

# How Social Psychological Factors May Modulate Auditory and Cognitive Functioning During Listening

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The framework for understanding effortful listening (FUEL) draws on psychological theories of cognition and motivation. In the present article, theories of social-cognitive psychology are related to the FUEL. Listening effort is defined in our consensus as the deliberate allocation of mental resources to overcome obstacles in goal pursuit when carrying out a task that involves listening. Listening effort depends not only on hearing difficulties and task demands but also on the listener's motivation to expend mental effort in challenging situations. Listeners' cost/benefit evaluations involve appraisals of listening demands, their own capacity, and the importance of listening goals. Social psychological factors can affect a listener's actual and self-perceived auditory and cognitive abilities, especially when those abilities may be insufficient to readily meet listening demands. Whether or not listeners experience stress depends not only on how demanding a situation is relative to their actual abilities but also on how they appraise their capacity to meet those demands. The self-perception or appraisal of one's abilities can be lowered by poor self-efficacy or negative stereotypes. Stress may affect performance in a given situation and chronic stress can have deleterious effects on many aspects of health, including auditory and cognitive functioning. Social support can offset demands and mitigate stress; however, the burden of providing support may stress the significant other. Some listeners cope by avoiding challenging situations and withdrawing from social participation. Extending the FUEL using social-cognitive psychological theories may provide valuable insights into how effortful listening could be reduced by adopting health-promoting approaches to rehabilitation.

**Key words:** Ageism, Appraisal, Attention, Coping, Effortful listening, Listening effort, Motivation, Self-efficacy, Social participation, Social support, Stereotype threat, Stress, Stigma, Working memory.

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## INTRODUCTION

In the consensus paper of the Eriksholm Workshop on Hearing Impairment and Cognitive Energy (Pichora-Fuller et al. 2016, this issue, pp. 5S–27S), listening effort is defined as the deliberate allocation of mental resources to overcome obstacles in goal pursuit when carrying out a task that involves listening. Considering Figure 1B of the consensus paper (Pichora-Fuller et al. 2016, this issue, pp. 5S–27S), in which the framework for understanding effortful listening (FUEL) is depicted, listeners may encounter obstacles or high demands when the acoustical quality of the sound produced by the source or transmitted through the environment, communication medium or technology is poor. Listening will be more demanding for listeners with poorer auditory and/or cognitive abilities than for those with better abilities. Listening demands will also be greater when fewer situational or linguistic cues are available to provide supportive context. Put another way, listening demands can be attributed to the characteristics of the signal, listener, environment, and message. Audiologists are very familiar with the importance of these types of input-related demands. Indeed,

the types of input-related demands included in the FUEL are similar to the components of the classic speech chain model (Denes & Pinson 1963; see also Humes & Bess 2013), to problem-based approaches to audiologic rehabilitation (Erber 1988; Pichora-Fuller & Kirson 1994; Robertson et al. 1997), and to the categories of adverse conditions for speech recognition (Mattys et al. 2012) adopted in the white paper of the British Society of Audiology on listening effort (McGarrigle et al. 2014). As illustrated in the FUEL, to overcome such demands listeners may allocate cognitive capacity (i.e., expend listening effort).<sup>\*</sup> However, since listening effort is the *deliberate* allocation of resources to overcome demands, it is also important for audiologists to appreciate the factors that affect listeners' decisions regarding when and to what extent they will expend effort in pursuit of a goal in a given situation. In particular, one of the research priorities identified in the consensus paper (Pichora-Fuller et al. 2016, this issue, pp. 5S–27S) is to identify factors related to listening effort that could be modified by intervention. In addition to the auditory and cognitive factors that are considered in typical interventions involving technology or training, social psychological factors are also important to consider.

## SOCIAL PSYCHOLOGICAL FACTORS IN APPLYING THE FUEL TO REHABILITATION

### Components Influencing the Allocation Policy in the FUEL

As stated above, audiologists are very familiar with the importance of input-related demands; however, they may be less familiar with the idea that these demands alone do not determine how much effort an individual allocates in pursuit of a goal when carrying out a task that involves listening. Just because demands increase, even if the listener has sufficient capacity to meet the demands, capacity may or may not be allocated depending on the person's evaluation of his or her capacity and willingness to expend the effort needed to meet the demands. The present article focuses mainly on the component of the FUEL concerned with the evaluation of demands on capacity because this is a key component in determining if and to what extent a listener responds to input-related demands by allocating capacity. As shown in Figure 1B of the consensus paper (Pichora-Fuller et al. 2016, this issue, pp. 5S–27S), this component of the FUEL can be influenced by low arousal, fatigue or (dis)pleasure and it may involve the evaluation of the competing demands on capacity by multiple possible activities. Another component of the FUEL that influences the allocation of capacity is the intentional attention component which can be influenced by the motivation of the individual to allocate capacity

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<sup>\*</sup>In the present article, as in the consensus paper, the following wording will be used interchangeably: *allocate capacity*, *supply capacity*, *allocate resources*, and *expend effort*.

to meet high demands if listening goals have sufficient value or successful performance is important to the listener (Richter 2016, this issue, pp. 111S–117S; see also Pichora-Fuller et al. 1998). Thus, if and to what extent a listener allocates capacity depends not only on input-related demands but also on at least two other components of the FUEL, the evaluation of demands on capacity component and the intentional attention component, both of which can be modulated by social-cognitive psychological factors.

### Interventions to Reduce Listening Effort

A key issue concerns how rehabilitation could alter the allocation of capacity (i.e., listening effort). In addition to reducing input-related demands using well-known treatments (e.g., by providing amplification or training talkers to speak clearly or by reducing room noise, etc.), it may be possible to use alternative rehabilitative approaches related to the other components of FUEL to reduce listening effort. For example, interventions might reduce listening effort insofar as they alter listeners' evaluations of the demands on capacity by changing their motivation and intention to perform listening tasks to achieve their goals. Social-cognitive psychological factors likely play a role in listeners' evaluations of how well demands can be met by their capacities and in the nature and degree of their motivation to succeed when performing a listening task in pursuit of goal. Thus, by considering how social-cognitive psychological factors relate to the FUEL, we may gain new insights into how rehabilitative audiology could modify listeners' experiences of effortful listening.

Widely accepted key assumptions in rehabilitative audiology are listed in the first column of Table 1. The FUEL prompts a new perspective on these common assumptions by considering

the reduction of listening effort as a purpose of intervention. In general, if the complaint of the person is that listening is too effortful in a target activity (e.g., following conversation in a multi-talker scene) that is required to meet an important communication goal (e.g., maintaining participation as a volunteer in a community organization), then interventions could be designed and implemented to reduce listening effort (i.e., the amount of capacity supplied to meet the demands of the activity). For interventions tailored to reduce listening effort, the common assumptions underlying rehabilitative audiology can be refined as shown in the second column of Table 1. Below, we examine in greater detail how social psychological factors could guide the tailoring of interventions to reduce listening effort in relation to the FUEL.

### Social Psychological Factors: Health Promotion, Ecology, and the Social Environment

The adage *we hear with our ears, but we listen with our brain* is extended in the consensus paper (Pichora-Fuller et al. 2016, this issue, pp. 5S–27S) by adding *and when and how much effort we expend during listening in everyday life depends on our motivation to achieve goals and attain rewards of personal and/or social value*. By underscoring the role of motivation and decision-making regarding when and how much effort is expended during listening, the extension to the adage is consistent with a health-promoting approach to rehabilitative audiology. Health-promoting approaches are based largely on theories from social psychology applied to behavior change and coping (e.g., Green & Kreuter 2005). Rehabilitative audiologists have recognized the potential usefulness of health-promoting approaches based on these theories for decades (e.g., Noh et al. 1994; Carson & Pichora-Fuller 1997; Hickson & Worrall

**TABLE 1. Common assumptions in audiologic rehabilitation and refinements to the assumptions based on the FUEL**

Assumptions Underlying Audiologic Rehabilitation	
Current	Refinements Based on the FUEL
Assessment identifies the everyday communication goals of the person who is hard of hearing (e.g., by administering the Client Oriented Scale of Improvement; Dillon et al. 1997).	Communication goals may entail reducing listening effort in target tasks required to achieve goals.
Planning intervention involves prioritizing goals based on their importance to and likely achievability by the person who is hard of hearing.	The importance of goals entails the person's motivation and evaluation of success importance. The achievability of goals entails consideration of the person's appraisals of demands and of his/her capacity for meeting those demands.
Implementation of intervention is tailored to achieving the person's prioritized goals.	Interventions can reduce the amount of listening effort that the person expends to attain prioritized goals. Specifically, the allocation of capacity (effort) can be altered by changes in how the person evaluates demands relative to his/her capacity to meet the demands.
Intervention is successful if the specific hearing-related goals of the person are achieved.	Intervention is successful if there is a favorable change in the evaluation of the balance between demands and capacities. Specifically, a favorable change can result from a higher appraisal of capacity and/or a lower appraisal of demands resulting in a better balance (cost/benefit) between the effort (cost) of listening and the value (benefit) attained from listening.
Intervention is successful at a more global quality-of-life level if participation in everyday activities is enhanced or potential declines in (or withdrawal from) participation are averted.	A better balance (cost/benefit) between the effort (cost) of listening and the value (benefit) attained from listening contributes to preserving and enhancing participation. Positive effects on participation can in turn promote health and well-being.

2003), and there has been renewed interest in applying them in patient-centered approaches (Grenness et al. 2014), in rehabilitation for older adults (Pichora-Fuller et al. 2015), in counseling (Borg & Borg 2015), and to facilitate help-seeking and the uptake of hearing aids (Laplante-Lévesque et al. 2013; Knudsen et al. 2013; Saunders et al. 2013, 2016; Wänström et al. 2014). Against this general backdrop of applying theories of social and health psychology to audiologic rehabilitation, it seems timely to consider the specific ways in which social psychological factors could inform the development of interventions to reduce listening effort in relation to the FUEL.

About 70 years ago, health was defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (World Health Organization 1946). Consistent with this reconceptualization of health, over the intervening decades there has been a shift in health care from the traditional biomedical model to a biopsychosocial model (Engel 1977). Twenty years ago, from the perspective of health promotion, the definition of health was recast as the capacity of people to adapt to, respond to, or control life's challenges and changes (Frankish et al. 1996). Importantly, this newer reconceptualization of health situates the patient in a personal and environmental context.

With increased emphasis on understanding the real-world ecology of the person, the paradigm for health care, and especially the paradigm for rehabilitation, has shifted further to a biopsychological model (Stineman & Streim 2010). This shift is compatible with the International Classification of Functioning, Disability, and Health (ICF) of the World Health Organization (2001) insofar as it incorporates the effects of personal factors and environmental factors on functioning. Relevant to rehabilitative audiology, approaches based on ecological principles have been proposed for communication (Borg et al. 2008) and aging (Wahl et al. 2012). Moreover, the American Speech-Language-Hearing Association (2001, pp. 394) has adopted an ecological definition of audiologic rehabilitation: “audiologic/aural rehabilitation is an ecological, interactive process that facilitates one's ability to minimize or prevent the limitations and restrictions that auditory dysfunctions can impose on well-being and communication, including interpersonal, psychosocial, educational, and vocational functioning.” How could ecology or the relationship between people and their environments be related to the FUEL?

In the ecology of listening conditions in everyday life, input-related demands include internal listener factors such as the person's auditory and cognitive abilities and external environmental factors (e.g., the acoustical properties of the physical environment may be aversive or conducive to listening). Likewise, internal listener factors include personal social-cognitive factors (e.g., self-efficacy) and external social environmental factors (e.g., social support). These personal social-cognitive and social environmental factors contribute to how listeners appraise listening demands, how they appraise their auditory

and cognitive abilities and capacity† to meet those demands, and the importance or value they ascribe to goals involving the performance of listening tasks. Whereas actual listening demands may depend more on the physical environment and auditory or cognitive abilities, the subjective evaluation of the demands on capacity and a person's motivation to expend listening effort to meet those demands likely depend more on social-cognitive psychological factors and the social environment. Audiologists have applied the ICF (World Health Organization 2001) to rehabilitative audiology (e.g., Kiessling et al. 2003) and the effects of hearing abilities and the physical environment on speech understanding are well known to audiologists; however, relatively little study has focused on the personal social-cognitive psychological and social environmental factors that influence functioning and participation in everyday life. This gap was identified in a recent review of the ICF core sets for hearing loss noting that the social context of people who are hard-of-hearing is under-represented in rehabilitative audiology (Danermark et al. 2013; Granberg et al. 2014a, b, c; see also ICF Research Branch 2013). The FUEL provides an opportunity to consider specific ways in which internal and external social psychological factors could be considered in the development of interventions to reduce listening effort because these factors can influence individuals' evaluation of demands on capacity and their cost/benefit analyses related to motivation.

## RELATING SOCIAL PSYCHOLOGICAL FACTORS TO THE FUEL

Some social psychological factors relevant to rehabilitative audiology that can be related to FUEL involve stress, social support, self-efficacy, and stigma. With reference to the FUEL, social-cognitive factors may influence listeners' appraisals of demands on capacity and their decision-making regarding when and how much effort to expend, with immediate and long-term

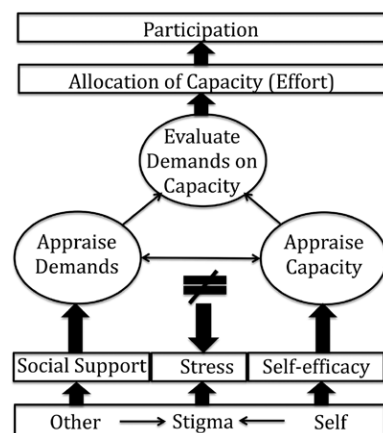


Fig. 1. The decision of listeners to allocate capacity (i.e., expend effort) to meet the demands of participating in listening activities is influenced by the evaluation of demands on capacity. This evaluation is influenced by their appraisals of demands and of their capacities. The appraisal of demands can be influenced by social psychological factors such as social support. The appraisal of capacity can be influenced by social psychological factors such as self-efficacy. Imbalance (≠) between the appraisals of demands and capacities can result in stress. Stigmatization by others and/or the self can influence social psychological factors such as social support, self-efficacy, and stress.

†Note that for the purposes of this argument, although the terms *capacity* and *ability* refer to different concepts in the FUEL, these terms are being used similarly here because the capacity (or resources) available to individuals to meet demands in a challenging listening situation will depend, at least partly, on their auditory and cognitive processing abilities. Assuming that two individuals have equivalent total capacity but that one person has better auditory and cognitive abilities than the other, the one with better abilities should be more efficient in processing information, thereby needing to use less capacity and having greater spare capacity during listening; see Rudner, 2016, this issue, pp. 69S–76S.



consequences to social participation. Figure 1 illustrates how these factors could be related to each other and to the FUEL.

### Consequences of Balancing Demands and Capacity for Social Participation

The top circle in Figure 1 (evaluate demands on capacity) is a component from the FUEL as depicted in Figure 1B of the consensus paper (Pichora-Fuller et al. 2016, this issue, pp. 5S–27S). The other two circles in Figure 1 are elaborations on the FUEL to show that listeners' evaluations of the demands on capacity are influenced by their appraisals of listening demands and their appraisals of their own capacity. According to the FUEL, there is a tradeoff of demands versus the capacity allocated such that less effort is needed when the balance is favorable and more effort is needed when the balance is unfavorable. The nature of this balance between the appraisal of demands and the appraisal of capacity would be evaluated as being (un)favorable in light of the importance of pursuing goals that depend on listening. When the balance is unfavorable, if success importance and motivation to pursue a goal are high, then more capacity will be allocated, but otherwise the task may be abandoned (e.g., a professor at a university reception may expend effort to listen to a distinguished visiting scientist but withdraw from conversation with unfamiliar students). The two rectangles at the top of Figure 1 illustrate that the cost/benefit evaluations of demands relative to capacity influence listeners' decisions about whether or not to allocate capacity (expend effort) in cases where a goal is sufficiently important. In turn, decisions about the allocation of capacity (effort) have consequences to a listener's participation in challenging situations. The decision to expend effort can secure participation, whereas the decision not to expend effort can jeopardize participation. Such inter-related effects of auditory, cognitive, and social psychological factors are apparent in the comment of an individual who is hard of hearing who recounts how not hearing led to not paying attention and jeopardized relationships because "People would say, 'You can hear, you just didn't pay attention.' And that was partly accurate. I stopped paying attention because I couldn't hear." (Bouton 2013, pp. 52).

### Effects of Social Psychological Factors on Appraisals of Demands and Capacity

The two rows of rectangles at the bottom of Figure 1 illustrate how various social psychological factors may modulate how listeners appraise demands and capacity.

**Stress** • In general, people respond differently to a wide range of potential stressors. Therefore, it is reasonable to assume that individual listeners will respond differently to the same input-related demands on listening when these demands are potential stressors. Importantly, the response to any potentially stressful situation, including many demanding listening situations, depends on how the person appraises the situation, including different stages of appraisal (Lazarus & Folkman 1984; Folkman et al. 1986). For the primary appraisal, individuals evaluate if the situation is harmful, threatening, or challenging. For the secondary appraisal, individuals evaluate whether or not they have adequate resources to cope with the challenges of the situation. There can also be a reappraisal as the situation changes. Put another way, whether or not listeners experience stress depends not only on how demanding a situation is relative to

their actual abilities but also relative to their self-perceptions in appraising their ability to meet those demands. In a situation that is appraised as being demanding and potentially stressful, if individuals appraise their abilities or resources to be sufficient to meet the demands then stress is not expected to occur; however, stress is likely to occur if individuals appraise their capacity to be insufficient to meet the demands of the situation. A stress response (e.g., fight or flight) can enable people to successfully contend with threatening or challenging circumstances; however, stress can also reduce performance in a given situation and chronic stress can have deleterious effects on many aspects of health, including auditory and cognitive functioning. As defined in the consensus paper (Pichora-Fuller et al. 2016, this issue, pp. 5S–27S), stress is an individual's total response (physiological, cognitive, and emotional) to environmental demands or pressures. Stress occurs when there is an imbalance between the person and his or her environment; that is, when the demands of a situation are perceived as straining or exceeding capacities, thereby threatening well-being.

Four main characteristics of demanding situations can induce a stress response; they are summarized in the acronym NUTS: novelty, unpredictability, threat to self, and sense of a lack of control (Lupien et al. 2012). Situations with these characteristics are often encountered by people who are hard of hearing when they are in the clinic (and sometimes in research labs) and in many real-world conditions of everyday life. Similar to other kinds of medical appointments, audiology appointments may produce stress that could be reduced by optimizing the physical and social environment of the clinic (for practical guidelines see Lupien et al. 2012). In everyday life, many of the most demanding listening situations could be stressful for people with normal hearing and difficulty hearing would likely increase stress responses. Thus, stress responses may exacerbate patients' experiences of effortful listening. Stress responses may affect performance on clinical speech-in-noise tests, research on listening effort, and the decisions of listeners about participation in everyday activities involving listening. Nevertheless, little is known about the specific effects of stress responses on individuals' evaluation of demands on capacity, their listening performance or participation choices. What is known is that exposure to stressing situations results in the production of stress hormones (see also Kramer et al. 2016, this issue, pp. 126S–135S). Furthermore, stress hormones can alter brain functioning, resulting in immediate stress-induced reductions in memory performance and in permanent changes to the brain and memory impairments in those exposed to chronic stress (Lupien et al. 2009). Interventions to counter-act stress responses and alleviate the experience of effortful listening could employ strategies to reduce the novelty and unpredictability of listening situations (e.g., by training in the use of communication strategies) and to bolster the person's resilience to threats to self and sense of loss of control (see Fig. 1 and sections on stigma and self-efficacy below). Conversely, interventions to reduce listening effort may help to manage the stress responses of listeners for whom the evaluations of the demands on capacity during listening are often unfavorable.

From an ecological perspective, stress is often thought of as the result of a mismatch or imbalance in the person–environment (P–E) fit (Stokols 1992). The idea that behavior is a function of both the person and the environment goes back to the seminal work of Kurt Lewin in the 1930s and over the intervening

decades the conceptualization of the P-E fit has continued to be refined (for reviews see Edwards & Cooper 1990; Caplan & Harrision 1993); for example, the P-E fit may be objective or subjective and the P-E fit may be interpreted in terms of facilitators or barriers. The facilitative perspective emphasizes how the supply of support or enrichment from the environment satisfies the person's motives, goals, and values (supply-value, S-V fit) or provides pleasure (see also Matthen 2016, this issue, pp. 28S–34S). The barrier perspective emphasizes how the demands of the environment can be met by the abilities and skills of the person (demands-abilities, D-A fit). In gerontology, the P-E fit has been shaped by Lawton's ecological theory of ageing, whereby *environmental press* or *competence press* emphasizes the relationship between the individual's functional capacity and the demands of the environment; that is, behavior and functioning depends not only on the nature of the environment and the competence (competence refers to the upper limit of the person's capacity) of older individuals as independent factors but also on the interactions between the environment and an individual's competence (for a review see Wahl et al. 2012). Recently, a new model of *aging well* was proposed that integrates both social and physical environmental factors, thereby advancing our understanding of changes in identity, well-being, and autonomy over the course of adult development and aging (Wahl et al. 2012). Within such an integrated social and physical ecological framework, the core assumption is that there are two processes that affect changes in P-E interactions with age: experience-driven belonging and behavior-driven agency (Wahl et al. 2012). Belonging refers to a sense of positive connection with other people and the environment, while agency refers to the process of becoming a change agent in one's own life by means of intentional and proactive behaviors.

Audiologists have already suggested that agency could be enhanced using rehabilitative approaches such as motivational interviewing (McFarland 2012) or patient-centered care to promote autonomy and internal motivation (Ryan & Deci 1999) in help-seeking and decision-making for hearing problems and the adoption of hearing aids (e.g., Ridgway et al. 2015, 2016). Similar approaches could also be beneficial in reducing listening effort if P-E interactions are improved and the evaluation of demands on capacity become more balanced. Furthermore, assuming that optimizing the P-E fit can reduce stress, and that the two main processes of change in P-E interactions over the lifespan are belonging and agency, then approaches to rehabilitation to reduce listening effort might also be enhanced by modifying social support to promote belonging and by modifying self-efficacy to promote agency. Figure 1 illustrates how a potentially stress-inducing imbalance between the appraisal of demands and the appraisal of capacity could be altered by the influence of social support on the appraisal of demands and/or the influence of self-efficacy on the appraisal of capacity (see also the sections on social support and self-efficacy below). Notably, social withdrawal in adulthood can be a consequence of exposure to high and persistent stress levels, but social support can modulate an individual's stress reactivity and stress-related outcomes, with positive support buffering stress and dysfunctional social interactions triggering stress (Sandi & Haller 2015). Some evidence even suggests that high quality social interactions may be protective for dementia (Amieva et al. 2010), which is a concern given that hearing loss may be a risk factor for social isolation in adults who are 60 to 69

years old (Mick et al. 2014; Mick & Pichora-Fuller 2016). Thus, the effects of stress on cognitive functioning (and also effortful listening) seem likely to be linked to social psychological and social ecological aspects of the P-E fit, including social support and self-efficacy.

**Social Support** • Social support by a significant other often mitigates stress and can lower the appraisal of demands. Social support can take a variety of forms, including instrumental (e.g., financial aid), informational (e.g., advice), emotional (e.g., empathy), or appraisal support (e.g., constructive feedback; Broadhead et al. 1988; Cohen 2004). It can have a positive effect on outcomes for many health conditions, by promoting the use of effective coping strategies and counter-acting negative interpretations of adverse events (Broadhead et al. 1983; Cohen & Wills 1985).

In audiology rehabilitation, social support by significant others has been shown to increase a person's motivation to use hearing aids (Carson 2005; Lockey et al. 2010), to pursue and adhere to treatment (Duijvestijn et al. 2003; Meyer et al. 2014), and to facilitate communication and the proper use and operation of hearing aids (Mahoney et al. 1996; Van den Brink et al. 1996; Manchaiah et al. 2013). Conversely, the negative attitudes of significant others may contribute to delaying help-seeking or rejecting treatment (Brooks 1989; Kochkin 2007). It is also worth noting that hearing loss affects not only the person who has hearing loss, but also significant others (Hétu et al. 1987; Stephens et al. 1995; Stephens 1996; Heine et al. 2002), reducing their physical, psychological, and social well-being. The burden of providing social support may strain relationships, increase stress, and compromise the health and quality of life of those who provide the support (Kramer et al. 2002; Danermark & Gellerstedt 2004). In particular, third-party disability manifests in wide ranging effects on the spouses of persons with hearing impairment (Stark & Hickson 2004; Scarinci et al. 2008, 2009a, b), including communication difficulties, emotional sequelae, and effects on relationships and everyday activities (Hétu et al. 1993; Wallhagen et al. 2004; Kamil & Lin 2015). Importantly, the availability of social support seems to differentiate successful from unsuccessful (Hickson et al. 2014) and satisfied from unsatisfied hearing aid users (Singh et al. 2015). Most research on social support in audiology rehabilitation has been concerned with the adoption and use of hearing aids, and the benefits of involving significant others in rehabilitation (Preminger 2003, 2007, 2009; Preminger & Lind 2012).

Relatively little research has been conducted on how social support may reduce listening demands during conversation and social interaction, but social support has been identified as a strong predictor of adjustment to the psychological distress associated with hearing loss (Frankel & Turner 1983). Furthermore, it seems likely that there may be powerful effects of social support on communication function if the significant other is a supportive conversational partner who uses strategies to enable fluent conversation (Erber 1988). A listening-specific example of instrumental support would be a communication partner's willingness to use assistive technology such as wearing an FM transmitter. A listening-specific example of informational support would be a communication partner's use of conversational repair or clarification strategies to optimize the accuracy of information exchange. Beyond the benefits of using technologies and honing conversational skills, a communication partner could also provide emotional support to encourage the listener

and appraisal support to reinforce the listener. Emotional support could increase a listener's motivation to communicate and the positive value of the relationship to the listener could increase the value ascribed to interaction, thereby predisposing the allocation of capacity even when listening demands are high. Appraisal support could reinforce the listener's decision to expend effort by confirming that intended goals were being achieved successfully. Overall, as shown in Figure 1, social support could influence the evaluation of demands on capacity. All forms of social support, but especially instrumental and informational support, could reduce the listener's appraisal of demands insofar as demands may seem to be lessened because of the support provided by a communication partner. In addition, as described above, emotional and appraisal support could increase the listener's motivation by increasing the importance or value of communication. Another possibility is that emotional and appraisal support could improve self-efficacy to boost the listener's appraisal of his or her capacity to meet demands.

**Self-Efficacy** • The appraisal or self-perception of one's abilities and capacity to meet demands is related to self-efficacy. Self-efficacy refers to domain-specific "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura 1997, pp. 3). Individuals with high self-efficacy tend to expend greater effort to achieve a target behavior, persevere despite difficulties, and cope better when emotional, social, and environmental demands are encountered (Bandura 1997). Self-efficacy plays an important role in the successful management of a wide range of chronic health conditions. In rehabilitative audiology, measures of self-efficacy for hearing aid use (Smith & West 2006b), listening (Smith et al. 2011), and managing communication situations (Jennings et al. 2014) have been developed. In addition, rehabilitative strategies for enhancing the self-efficacy of people who are hard of hearing have been described (Smith & West 2006a). Some strategies to enhance self-efficacy directly target reducing physiological stress (e.g., by taking breaks) and negative emotional states (e.g., by using calming feedback). Other techniques include providing opportunities for listeners to experience mastery in performing tasks (e.g., in role playing) or to have vicarious experiences of others modeling the performance of tasks (e.g., demonstrations by peer models). These experiences could also serve to reduce stress by reducing novelty and increasing predictability and the person's sense of control in situations where demands are high. Another technique is verbal persuasion that could involve social support, especially emotional support or appraisal support, which in turn could also reduce stress.

Overall, as shown in Figure 1, self-efficacy could influence the evaluation of demands on capacity by boosting the listener's appraisal of their capacity to meet the demands of listening when input-related demands are high. Directly or indirectly, increased self-efficacy could also reduce stress. Interestingly, both of the two subscales (hearing ability and confidence) of the Self-Efficacy for Situation Communication Management Questionnaire were negatively associated with measures pertaining to the experience of hearing loss (i.e., consequences of hearing loss and negative beliefs and attitudes toward hearing loss and its consequences), but only scores on the hearing ability subscale were associated with hearing loss (Jennings et al. 2014). These connections between self-efficacy (confidence) and negative attitudes and beliefs may involve stigma.

**Stigma** • In general, stigma involves the (self-)identification of a person as having a characteristic that is devalued in a social context (Southall et al. 2010). Negative ageist views of older adults as having diminished cognitive and social competencies can be held by others or by the self, with their perceived deficits often being more severe than their actual deficits (for a review see Richeson & Shelton 2006). Negative stereotypes that under-estimate the competencies of older adults may deter them from becoming involved in new activities or participating in activities to their full potential. Moreover, negative stereotypes by others and self-perceptions of aging may affect the health of older adults (Levy et al. 2002a). Strikingly, older adults with more positive self-perceptions and views of aging have better physical health and live an average of 7.5 years longer compared to peers with more negative self-perceptions and views, even after controlling for appropriate variables, such as gender and socioeconomic status (Levy et al. 2002b).

It is appropriate to consider the effects of stigma on listening effort because hearing and memory are two domains in which others often negatively stereotyped older adults (Goffman 1963; Hummert et al. 1994; Chasteen et al. 2002; Cuddy et al. 2005; Levy 2009). The stigma associated with hearing loss is entangled with ageism (Wallhagen 2010). Perceptions of stigmatization can fuel the denial of hearing problems and nonadherence to rehabilitative treatments (Hétu 1996; Gagné et al. 2009), although these effects may vary with age, differ between men and women, and be associated more with hearing loss than with hearing-aid use (Erler & Garstecki 2002). Ageist stereotypes held by communication partners can have short- and long-term negative effects on the communication and social interactions of older adults (Ryan et al. 1986, 1995). Furthermore, negative stereotypes can lower older people's self-perceptions of their hearing and memory abilities relative to their actual abilities (Hertzog & Hultsch 2000; Hertzog & Dunlosky 2011) and even accelerate declines in hearing (Levy et al. 2006). Age per se is not correlated with negative views of aging (Kang & Chasteen 2009); however, these negative views are associated with self-perceptions of hearing and memory abilities which in turn are associated with actual performance on behavioral tests of hearing and memory abilities (Chasteen et al. 2015). Figure 1 illustrates that stigma and negative views held by the self could lower a person's self-perceived listening competency (poorer listening self-efficacy). It is also possible that negative views held by a communication partner that under-estimate the person's auditory and cognitive competency could compromise social support during listening.

Importantly, responses to stigma can vary depending on context such that some individuals are vulnerable while others are resilient to stigma (Southall et al. 2010). Thus, there is potential to tailor interventions according to the individual's responses to stigma. Models have been proposed to address identity-related issues in audiologic rehabilitation by engaging people who are hard of hearing and their significant others in making changes to overcome the negative effects of stigma (Hogan et al. 2011). Such interventions have not been explored in relation to listening effort, but it seems very likely that stigma is a factor that influences when and to what extent a listener will expend listening effort. Those who are experiencing the negative effects of stigma will likely have lower



appraisals of their capacity related to poorer self-efficacy and they may also have higher appraisals of the demands in a situation related to poorer social support. Interventions to instill more positive views of aging could alter how the person evaluates demands on capacity. Interventions could also be developed to modify motivation and how the person evaluates the importance of success; for example, based on recent findings that the under-performance of older adults in response to negative stereotyping is more pronounced when success on a cognitive task depends on being correct than when it depends on avoiding errors, interventions could use a loss-avoidance motivational strategy to counter-act the deleterious effects of stigma (Barber et al. 2015).

## CONCLUSION

The FUEL builds on well-known connections between hearing and cognition and draws on psychological theories of cognition and motivation in an attempt to advance our understanding of when and to what extent listeners expend effort in the challenging communication situations of everyday life. Over many decades, the conceptualization of health and the delivery of health care have evolved by placing increasing emphasis on the psychosocial ecology of people. Audiologic rehabilitation has followed this trend and there has been a recent rebirth in the application of social psychological theories and health-promoting approaches to hearing care. Social psychological theories have been applied mostly in interventions to promote help-seeking and the adoption and use of hearing aids, and to a some extent in conversational therapy and interventions to increase participation. In the present article, the possible application of theories of social psychology is considered in relation to the FUEL with a view to informing the development of rehabilitation to reduce listening effort. In particular, stress and the effects of social support, self-efficacy and stigma seem to be relevant to how listeners appraise demands and capacity. Interventions to improve social support and self-efficacy and to reduce stigma seem to be promising approaches that could shift listeners' appraisals of their capacities to be higher and their appraisals of demands to be lower. By improving balance in the evaluation of demands on capacity, these shifts could reduce the stressfulness of listening and alleviate the experience that listening is too effortful.

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