Designing audio-enhanced paper photos for older adult emotional wellbeing in communication therapy ☆

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ABSTRACT

This article introduces audio-enhanced paper photos enabled by digital pen technology as an interaction paradigm for supporting and understanding emotional wellbeing in late adulthood, particularly in the context of communication therapy activities and related social interactions. We describe the development of a multimodal pen-based system that enables creation of audio-enhanced paper photos and the application of this technology to two domains: older adults with aphasia working to regain expressive and receptive language after a stroke, and older adults wanting to interact with a family member of advanced age with memory loss. Our pen-based authoring software enables caregivers, both therapists and family members, to create audio-enhanced paper photos to encourage meaningful and emotionally appropriate interaction with the older adults they support. We examine the ways in which emotional information is embedded in audio-enhanced photos and how this approach addresses various aspects of emotional wellbeing in late adulthood.

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1. Introduction

The global trend of an increasing older adult population makes it a priority not only to design interactive experiences that are sensitive to the social and emotional needs of people in late adulthood but also enhance overall wellbeing in late life. The proportion of people over age 60 compared to younger populations is growing at a rapid rate. For the United States, the older population in 2030 is projected to be twice as large as the population was in 2000, growing from 35 million to 72 million, representing nearly 20% of the United States population (NCHS, 2012).

Much research examines the relationship among aging, social interaction, and late life wellbeing. Interpersonal relationships play an important role in emotional wellbeing (Asay and Lambert, 1999; House et al., 1998), yet there is strong evidence that one's social network shrinks as a function of age (Gordon and Gaitz, 1976; Harvey and Singleton, 1989; Carstensen, 1992). This may be due to a limited number of surviving relatives and peers as well as physical or cognitive declines that present barriers to social participation. There are many benefits for maintaining social support and engagement in social activities, including living longer and improved mental and physical health (Stuck et al., 1999; Ferlander, 2007). Frequent social interactions may create an increased sense of wellbeing in older adults (Czaja et al., 1993), and in contrast, a lack of social interaction may contribute to higher rates of disability, slower recovery from illness, and even early death (Lubben and Gironda, 2003; Blazer, 1982).

An important topic of research related to emotional wellbeing is understanding design for the changing social and emotional needs across the lifespan. Here, we focus on design for people in late adulthood. In our work, the end goal is to prevent social isolation and loneliness through communication therapy, which may include structured speech-language therapy, reminiscence or narrative therapy (White and Epston, 1990), and audio-visual prompts for grounding face-to-face interaction. When designing technologies for people in late adulthood, it is important to consider the unique social and emotional qualities of older adults (Carstensen, 1995; Carstensen and Charles, 1998). While social interaction may decrease in late adulthood, many older adults report overall satisfaction with their life as well as sustained or improved satisfaction with interpersonal relationships (Diener and Suh, 1997; Carstensen and Charles, 1998). Older adults are motivated to stay connected with people with whom they already have a strong emotional connection (Carstensen et al., 2003) and contact with family becomes increasingly important (Cicirelli, 1989). Furthermore, Carstensen et al. (2003) argue that aging is associated with an increase in motivation to derive emotional meaning from life.

This paper describes the design and use of audio-enhanced paper photos to support and understand older adult emotional wellbeing. The creation of and interaction with audio-enhanced paper photos is enabled by digital pen technology and custom software (Piper et al., 2012) we developed for the Livescribe pen,[1] a widely available digital pen that enables recording and playback of audio. We introduce this technology into two contexts and present case studies of how caregivers design audio-enhanced paper photos based on the interests and emotional needs of the older adults for whom they are caring. In both case studies we printed paper photos on Anoto digital paper[2] and we used sticky labels pre-printed with Anoto pattern to augment existing paper photos and interact with them through the Livescribe pen. The first case study examines how a speech-language therapist designs custom audio-enhanced paper therapy activities for an older adult with aphasia. In this context, the therapist designs activities that leverage personal artifacts in the older adult's life. He balances the need to engage the older adult in therapy without incorporating overly emotional content. Negative emotions (e.g., sadness about not seeing a family member) severely impact the older adult's ability to communicate and willingness to participate in therapy. In the second case study, we describe the creation and use of audio-enhanced paper photos involving a person of advanced age with memory loss and her extended family and care staff. Family and care staff attach personalized audio messages to printed photos of people in the older adult's life. This approach successfully engages the older adult in reminiscence activities and improves her awareness of people in her social circle. Taken together, these case studies provide new insights into the design of audio-enhanced photos for late life communication therapy, exploring the ways in which this media form supports emotional expression, reflection, and interpersonal communication.

2. Related work

This research brings together literature on aging and the social and emotional goals of older adults, photographs and audio as media that carry and evoke emotion, and technologies for older adult communication, reminiscence, and therapy. We also describe related work on digital pen technology as an interaction technique for older adults.

2.1. Emotion, aging, and social interaction

Literature on emotion and aging has emerged within the past two decades primarily because early models of late-life emotional regulation presumed a decline in this area similar to age-related slowing of physical and cognitive functioning. It is well documented that people in old age interact with others far less than in youth (e.g., Gordon and Gaitz, 1976; Harvey and Singleton, 1989). Early theories in psychology presumed that this decrease in social interaction would have a negative impact on emotional wellbeing in late life. Recent work, however, indicates that older adults are more satisfied with interpersonal relationships and their lives overall (Diener and Suh, 1997; Carstensen and Charles, 1998).

Socioemotional selectivity theory (SST) (Carstensen, 1995) provides a foundation for understanding emotion and social interaction across the lifespan. The theory suggests that a similar set of goals persists throughout the lifetime, but the importance of these goals changes depending on one's perception of the end of life. Carstensen and colleagues argue "that the realization that

time is limited directs social behavior to experiences that are emotionally meaningful," (Carstensen and Charles, 1998). SST also suggests that older adults value self-achievement and the development of self-concept less than younger populations, but they place higher value on regulation of emotion. Older adults are often motivated to stay connected with people in their social network with whom they already have a strong emotional connection (Carstensen et al., 2003). Compared to younger adults, older adults are less concerned with the goal of information seeking, in which novel social partners are often the best sources and are especially valuable in fulfilling this goal (Carstensen, 1995). Contact with family, particularly siblings, takes on new importance in old age and a disruption of those bonds may be related to depression (Cicirelli, 1989). People optimize for socioemotional experience in late life, and this can be characterized as a more complex or multifaceted emotional experience due to the positive and negative emotions associated with nearing the end of one's life (Carstensen and Charles, 1998).

Aging is also associated with a variety of changes in cognitive abilities, including declines in short-term memory (Gregorie and der Linden, 1997), semantic knowledge (Park, 2002; Schaie, 1996), and verbal ability (Schaie, 1996). Some aspects of cognitive functioning, however, remain relatively stable over the lifespan. Stable aspects include autobiographical memory (Fromholt et al., 2003), implicit memory (accumulation of life experiences and learnings) (LaVoie and Light, 1994), ability to process emotional information (Carstensen et al., 2003), and theory of mind (recognizing the viewpoints of others) (Happe et al., 1998). Our approach to design draws on these strengths of older adults, particularly autobiographical and emotional awareness, through the use of personal photos augmented with custom audio messages.

2.2. Audio-enhanced photographs

Photographs are a powerful tool for social interaction (Hirsch, 1997) and provide anchors for discussion (Sit et al., 2005). Moreover, photographs are both carriers of and triggers for emotion. The medium of audio adds another dimension of emotional information, providing nuanced richness of voice that conveys speaker affect. We couple paper photos with audio recordings through the use of digital pen technology. Our implementation of audio-enhanced photos builds on the idea of audiophotography (Frohlich and Tallyn, 1999). Enhancing a photo with audio has the potential to bring the image to life and to aid one's memory of events (Frohlich and Tallyn, 1999; Frohlich, 2004). Similarly, Dib et al. (2010) explore the notion of a "sonic souvenir" for family remembering. Compared to photos, sounds were found to be more varied, familial, and creative as well as being evocative and generating reflective narrative.

Central to our design for older adults is the introduction of augmented paper photos rather than digital images. The term "Kodak culture" (Chalfen, 1987) refers to generations of people who grew up with photos printed on paper, largely today's older demographic. Paper photos have immediate affordances understandable by everyone (Petrelli and Whittaker, 2008), whereas digital photo sharing alternatives require a level of technical understanding, which often limits use by older generations (Sarvas et al., 2008). Frohlich and Fennell (2007) recommend audio photographs rather than video clips as a new media form, emphasizing the importance of paper photos in contrast to a screen-based viewing experience.

2.3. Tools for reminiscence and therapy

Much related work describes the development of technologies for older adult communication, reminiscence, and related therapies. This includes studies of older adults' attitudes about keeping