CHAPTER 41

Cyberpsychology and Affective Computing

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Abstract

Cyberpsychology is a recent branch of psychology whose main research objects are the processes of change induced by new technologies. Some of these processes are related to and involve a variety of affective processes. The discipline's overlaps with affective computing and human–computer interaction in general are significant, yet its psychological origins suggest that the research communities have somewhat different focuses. This chapter reviews their histories and discusses the similarities and differences that are currently found in the different bodies of literature. The authors focus in particular on how technologies can be used to help people change behavior in both clinical situations (cybertherapy) and in personal development (positive technology/computing and smart health).

Key Words: cyberpsychology, cybertherapy, positive technology, smart health

Introduction

Clinical psychology has been traditionally based on face-to-face interactions that involve verbal and nonverbal language, without any technological mediation. However, emerging technologies—the Internet, mobile devices, virtual reality (VR), and the like—are modifying these traditional settings (Castelnuovo, Gaggioli, Mantovani, & Riva, 2003; Preziosa, Grassi, Gaggioli, & Riva, 2009; Riva & Mantovani, 2012). As the availability of these technologies expands the ways in which treatment can be provided, psychologists are expected to incorporate these innovations into their practice and research (Barak, 2008). Cyberpsychology is a recent branch of psychology that is trying to support this process. In particular, it aims at the understanding, forecasting, and induction of the different processes of change related to the use of new technologies.

Within this broad focus, cyberpsychology has two faces. On one side, cyberpsychology tries to understand how technologies can be used to induce clinical change (cybertherapy). On the other side, cyberpsychology focuses on the possible use of technology for improving personal development and well-being (positive technology/computing and smart health).

Both aspects of cyberpsychology are related to and involve a variety of affective processes. The discipline's overlap with affective computing and human–computer interaction (HCI) in general are significant, yet its psychological origins mean that the research communities have somewhat different focuses. Affective computing started as an engineering discipline, driven by a motivation to engineer new technologies that could better understand humans and be more effective for humans. Cyberpsychology originated in psychology and has been driven by the quest to help humans deal with their digital environments and use these environments to promote well-being. The object of study in cyberpsychology, as it is for many HCI researchers, is the change introduced by the technology and not the technology itself. In this chapter, we review these histories and discuss how affective computing can (or could in the future) assist cyberpsychology in terms of both treating existing mental diseases (e.g., anxiety disorders, depression, mood disorders, personality disorders) and in terms of preventive approaches to nurture health and well-being (e.g., promoting healthy lifestyles, behavior change interventions). Many mental diseases are directly related to a variety of affective processes: emotional experience (e.g., sadness, stress), mood disorders (e.g., bipolar), depression (hopelessness, helplessness), and personality (e.g., borderline). Similarly, preventively nurturing health and well-being often involves making life changes (e.g., toward health-promoting lifestyles), which in themselves are often associated with a variety of fluctuating affective states (e.g., hopefulness of being healthy, frustration of not managing to stay away from fatty foods, discouragement of postponing to join the gym indefinitely, joy of having lost 2 pounds in a week, pride in having implemented a major lifestyle change).

Affective computing—whose main focus is to develop technologies to sense, recognize, understand, and simulate affective processes—can therefore make important contributions to the enhancement of existing cybertherapies and positive technologies, as well as to the design and development of novel ones.

Cybertherapy and Affective Computing

What Is Cybertherapy?

Cybertherapy is the branch of psychology that uses new technology to induce clinical change. Historically e-therapy—the use of the Internet and related media for clinical care—has been the first area of cyberpsychology to have an impact on psychological treatments (Manhal-Baugus, 2001). It is generally agreed that innovative e-therapy approaches are an opportunity for earlier and better care for the most common mental health problems (Christensen & Hickie, 2010). The successful models of e-therapy services include different levels of interactivity and support:

- *Content-centric systems that offer prevention, self-help, and self-care to users*. Multiple charities and government-funded projects offer support that follows this approach.
- *Consumer-assisted support*, in which the level of peer interaction is offered online through volunteers with lived experience of a mental disorder
- *Virtual clinics and general practice*, in which a professional offers early interventions and treatment through the Internet
- *Blended approaches,* in which a range of services, such as Internet and face-to-face, are integrated to offer prevention and care

These e-therapy approaches allow the patient to engage in treatment without having to accommodate to office appointments, often reducing the social anxiety of face-to-face treatment (Mair & Whitten, 2000). Internet-based therapies have shown to be economically sound by being effective at a low cost (Kadda, 2010). They also have the potential to reach people in isolated places, where mental health is often a problem (Hordern, Georgiou, Whetton, & Prgomet, 2011).

Furthermore, Internet-based applications allow for the use of interactive monitoring systems that give the therapist instant access to clinical data during therapy and gives the individual patient the possibility of monitoring his or her progress. This is in line with the "know thyself" motto of recent HCI research (Li, Forlizzi, & Dey, 2010), which posits that reflecting on personal data, such as our exercise patterns, can help us lead more healthy lifestyles.

A great number of studies have shown significant results in Internet-aided psychotherapy applied to both individual therapy (Andersson, 2009; Bergstrom et al., 2010) and self-help support (Andersson et al., 2005; Carlbring, Ekselius, & Andersson, 2003). Journals such as *CyberPsychology, Behavior and Social Networking, IEEE Transactions on Biomedical Engineering, Journal of Cybertherapy and Rehabilitation, Journal of Medical Internet Research, Telemedicine and e-health* are dedicated to reporting progress in this field. However, cybertherapy also involves two emerging technologies: VR and mobile devices.

The characteristics of VR therapy, the use of VR for clinical care, include a high level of control of the interaction with the tool and the enriched experience provided to the patient (Riva, 2005; 2009). Typically in VR, the patient learns to cope with problematic situations related to his or her problem. For this reason, the most common application of VR in this area is the treatment of anxiety disorders and phobias, such as fear of heights, fear of flying, and fear of public speaking (Emmelkamp, 2005; Wiederhold & Rizzo, 2005). Emerging applications of VR in psychotherapy include eating disorders and obesity (Ferrer-Garcia & Gutierrez-Maldonado, 2012; Riva et al., 2006; Riva, Manzoni, Villani, Gaggioli, & Molinari, 2008), posttraumatic stress disorder (Reger & Gahm, 2008), addictions (Bordnick et al., 2008), sexual disorders (Optale, 2003), and pain management (Hoffman, 2004).

M-health—the use of mobile devices such as smartphones and tablets for clinical care—is also an emerging area of cybertherapy (Istepanian, Jovanov, & Zhang, 2004). The wide availability and acceptance of mobile devices—significantly higher than PCs—make them the perfect tools to bridge the gap between inpatient and outpatient treatment (Preziosa et al., 2009). On one side, mobile devices offer a nonintrusive way to monitor patients in their real-life contexts (Gaggioli, Cipresso et al., 2012), thereby affording the therapist the possibility of optimizing the patient's treatment (Gaggioli, Pioggia et al., 2012; Kauer et al., 2012). On the other side, advanced multimedia capabilities of these devices give developers the ability to create interactive applications that allow the patients to autonomously experience clinical support (Cipresso et al., 2012).

Affective Computing in Cybertherapy

Affective computing offers new interaction opportunities for the different modalities of e-therapy just described (Luneski, Konstantinidis, & Bamidis, 2010), specifically in the field of anxiety and stress management (Parsons & Rizzo, 2008; Riva, Grassi, Villani, Gaggioli, & Preziosa, 2007; Villani et al., 2012; Villani, Lucchetta, Preziosa, & Riva, 2009). Moreover, affect detection, from verbal or nonverbal expressions, can be used to adapt the interaction with an avatar or other Internet-based systems (Yang & Bhanu, 2012). Many of these techniques have or could be used in e-therapy conditions. Affect generation techniques such as those discussed by [see section on Affect Generation in this volume] are being used to make more expressive avatars. In the next paragraphs, we list some examples of the use of affective computing in cybertherapy.

AFFECTIVE COMPUTING AND EMOTIONAL WRITING

Many e-therapy approaches use writing activities as an essential element for reflection. This is based on research that suggests that writing about thoughts and feelings of past upsetting experiences is beneficial to some individuals. One of the leading researchers in this field has been J. W. Pennebaker (1997) who developed a short-term (3–5 sessions) writing therapy involving participants writing for 15–20 minutes about traumatic or emotional experiences.

A recent meta-analysis of 146 research trials (Frattaroli, 2006) using various unstructured emotion writing methods concluded that the impact of this type of writing approach may have some benefits for some individuals, but the overall effect size was very small (r-effect size = 0.075).

One alternative method to unstructured writing is to structure how participants write during the writing task. Writing instructions could be manipulated to increase the likelihood that participants write in a way that is suggested to be therapeutic (e.g., write about something that you are thinking or worrying about too much, about something that you feel is affecting your life in an unhealthy way, etc.) and therefore increase the likelihood that they obtain benefits from the task.

A number of emotion writing studies have manipulated the writing condition in such a manner (King, 2001; King & Miner, 2000) but could not demonstrate causal links between hypothesized theoretical processes and outcomes. Difficulties have been due to the absence of clear operational definitions of the processes within the writing sessions and therefore poorly targeted assessment of expected changes according to these processes of change. For example, King and Miner (2000) found writing about positive benefits from past upsetting experiences was beneficial to health and suggested this may have been due to enhanced self-regulation skills and a sense of self-efficacy. The study did not, however, measure changes in self-regulation or self-efficacy and could not confirm the proposed mechanisms of action. One final area to be studied is how affective computing techniques can be used to detect emotions in text (Calvo & Kim 2012).

AFFECTIVE COMPUTING AND VIRTUAL REALITY

In general, the most common application of VR in cybertherapy is in the treatment of anxiety disorders and phobias (Emmelkamp, 2005; Wiederhold & Rizzo, 2005). Indeed, VR exposure therapy (VRE) has been proposed as a new medium for exposure therapy (Riva, 2005) that is safer, less embarrassing, and less costly than reproducing real-world situations. The rationale is simple: in VR, the patient is intentionally confronted with the feared stimuli while allowing the anxiety to attenuate. Avoiding a dreaded situation reinforces a phobia, and each successive exposure to it reduces the anxiety through the processes of habituation and extinction. In fact, VR can be described as an *advanced imaginal system*: an experiential form of imagery that is as effective as reality in inducing emotional responses (Vincelli, Molinari, & Riva, 2001). As underlined by Baños, Botella, and Perpiña, the VR experience can help the course of therapy (Baños, Botella, & Perpiña, 1999) through "its capability of reducing the distinction between the computer's reality and the conventional reality." In fact, "VR can be used for experiencing different identities and . . . even other forms of self, as well" (p. 289). The possibility of structuring a large amount of realistic or imaginary stimuli and, simultaneously, of monitoring the possible responses generated by the user of the technology offers a considerable increase in the likelihood of therapeutic effectiveness as compared to traditional procedures (Riva & Davide, 2001).

A more detailed discussion related to the use of affective computing methodologies in VR has been discussed in Bickmore's chapter in this volume.

AFFECTIVE COMPUTING AND MOBILE DEVICES

Mobile phone usage has already been harnessed in health care generally, but in the past few years applications of this technology are also being explored in the mental health field. In general, the most common mobile feature used in mental health is text messaging, both to help patients to express themselves and to support them in real-life settings (Preziosa et al., 2009). However, an emerging group of researchers have tried to test the effectiveness of multimedia mobile phones applied to emotion induction. Preziosa and colleagues (Preziosa, Villani, Grassi, & Riva, 2006; Riva, Grassi, et al., 2007; Riva, Preziosa, Grassi, & Villani, 2006) tested the efficacy of a mobile protocol for helping students manage exam stress in controlled studies by comparing it with other media (DVD, mobile without video, mobile with video, CD). The trial showed a better efficacy of video mobile narratives experienced on mobile phones in reducing the level of exam stress and in helping the student to relax. This result was recently replicated with a larger sample (Grassi, Gaggioli, & Riva, 2011). In a different study, Grassi and colleagues (Grassi, Gaggioli, & Riva, 2009) tested the ability of mobile narratives (narrated video) supported by multimedia mobile phones to enhance positive emotions and reduce work anxiety in a sample of commuters. Here again, the use of a mobile narrative was significantly better than other media in decreasing anxiety levels and increasing relaxation levels. A similar approach was also used for reducing anxiety before outpatient surgery (Mosso et al., 2009) and for improving stress management in a sample of nurses working with cancer patients (Villani et al., 2012; Villani et al., 2013). All these mobile protocols share a similar approach: first, they use the multimedia capabilities of mobile phones to train the user to the use of easy relaxation techniques (e.g., breathing control); second, they use the *stress inoculation training* paradigm (e.g., exposure to stressful situations) to help the user gain confidence in his or her ability to cope with anxiety and fear stemming from the situation.

Several research groups are also experimenting with mobile, noninvasive data collection solutions for the automatic detection of affective states. For example, Gaggioli et al. developed PsychLog (http://sourceforge.net/projects/psychlog/) a free, open source mobile psycho-physiological data collection platform that allows gathering self-reported psychological information and electrocardiogram (ECG) data (Gaggioli, Cipresso et al., 2012). These signals are sensed and wirelessly transmitted to the mobile phone and gathered by a computing module that stores and processes the signals for the extraction of heart rate variability (HRV). Heart rate variability is considered a useful psycho-physiological measure because it reflects the natural variability of heart rate in response to affective and cognitive states. Heart rate variability indexes have been used to characterize a number of psychological illnesses, including major depression and panic disorders (Kimhy et al., 2010). Using PsychLog, ECG data can be correlated with user's self-reported feelings and activities. In this way, it is possible to investigate the relationship between behavioral, psychological, and physiological variables, as well as to monitor their dynamic fluctuations over time.

Affective Computing for Positive Technology

Psychologists began to recognize that the discipline's focus on helping people with mental health problems, the diagnostic-treatment model, left many outside their scope. Early in the past decade, psychologists such as Seligman and Csikszentmihalyi proposed increasing the attention giving to developing well-being (Seligman & Csikszentmihalyi, 2000). *Positive psychology*, as they called it, was to study what makes people happier, in the broadest sense. Since then, the positive psychology field has flourished. In his book *Authentic*

Happiness Seligman talked about the "three pillars" of a good life (Seligman, 2002):

- *the pleasant life*: achieved through the presence of positive emotions;
- *the engaged life*: achieved through engagement in satisfying activities and utilization of one's strengths and talents;
- *the meaningful life*: achieved through serving a purpose larger than oneself.

Notwithstanding its fast growth, some have underlined that positive psychology has relevant methodological limitations related to the focus and length of most studies (McNulty & Fincham, 2012). To address this issue, Riva recently suggested that positive psychology may be the science of personal experience (Riva, 2012*a*) in that its aim should be understanding how it is possible to manipulate the quality of personal experience with the goals of increasing wellness and generating strengths and resilience in individuals, organizations, and society.

In this view, positive functioning is a combination of three types of well-being (Keyes & Lopez, 2002)—high emotional well-being, high psychological well-being, and high social well-being—that are achieved through the manipulation of three characteristics of our personal experience—affective quality, engagement/actualization, and connectedness.

Riva and colleagues (Riva, 2012*b*; Riva, Banos, Botella, Wiederhold, & Gaggioli, 2012) also suggested that it is possible to combine the objectives of positive psychology with enhancements in information and communication technologies (ICTs) in a move toward a new paradigm: *positive technology*. The main objective of this new paradigm is to use technology to manipulate and enhance features of our personal experience for increasing wellness and generating strength and resilience in individuals, organizations, and society (Wiederhold & Riva, 2012). In the proposed framework (see Figure 41.1), positive technologies are classified according to their effects on the pertinent features of personal experience (Botella et al., 2012):

- *Hedonic* technologies are used to induce positive and pleasant experiences.
- *Eudaemonic* technologies are used to support individuals in reaching engaging and self-actualizing experiences.
- *Social/Interpersonal* technologies are used to support and improve social integration and/or connectedness between individuals, groups, and organizations.

Affective computing can contribute to systems at all these levels. The first dimension of positive technology is concerned with how to use technology to foster positive emotional states. At this level, affective computing can exploit the link between user experience and emotions (Norman, 2004). According to the model of emotions developed by James Russell (Russell, 2003; 2005), it is possible to modify the affective quality of an experience through the manipulation of "core affect." Simply put, a positive emotion is achieved by increasing the valence (positive) and arousal (high) of core affect (affect regulation) and by getting the user to attribute this change to the contents (affective quality) of the proposed technological experience (object).

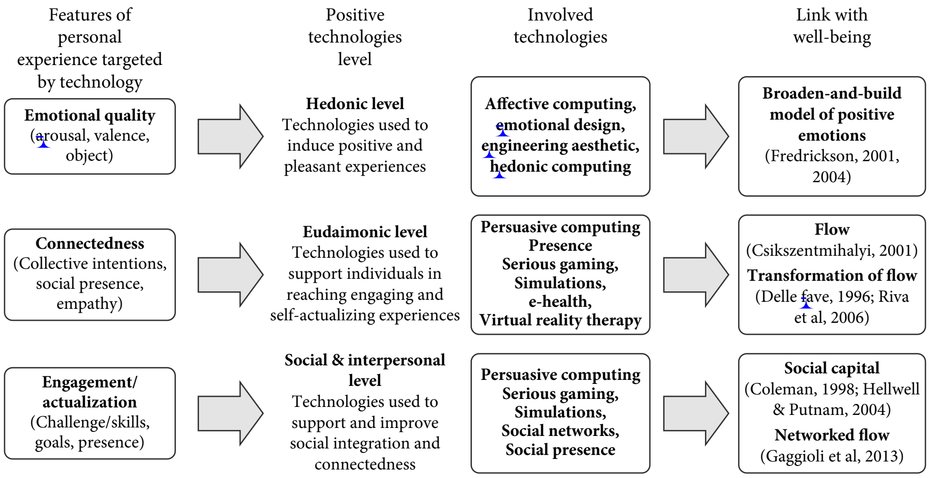

Fig. 41.1 ~~Riva Cyberpsychology Applications.~~ Positive technology levels.

The second dimension requires exploring systems that can engage us more with what we do, for example during learning interactions. This has been a growing research focus of the artificial intelligence in education community (Calvo & D'Mello, 2012). For example, different authors (Calvo & D'Mello, 2011) have investigated the occurrence of engagement, together with confusion, delight, and other emotions in the context of learning environments. Engagement, confusion, frustration, boredom, curiosity, and happiness are the most commonly occurring affective states observed across a range of technologies (D'Mello, in press). Dimensional representations can also be used to model affect during learning (Hussain, AlZoubi, Calvo, & D'Mello, 2011). In one study, a fully automated, affect-sensitive, intelligent tutoring system for computer literacy—*Affective AutoTutor*—(Graesser et al., 2008) was developed (see D'Mello & Graesser, this volume). The Affective AutoTutor can promote engagement by automatically detecting students' boredom, confusion, and frustration through gross body movements, facial features, and contextual cues. The affective states detected by the system are used to adapt the computer tutor's responses. A pedagogical agent (i.e., avatar) synthesizes affect via its verbal responses and nonverbal facial expressions and speech intonation.

It is less clear how affective computing or HCI can be used to support the eudaemonic level. A possible strategy comes from Rogers (2006), who called for a shift from "proactive computing" to "proactive people," in which "technologies are designed not to do things for people but to engage them more actively in what they currently do" (p. 406). Following this path, Calvo and Peters (2012) have speculated on features that would support such systems, particularly informed by the psychological literature. These include:

- *Intrapersonal skills,* particularly *introspection, reflection,* and *self-criticism*.
- *Interpersonal skills*, including *social intelligence, empathy,* and *compassion* (see Bickmore's chapter [this volume] for a discussion of how these are particularly important attributes in healthcare).
- *Change and uncertainty* features that remind us how things change, are impermanent, and uncertain.
- *Balance* of intrapersonal, interpersonal, and extrapersonal interests over the short and long term has been identified as a key developmental achievement (Sternberg, 2001).
- *Relativism,* an understanding of the multiple perspectives that can be taken with regards to common life events.
- *Mindfulness*, the conscious attention to the present moment (or task), is of increasing interest in HCI (Sengers, 2011).
- *Reflective insight*, mainly ways to develop *reflection, emotion-regulation,* and *dialectical thinking*.
- *Social consciousness*, to promote the selfless motivation to help others and take action toward improving the human condition.

The theory of flow, developed by positive psychology pioneer Mihaly Csikszentmihalyi (1990), provides a theoretical framework for addressing this challenge. Flow, or optimal experience, is a positive and complex state of consciousness that is present when individuals act with total involvement in a task. The basic feature of this experience is the perceived balance between high environmental opportunities for action (challenges) and adequate personal resources in facing them (skills). Additional characteristics are intrinsic motivation, deep concentration, clear rules in and unambiguous feedback from the task at hand, loss of self-consciousness, control of one's actions and environment, and positive affect.

Ghani and Deshpande (1994) identified three factors that influence the occurrence of flow in HCI: perceived control, fitness of task (i.e., the difference between challenges and skills), and cognitive spontaneity ("playfulness").

The final level of positive technology—the social and interpersonal one—is concerned with the use of technologies to support and improve the connectedness among individuals, groups, and organizations. Here, affective computing may be used to understand how to use technology to create a mutual sense of awareness. Following this vision, Morris (2005) recently described how social networking and pervasive computing technologies can be effectively used to help reduce feelings of social isolation and depression in elderly individuals. In their approach, sensor data measuring phone calls and visits were used to derive public displays of social interactions with relatives and friends, which they introduced into selected elders' homes. These ambient displays, which reflect data on remote and face-to-face interaction gathered by wireless sensor networks, were intended to raise awareness of social connectedness as a dynamic and controllable aspect of well-being. According to findings, this strategy was effective in reducing the feeling of social isolation in elderly users.

Affective Technologies for Smart Health

Recent epidemics of behavioral-related health issues, such as excessive alcohol, tobacco, or drug use, overeating, and lack of exercise, place people at risk of serious health problems. In 2013, the World Health Organization reported that worldwide obesity has more than doubled since 1980. It found that 1.5 billion adults were overweight, of which 500 million were obese, and 43 million children under the age of 5 were overweight. In the United States alone, obesity afflicts 33.8% of adults, 17% (or 12.5 million) of US children and teens, and obesity has tripled in one generation (WHO, 2013). As well, excessive alcohol use is the third leading preventable cause of death in the United States (79,000 deaths annually) and is responsible for a wide range of health and social problems (e.g., risky sexual behavior, domestic violence). Alcoholism is estimated to affect 10–20% of US males and 5–10% of US females at some time in their lifetimes. Similar risks exist with other forms of substance abuse.

Medicine and healthcare have therefore started to move toward finding ways of preventively promoting wellness rather than solely treating already established illness. Health promotion interventions aimed at helping people to change their behavior toward healthier lifestyles are being deployed, but the epidemic nature of these problems calls for drastic measures to rapidly increase access to effective behavior change interventions for diverse populations. It is economically impossible for medical and healthcare professionals to provide appropriate medical care and health education for millions of people in need (and the numbers are growing). Interventions must involve the use of automation to provide help to people in need. Smart health and well-being technologies that leverage the latest technological advances (e.g., sensors and sensors networks, actuators, robots, and virtual assistants) to build intelligent care (e.g., smart homes for independent living, wearable prosthetics, life-style modification coaching) are therefore being researched and developed at increasing speed (Pavel, 2012). One important aspect of smart health and well-being that affective computing is particularly relevant to deals with patient-centric approaches, whether home- or mobile-based, to empower people *before* they get sick (as well patients) to become active informed participants about preserving or regaining their own health (Pavel, 2012). As mentioned earlier, preventively nurturing health and well-being often involves making life change (e.g., toward health-promoting lifestyles), which itself is often associated with a variety of fluctuating affective states. Affective computing with its main focus on developing technologies to sense, recognize, understand, and simulate affective processes such as emotions, attitudes, personality, and motivation, can therefore make important contributions to novel smart health and well-being approaches because emotion is a major motivating factor in decision making.

For example, computer vision researchers are developing techniques to automatically detect depression from video of the patients' face (Ellgring, 2008). In one such study, McIntyre et al. (2009) used *active appearance models* to track local shape and texture features in the face and then a Multiboost classifier to build the automated detection model.

Smart Health Behavior Change Interventions

Although multiple approaches to smart health and well-being involve sensing and monitoring the patient's physiological signals related to their health (e.g., ECG, BVP, GSR) in real-life settings using mobile technologies, communicating them (in real time if needed) to their physicians, and storing them for individual's self-monitoring, other approaches involve computer-based interventions (CBIs) for behavior change and are delivered via the internet in the privacy and comfort of one's home. There are multiple advantages to CBIs for behavior change (see Bewick et al., 2008; Hester, Squires, & Delaney, 2005; Krebs, Prochaska, & Rossi, 2010; Lustria, Cortese, Noar, & Glueckauf, 2009 for useful reviews). In particular, research has already shown that computer-based assessment and feedback systems can:

- *Increase accessibility and cost-effectiveness and decrease barriers to access:* Research shows that as few as one or two motivational interviewing sessions often yield greater change than no counseling at all (Miller & Rollnick, 2002), and yet these short interventions are often unavailable. Furthermore, even though follow-up sessions have been shown to increase positive outcome, they are unfortunately not always offered in medical and public health settings due to a lack of human resources. On the other hand, there is some evidence that people will accept computer-based assessment and feedback programs (Lustria et al., 2009), which can be as effective as interventions delivered by a person (Hester et al., 2005). Computer-based interventions can easily be reproduced and delivered over the Internet, on mobile devices, or in community-based waiting rooms.

• *Increase confidentiality and sensitive information divulgence:* Patients who engage in behaviors that can put them at risk (e.g., excessive drinking, unsafe sex, overeating) tend to report more information to a computer interviewer than to a human (Servan-Schreiber, 1986). The knowledge that a computer does not have an intrinsic value system to judge the patient favors the divulgence of sensitive information. Provided with sensitive information that a human would not have access to, CBIs can address issues that would otherwise be ignored.

• *Tailor information:* Tailored communication, intended to reach one specific person's needs versus generic communication (e.g., a brochure) leads to better patient outcomes and is derived from individual assessment (see for reviews Krebs et al., 2010; Noar, Benac, & Harris, 2007). Computer-based interventions can assess and create a user model to deliver tailored information and dynamically update the user profile over multiple adaptive sessions (Yasavur, Amini, & Lisetti, 2012). The user model can be produced using affective computing models that can be used to target an intervention when certain emotions are detected.

• *Diminish variability:* There is wide variability (from 25% to 100%) in different counselors' rates of improvement among their patients (Miller & Rollnick, 2002). In medical or public health settings, for example, personnel well trained in delivering motivational interventions are not always available. When trained personnel are not available, a good CBI can alleviate variability, thus providing more people with motivating experiences.

• *Avoid righting reflex:* One of the traps many counselors experience when they try to help people is the righting reflex or the tendency to set things right, employing direct advocacy for the advantages of change and thereby acting out patients' ambivalence toward changing (increasing resistance rather than simple awareness of discrepancy). This behavior is common within the traditional biomedical model of counseling, in which the counselor acts as an expert by providing advice or extrinsic motivation. Successful counselors are those who can inhibit their righting reflex (Miller & Rollnick, 2002). Although we strive to enable computers to be more human-like, computer-based systems inherently do not have such drives to overdo helping and therefore can be at an advantage with respect to the righting reflex.

• *Demonstrate infinite patience:* Another trap for counselors is to try to move a patient toward change more quickly than he or she is ready for. Respecting the various stages of change (Prochaska & Velicer, 1997) and the patient's pace toward change can be challenging for therapists. However, computers have infinite patience.

Other Smart Health Behavior Change Interventions

Personal informatics and quantified self are yet another form of intervention, commonly associated with a new motto "Know thyself" (through behavioral data that we store on the cloud). The basic tenet of this research (Li et al., 2010) is that by reflecting on our past we can improve the way we lead our lives. For example, if we are shown evidence that we are not getting enough exercise or are eating too much, we are more likely to change our behaviors accordingly.

This has prompted the definition of ecological momentary assessment methods (EMA) that use technology to analyze and record behavior in naturalistic settings. An advantage of EMA over conventional psychological assessment includes the ability to assess the temporal relationship between variables, high ecological validity, and recording of highly detailed information on subjective experience (Barrett & Barrett, 2001). In the past, EMA-based studies have been mainly done via paper-and-pencil measures. Today, smart phones allow researchers to develop EMA tools that take advantage of the latest advances in computational recognition and sensing technologies to automatically detect critical (e.g., stressful) events that can trigger data collection (Gaggioli & Riva, 2013).

One such tool is MyExperience (http://myexperience.sourceforge.net/), a mobile platform that allows the combination of sensing and self-report to collect both quantitative and qualitative data on user experience and activity. The platform supports 50 built-in smartphone sensors, which include GPS, GSM-based motion sensors, and device usage information. Sensed events can be used to trigger custom actions such as sending SMS messages to the researcher and/or presenting in situ self-report surveys.

Morris and colleagues (Morris et al., 2010) used this platform to develop a mobile application that combines experience sampling of mood with exercises of emotional awareness and self-regulation inspired by cognitive behavioral therapy. Participants were prompted via their mobile phones to report their moods several times a day on a Mood Map and a series of single-dimension mood scales. Using the prototype, participants could also activate different mobile therapy contents as needed.

Consolvo and colleagues have developed guidelines (Consolvo, Everitt, Smith, & Landay, 2006) to encourage physical activity: give proper credit; provide history, current status, and performance measures; support social influence (i.e., use social pressures and support); and consider practical constraints. These guidelines are becoming a common principle in the design of commercial "motivational" products in sports.

One of the underlying theories for these designs is that of *cognitive dissonance* (Festinger, 1957) which describes the psychological discomfort (dissonance) felt by a person when his or her behavior is at odds with his or her attitudes or values. These researchers argue that when the person is motivated (and has the option) to eliminate this internal conflict, behavior change can be achieved.

For example, Lane and colleagues developed BeWell (https://www.bewellapp.org/) a real-time, continuous sensing application that allows monitoring of different user activities (sleep, physical activity, social interaction) and provides feedback that should promote healthier lifestyle decisions (Lane et al., 2011). A similar application, YourWellness, supports older adults in monitoring their emotional well-being, as well as other parameters of well-being they consider important to their overall health (Doyle, O'Mullane, McGee, & Knapp, 2012). It can also check if some action or behavior change is required on the part of the older person. Other mobile well-being applications help users to monitor and manage stress levels. Gaggioli and colleagues (Gaggioli, Pioggia et al., 2012) describe a mobile system designed to automatically detect psychological stress events during daily activities from heart rate and activity data collected with a wearable ECG platform coupled to a smartphone. Detected stress levels are provided to the user in the form of graphs displayed on the mobile phone application; apart from these instantaneous values, the user can check the history of stress-level variations during the monitoring period.

Conclusion

In this chapter, we reviewed how cyberpsychology and cybertherapy are combining with affective computing to offer new ways of delivering therapies for mental health, positive psychology, and behavior change toward health well-being. Sensors, multimodal user interfaces, mobile technologies, intelligent virtual characters, user modeling, and natural language processing are all smart technologies that need to be coupled with progress in psychology, healthcare, and medicine to promote health and well-being anytime, anywhere, and for everyone.

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