is still a common strategy to avoid the emotional confrontation of a face-to-face breakup (Gershon 2010). Much worse than a breakup, cyberstalking—stalking someone using electronic communication or the Internet—is also common, especially from former romantic partners, regardless of whether that relationship began online or not (Jerin and Dolinsky 2007). Scholars argue whether those who have tendencies toward obsession, addiction, and stalking behavior are simply manifesting it online (Spitzberg and Cupach 2007), or if those simply searching for relationships are drawn in by the illusion of intimacy (Bridges 2012). Because there is “very limited research on actual and perceived risk of victimization as a result of engaging in online relationships,” (Jerin and Dolinsky 2007, p. 152) “little to nothing is known about the motives of cyberstalkers” (Spitzberg and Cupach 2007, p. 138). Mediated stalking can utilize social networks, mobile communication, and public data, thereby situating it as another important topic for future research at the intersection of social emotions and technology.

In this section, I have highlighted some of the most technologically profound and emotionally evocative areas of research: the workplace, social worlds and games, and online dating and mediated romance, while neglecting many other areas such as auction websites, social networking, pornography, sexting, cyber bullying, and crowd sourcing. Next, I turn to interactions with technology itself.

24.4 Emotions in Interaction with Technology

Technology can be the basis for emotional reactions due to its novelty, ability, malfunctions, or social function. In this section, I focus on how technology changes individuals’ emotions on its own, not as a medium for transmitting social and emotionally charged actions. People interact with all types of objects, nonhumans, and technology and do so in social ways (Cerulo 2009). These interactions with technology have implications for interactants’ emotions, networks, relationships, and cultural beliefs about technology and humanity.

I start this section by considering Sherry Turkle’s research which focuses on the implications for individuals in a society which replaces ties to humans with ties to computers and robots (2011). By looking at a broad swath of technologies and cultural practices that have developed alongside those technologies, she argues that cheap and stable technologies are replacing the often socially-challenging interpersonal relationship. People’s desire to care for the elderly without frequent visits and to augment raising children with media indicates, to Turkle, the dangers of technological innovation. She argues that without careful consideration, we as a society may end up denigrating the intimate relationships most find important (Turkle 2011), because people invest themselves emotionally into technological objects and creations (Turkle 1984/2005).

While Turkle’s tone is cautious, even pessimistic, others such as David Levy (2007) are more optimistic about humanity’s emotional relationship with robots and technologies. He argues that the progression of these technologies into caretaking and intimate roles primarily fulfill unmet needs and, therefore, are a technological triumph in the area of interpersonal relationships. As his title *Love and Sex with Robots* (Levy 2007) suggests, the most intimate desires will soon be met by machines, once the technology develops and our cultural view of machines changes from hard plastic and metal laptops, phones, and ATMs, to the softer, human-looking

and human-acting androids. Turkle's volume (2011) responds directly to his philosophic stance and his book by asking: are the conveniences and self-fulfillment are worth the costs of loneliness and emotional disconnection? Levy (2007) counters that the emotions and relationships with machines are equally as real with equally real socioemotional effects.

I would like to consider this Turkle-Levy debate—a relational version of technological utopianism and dystopianism—in the context of a larger debate in the social sciences about the strength of interpersonal and affective ties. The sociological debate began when scholars asked if community involvement and close friendships are on a decline in the United States (McPherson et al. 2006; Putnam 2001), potentially due to people's use of technology and other cultural or structural factors. Part of the response considered how people adapt and transform the ways they make affective ties and maintain those ties in the face of a commercial, networked, and mediated world (Lawler et al. 2009; Rainie and Wellman 2012; Wang and Wellman 2010). While there is no doubt that technology has played a role in changing social relationships, intimacies, and even definitions of friendship, few studies address how technologies might or might not be substitutable for affective relationships with people. The technological capacity to emulate human behavior, appearance, and emotions using artificial intelligence techniques (Levy 2007) poses a new challenge to strong affective bonds traditionally reserved for person-to-person relationships.

While both Turkle and Levy find examples supporting their arguments, a theoretical research program could link the affective outcomes of human-technology interaction with the larger societal trends. To me, this is the most important issue in the research domain of emotions and technology, and a particularly appropriate undertaking for sociologists. I review some research and theory that has contributed to this issue, specifically those focused on how human interaction with technology alters emotions, behaviors, and social life.

24.4.1 Theory and Research on Interaction with Technology

One theory, actor-network theory, argues for the direct inclusion of technological objects and other nonhumans into sociological analysis. Its theoretical argument involves deconstructing the presupposition that humans are the only agentic actors in interactions. Instead, actor-network theorists consider that objects or networks of objects can be studied as the producers of actions (Latour 2005). These interactions are often imbued with emotional significance for the object especially when it is both important to people and complex enough to produce different—i.e., not completely predictable—results (Law and Singleton 2005). For example, scientific equipment can be central to a research process, and can express a human-like difficulty in terms of technical malfunctions, usability, and results, leading to emotional responses about that technology (Walby and Spencer 2012).

Another theoretical program, *computers are social actors*, replicates social psychological experiments replacing a human partner with a computer agent, robot, or other machine (Nass and Yen 2010; Reeves and Nass 1996). The results from this program indicate most classic psychological experiments produce analogous trends when one's interaction partner is technological. The *computers are social actors* argument is two-fold: first, humans react to agents in similar ways as they would to other humans (Reeves and Nass 1996); and second, this is based on automaticity or mindless processing (Kim and Sundar 2012). Studies in this tradition focus on a range of topics including personality traits, norms, communication cues, cooperation, and emotion.

Often when a computer engages in a positively or negatively evaluated behavior the resulting emotions of its human interactant are exactly what would be expected from the parallel human-human interaction (Ferdig and Mishra 2004). For example, when a computer agent displays other-oriented or empathic emotion participants respond with rating the computer agent as more likeable, supportive, and trustworthy (Brave et al. 2005). In contrast, when the agent displays

self-oriented emotions, people do not alter their view of the agent. When computer agents or robots exhibit more displays of realism—visually, linguistically, socially, and emotionally—people tend to respond in traditional social ways, i.e., as humans do to each other. This parallels the findings in human mediated communication, in which a greater number of affective mediation channels lead to increased emotional and affective communication.

Several studies employ direct comparisons of human-agent interaction with human-human interaction, often using mediated interaction to control for features and status markers of the humans and agents. These studies are particularly important for application of sociological theories of interaction, which tend to be more macro than theories in communication, human-computer interaction, and psychology. If in fact the most social elements of interaction are retained when one is interacting with a nonhuman digital or mechanical partner, then theories constructed for evaluating humans can easily be adapted to interaction with technology. In contrast, if there are differences and these differences are systematic, then theory must be developed and expanded to bridge the human-only and human-computer interaction divide.

When interacting with human versus computer partners some report no emotion differences after one shot interactions (Ferdig and Mishra 2004) while others find differences after more sustained interactions (Shank 2013). In one study, interaction with a computer or human altered one's emotional outcomes by decreasing the strength of receiving a positive or negative outcome on being angry and upset (Shank 2013). An individual's perception of an interactant as a computer agent instead of a human weakens the perceivers' reactions including some emotions, behavior, and impressions of justice and goodness (Shank 2012, 2013). The research on interactions with computers not only contributes to the debate about affective bonds in society, but also contributes to the foundational knowledge from which engineers, programmers, and scholars can incorporate theoretical models of emotion into computer agent design.

24.4.2 Designing Computer Agents based on Theories of Emotion

Incorporating theory on emotional intelligence and expression into the design of virtual agents—known as affective computing (Picard 1997)—improves agent's ability to approximate human behavior and therefore the realism of the human-agent interaction. One part of this is a consistency among the agent's speech, actions, and non-verbal communication (Brave and Nass 2008). Because emotion is primarily expressed through the face, coding human facial expressions into agents constitutes a major step in affective human-agent interaction. Based on Ekman's facial action coding system (Ekman and Friesen 2003) researchers have been able to create robotic faces that emulate human facial movements (Wu et al. 2009) as well as computer agents that change their facial expressions based on emotions (Rosis et al. 2003).

Appraisal theories are commonly used to develop a mental model of emotions for computer agents (Scherer et al. 2010) basing the agent's reactions on a cognitive structure and attributions of causality for events that concern them (Ortony et al. 1988). For sociologists, the most relevant research incorporates multiple social factors—including emotions, relationships, identity, and culture—into the mental model of an agent. Few sociological theories have been applied in this way; however some affect control theorists are developing research and design toward this end. Affect control theory (Heise 2007), which provides theoretical connections among social interactions, emotions, and identities within a cultural context, can be extended to account for the related emotional facial expressions of virtual agents (Heise 2004) and the functioning of such agents in virtual worlds. Because affect and identity are key components both in social interaction and virtual worlds, interaction follows similar affective processes to the extent that virtual worlds allow for social, personal, and environmental presence (Troyer 2008).

To determine if affect control theory's predictions could be applied to interaction with technological agents, it is necessary to have data on

technological agents and expansion of the theoretical model to include nonhumans. One pilot data collection of technological terms indicates a close correspondence between human-human and human-technology interactions (Troyer 2004). A larger affect control theory dictionary of the sentiments of 80 technological items includes those that could be classified as social actors, settings, or actions dealing with technology (Shank 2010a). Comparing the sentiments of technology terms with other affect control theory dictionaries confirms that technology terms conform to similar distributions as non-technology terms (Shank 2010a). Affect control theory can model several types of human-nonhuman interactions, including humans' trust in technological agents (Shank 2010b) and how the design of technological and nontechnological products elicits human emotions (Lulham 2013). A formal Bayesian model of affect control theory extends the theory to incorporate learning from past interactions and therefore could allow autonomous agents to probabilistically determine an interactant's identity (Hoey et al. 2013).

For a computer agent to competently interact with humans the agent requires implementation of wide range of social, mental and physical processes. Most sociological theories do not cover all of these, focusing on affective, interactive, or cultural processes instead of cognitive or physiological processes. One solution, modeled itself on computer programming, is to modularize theories, essentially allowing different theoretical components to be added or removed according to need (Markovsky 2010). This would allow for the reciprocal and iterative development of computer agents and sociological theory.

24.5 Technology-Based Methodologies

While this chapter has primarily focused on theoretical and empirical developments, I turn now to a discussion of methodological developments. Technology-enabled methods including big data analysis, Internet surveys and experiments, non-invasive emotion measurement, and experiential

sampling each allow social scientists to enhance emotion measurements and capture nuanced processes. While not exhaustive, I hope this sampling of new methods and their uses will exemplify how they might contribute not only to empirical results, but also to theoretical refinement.

Due to the growth of information technology, especially the Internet, the amount of data available to researchers continues to increase at unprecedented levels. Just as programs developed for microcomputers transformed the process of statistical analyses, big data analysis tools that are being rapidly developed and implemented greatly expand the breadth of social science research (Lazer et al. 2009). One example involves an analysis of Google's collection of books (Google's *N-gram Viewer*) to study the historical pattern in the expression of emotions over the course of the 20th century (Acerbi et al. 2013). The authors' expectation was that there would be a consistency of emotion terms over time as many books that were technical or not focused on current events. However, the data indicates that the number of positive or negative affective terms changes greatly during major historical events, such as turning more negative during the Second World War. Interestingly, the overall trajectory is a decrease in affective words over time. Another application of big data for emotions research is charting geographic and temporal affective patterns. Analyses using Twitter data from across the globe indicate patterns and variations in mood based on season, time of day, and work norm differences across cultures (Golder and Macy 2011).

A related methodological development is the expansion of diverse data collection over the Internet. Specifically, while the Internet continues to serve as a medium for surveys, more recently experimental Internet research has grown. Amazon's *Mechanical Turk* was designed as a micro-task market to facilitate the crowdsourcing of tasks, yet provides a convenient subject pool for psychologists and social scientists lacking a physical laboratory, time, or a diverse population. While methodological, ethical, and logistic concerns differ between *Mechanical Turk* and a more traditional laboratory setting, scientists suggest that, if used carefully, the data quality can be just

as high (Buhrmester et al. 2011). Using this online resource, social scientists study diverse topics, such as emotional reactions involved in the process of entering lotteries (Eriksson and Simpson 2010) and the relationship between compassion, religiosity and pro-social behavior (Saslow et al. 2013).

Because websites such as *Mechanical Turk* generally allow access to more diverse populations than university samples, there is excellent potential for emotions research. For theories of emotion such as identity theory, affect control theory, expectation states theory, and emotion management that focus on roles and identities, this provides an opportunity to consider a wider array of participants with a diversity of roles. For theories attentive to power, structure, and networks this diversity may be a disadvantage, yet recruiting larger numbers of people simultaneously could be an advantage. While *Mechanical Turk* and similar sites of the future might be popular for a number of sociological studies on emotion, researchers may be frustrated by limitations as such sites not designed specifically for social scientists. An excellent alternative is *Time-sharing Experiments for the Social Sciences* (TESS), an ongoing, NSF-funded program for delivering social science experiments to large, nationally-representative populations (tessexperiments.org 2013).

Another way to experiment, observe, or survey in a more nuanced research environment involves conducting research within virtual worlds. While virtual worlds have their own cultures, including affective meanings (Boellstorff 2008), they also can allow for research unavailable in the real world. This includes existing data about huge social networks over time, the manipulation of physical appearances in the virtual environment, and the ability to see the results of alternate government or organizational forms on individuals' emotions, behaviors, and perceptions (Bainbridge 2007).

Another technologically improved method for emotions research is in the application of advanced techniques for understanding the physiological aspects of emotions. Promising technologies include fMRIs, PET and related brain scans,

biomarkers such as heart-rate, temperature, skin conductivity, levels of cortisone and adrenaline, and infrared video. An example of the utility of the latter is an experiment using non-invasive infrared thermography to measure social emotions, specifically those resulting from a student being praised or criticized by another student (Robinson et al. 2012). The authors find evidence of facial thermographic differences relating to both the participant's self-reported emotions and the identity disruption caused by the praise or criticism. In this handbook, Chap. 12 by Robinson and Rogers fully discusses advanced technologies used to measure social emotions.

Another technological advancement involves improvements to experiential sampling techniques—sampling participants during their daily life activities. Experiential sampling is a reliable way to unobtrusively obtain social data over a period of time in one's life (Burke and Franzoi 1988) and a particularly appropriate technique for considering the relationship between emotions and routinely enacted situational identities (Smith-Lovin 2009). With high levels of mobile device ownership, especially smartphones with programmable apps, experiential sampling is not only easier to do, but facilitates new possibilities. Individuals' mobile phones and devices can include global positioning systems (GPS), voice recognition, basic medical scanners and other biomarkers, as well as social network connection information. These technologies enable researchers to combine disparate areas of emotion research, such as empirically considering both situation and physiology or accounting for causality in longer term affective states such as moods.

Technological development also presents challenges to methodologies. Experimental work in the sociology of emotions often uses fictitious others as interaction or exchange partners sometimes providing little more than a name and other times using computer interfaces, voices, dialogues, and videos to produce a much more elaborate cover story or manipulation (Webster and Sell 2007). While the developments in laboratory technology and technique continue to improve and standardize experiments, the continual development of technology creates new challenges

for experiments (Troyer 2007). One challenge is rooted in participants' increased exposure to intelligent computer agents, such as artificial intelligence in computer games, automated phone systems, and websites with intelligent interfaces. Participants that believe they are interacting with computer programs when they are told that they are interacting with other people can bias experiments as participants can have weaker social and emotional reactions to computer agents compared to humans (Shank 2012, 2013). The use of computer agents without deception regarding their identity can also be an advantage for social science experiments. Using computer agents as interactants eliminates the costly and often problematic use of confederates and can more accurately control for some social characteristics (Nass and Yen 2010). Similar to experiments in virtual worlds (Bainbridge 2007), these techniques hold promise for separating mechanisms that have traditionally been highly correlated.

24.6 Conclusion and Future Directions

This chapter was intended as a bird's eye view of different connections between emotion and technology of relevance to sociology and its sister disciplines. Our flight path has generally transitioned from the more abstract, macro, cultural, and philosophic toward the more concrete, micro, interactive, and applied. This ordering was my intentional effort to display the continuum of research as a mental diagram useful for facilitating new connections, research, and interdisciplinary collaboration. Structural patterns, mediated communication, technological interaction, and methodological innovation each highlight the different and important ways technology and emotion coexist. My suggestion for researchers in each area is to consider theory, findings, assumptions, and framing from the others in order to enrich the applicability of this area. Here I present just a few ideas, building on the earlier discussions in this chapter.

Theories on the sociology of emotion can help elucidate the mechanisms and processes involved in patterns of digital technology use. While it is

important to understand the demographics and related inequalities of changing technology access, use, and experiences, it is equally important to connect those patterns to underlying social-psychological, and often affective, processes. For example, we know that people vary in their skill at managing their own or others' emotions in person (Hochschild 1983). This could be posed as the mechanism to explain why adolescents with weaker social skills opt for increased online communication (Bonetti et al. 2010) as online expressions of emotion are more controlled and less visible. If it is a contributing mechanism, there could be a cyclical effect whereby adolescents learn or fail to learn emotion management skills through mediated interaction. In another example, consider the research question of how commitment to a virtual world might equal or exceed commitment to the real world, or real world groups such as one's family. Applying theoretical research on affective commitment (Lawler et al. 2009), a process for developing an affective tie and commitment for a virtual world might involve positive emotions toward people in that world—a person-to-person affective bond—transformed over time into an affective commitment toward the entire virtual world community—a person-to-group bond. Therefore, a comparison of strength of the individual's relational ties within and outside of the virtual world could be one explanatory mechanism for differential levels of commitment to the virtual world.

Some might view affective mediation as the purview of communication or new media scholars who have the largest bodies of research on these topics. I note, however, that affective mediation is currently an ideal frontier to expand sociological theories of emotion. Affective mediation has become more sociological as technology evolved from the simplicity of emails and telephony to rich social interactions realized in context such as virtual worlds, video conferencing, online romance, and social networking sites. A key concern for sociologists is how to leverage current theories of emotion to explain outcomes in different technological domains. My suggestion would be to consider aspects of the domain that most readily convert into concepts in

the theories, such as identity for online profiles, network structure for social networking sites, and emotion expression for avatars in virtual worlds. Like theories, some technological domains preference particular aspects to the neglect of others.

The forms of affective mediation—number of channels, synchrony, and directionality – imply not only differences between mediated interaction, but how different forms could modify social and emotional processes. Researchers should compare mediated communication and interaction to their face-to-face counterparts as well as consider the power of channels, synchrony, and direction to essentially modify the basis of social processes. Often theories of emotion explicitly or implicitly suggest what forms might be essential to a particular social process. For example, expectations states theory specifies explicit scope conditions which can be met through mediated interaction, as seen in the status characteristics theory's standard experimental setup. The theory of emotion management usually applies to face-to-face interaction, but discursive discussions often revolve around managing specific external channels such as word choice, facial expressions, and vocal tone. An integration of forms of affective mediation into theories of emotion is needed to expand the scope of these theories into the realm of mediated interaction.

Similarly, theories of emotion must be expanded and carefully examined in order to apply them to the area of human-agent interaction. Not only is it more common for humans to interact with computer agents as mobile devices and networks become more ubiquitous, but the nature of those computer agents is rapidly changing. Whether we consider Siri the intelligent personal assistant, Amazon's recommender system, GPS directions, or bots in immersive games, many aspects of computer agents are more closely emulating aspects of humans. While it may only require minimal cues to get people to treat computers like humans (Reeves and Nass 1996), advanced agents possess many characteristics typical of social interaction. It is therefore essential for future research to precisely specify the social aspects that are essential to affective processes and those that are peripheral.

Many sociological theories of emotion must simplify the real world to be able to produce testable, parsimonious predictions. Affect control theory handles situations that can be translated into an interaction or series of interactions between two actors within a particular cultural vantage. Power and status theory conceptualizes the relative levels of power and status within a relationship between people and how that shapes the emotions produced and expressed. These and other theories, therefore, give prominence to particular concepts while ignoring others. Mediated interaction in most contexts reduces the channels of information, disentangling the status characteristics and identities that operate in face-to-face interaction, or allowing relationship to begin in the absence of a community or other social ties. In essence, mediated interaction produces an environment of control, similar in some ways to laboratory experiments. I envision the possibility of researchers applying theories of emotions to technology mediated domains that provide more control than natural settings, while less artificiality than a traditional laboratory.

Sociologists of emotions should not ignore cutting edge methodologies, but should carefully consider which might relate to the current strengths of our subfield. Big data analysis and Internet data collection are particularly important for cultural, demographic, and macrostructural research on emotion, which has recently relied heavily on the General Social Survey 1996 Emotions Module dataset. Wikis, websites, blogs, forums, and virtual interaction are excellent supplements in ethnographic research, but are also important as the place where people interact, express feelings, and pursue important life goals. New opportunities and challenges exist for experimental research to move from the physical laboratory to cyberspace, or to adapt the laboratory for important innovations in computer agents and populations' technological enculturation. Furthermore, theorists of emotion, both of formal and discursive theories, may consider how a theory's scope might operate in relation to virtual or mediated interactions and places, and how the concepts might be clarified by precise and new measures of emotion.

In conclusion, I want to advocate that the biggest issue facing scholars with regard to technology is the impact of socioemotional digital technology—those programs, devices, agents, avatars, and robots that people are caring for and attaching to. Most people agree that technologies like these will continue to be developed, likely with increasing sophistication and emotional intelligence. What is unknown is the level of emotional engagement and affective commitment that individuals can hold toward these technologies and the effect this could produce for human relationships. Likewise, little is known about how societies and cultures will respond, regulate, or promote these social technologies. A sociological perspective on emotion is beneficial for understanding of both these micro and macro issues, leading to an enhanced understanding of people's emotions in general and toward technology.

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