Behavioral Mimicry as a Strategy to Increase Drinking Behaviors in Older Adults

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Abstract

Purpose: Individuals with dysphagia, particularly in the presence of dementia, are at high risk for decreased nutrition and hydration. Unfortunately, current treatment options are not without limitations and often ignore the crucial social aspects of mealtimes. The aim of this exploratory, proof-of-concept study was to examine whether the social phenomenon of nonconscious behavioral mimicry can increase drinking behaviors in healthy older adults.

Methods: Forty-two older adults (M_{age} = 68.26 years, *SD* = 6.49) participated. Participants and a member of the research team posing as another participant (a confederate) took turns describing two series of pictures while, unbeknownst to the participants, the confederate either frequently drank from a cup of water or touched the cup. The primary outcome measures (number of drinks per minute, number of cup touches per minute, percentage of time spent drinking, and percentage of time spent touching the cup) were coded and analyzed across both the confederate drinking and cup touching conditions.

Results: Participants drank more frequently and spent more task time drinking during the confederate drinking condition as compared to the cup touching condition. There was significant variability in drinking patterns across participants, with some only drinking when they were not engaged in the picture description task.

Conclusions: Behavioral mimicry may increase drinking behaviors in healthy older adults, although the effect may not be as robust among certain subsets of individuals. Clinically, mimicry may hold potential as a powerful, non-invasive supplemental mealtime strategy for increasing intake in those who are most at-risk for malnutrition.

Introduction

Meals are more than just a means for nutrition and survival. Eating and mealtimes reinforce our physical, psychological, and emotional connections to our families, social networks, and ourselves (Mintz & Du Bois, 2002; Plastow et al., 2015). Socializing and eating are activities that are strongly related to the creation of positive emotion and the maintenance of one's social and cultural identities (Brown et al., 2013; Locher et al., 2005; Ochs & Shohet, 2006; Plastow et al., 2015). Thus, it is clear that the shared meal merges two of the most fundamental and pervasive human needs that ultimately drive behavior: basic physiological needs such as nutrition and hydration and interpersonal involvement (Baumeister & Leary, 1995; Maslow, 1943).

It is not surprising, then, that the biopsychosocial impacts of dysphagia are particularly widespread. Across patient populations, the presence of dysphagia is associated with an increased risk of mortality and morbidity, such as pneumonia (e.g., Allen et al., 2019; Cabre et al., 2014; Langmore et al., 2002; Shune et al., 2012). Individuals with dysphagia, particularly those on textured modified diets and/or thickened liquids, also frequently demonstrate decreased overall intake, leading to an increased risk of malnutrition and dehydration (Finestone et al., 2001; Foley et al., 2009; McGrail & Kelchner, 2015; Penalva-Arigita et al., 2019; Serra-Prat et al., 2012; Whelan, 2001). Further, difficulties with eating and swallowing can result in decreased quality of life and social participation and increased anxiety, depression, and social isolation (e.g., Carneiro et al., 2014; Klinke et al., 2013; Nguyen et al., 2005). Similarly, malnutrition can also negatively impact quality of life and mental well-being (e.g., Barker et al., 2011; Hernández-Galiot & Goñi, 2017; Thomas et al., 2002).

Unfortunately, the relationship between dysphagia, malnutrition, and quality of life/mortality is likely cyclical, with multiple potential "entry points" into a downward spiral. For example, dysphagia can contribute to malnutrition; malnutrition can contribute to the deterioration of functional capacity and muscle debilitation; decreased functional capacity and muscle debilitation can increase the likelihood of dysphagia; and so forth. This may be particularly relevant among our growing population of older and frail adults as advanced age is a risk factor for both malnutrition and the development of dysphagia (Baijens et al., 2016; Forster & Gariballa, 2005; Ney et al., 2009). Significantly, older adults with cognitive impairments, such as dementia, may be at the highest risk of malnutrition and dehydration as they often lack the ability to monitor their own food or liquid intake, do not recognize the need to eat, are uninterested in food, show no signs of being hungry or thirsty, and/or present with eating and swallowing difficulties (Aselage & Amella, 2010; Benigas & Bourgeois, 2016; Rudman & Feller, 1989). Thus, nutritional intake, particularly when given the presence of dysphagia, is of high concern in this particularly vulnerable population.

Unfortunately, traditional behavioral interventions, which often rely on typical cognition and memory, are not always the most effective or efficient for improving nutrition in this population (Aselage & Amella, 2010). Current behavioral interventions broadly include: education (e.g., Jackson et al., 2011; Liu et al., 2014), training (e.g., Benigas & Bourgeois, 2016; Lin et al., 2010), feeding assistance (e.g., Altus et al., 2002; Simmons & Schnelle, 2004), and environmental modifications (e.g., Jackson et al., 2011; Liu et al., 2014). Though increasing staff education and training can result in a significant improvement in knowledge and positive attitudes towards feeding patients with dementia, these interventions generally have not lead

to increased patient nutritional intake (Liu et al., 2014; Suominen et al., 2007). Feeding assistance has been found to significantly increase total caloric intake, body mass index, and body weight in persons with dementia, but this approach requires intensive involvement of a caregiver or loved one, thereby increasing burden of mealtime care (Altus et al., 2002; Simmons et al., 2001; Simmons & Schnelle, 2004). Additionally, direct verbal cueing, such as frequent reminders and conversations about health-related topics, may be perceived negatively by the patient, thereby causing dissonance in their relationship with their caregiver or family member (Goldsmith et al., 2006). Moreover, high staff turnover ratios, inadequate staffing, and lack of professional supervision may all limit the practicality of both education/training and feeding assistance interventions (Burger et al., 2001). Lastly, environmental modifications, such as sensory manipulations to promote mealtime success (e.g., contrast tableware, special lighting, therapeutic music), have been found to increase percentage of food intake and decrease agitation in several studies (Edwards & Beck, 2013; Hicks-Moore, 2005; Ho et al., 2011; Richeson & Neil, 2004; Thomas & Smith, 2009), whereas other studies have found little evidence for increased food intake with these modifications (Liu et al., 2014).

Notably, these current interventions do not focus on, or capitalize on, the important social aspects of mealtimes and some may actually interfere with the quality of mealtime interactions. Eating in company not only enhances the emotional experience of dining, but social companionship is indeed associated with greater food intake (e.g., Brown et al., 2013; de Castro, 1994; de Castro & de Castro, 1989). Research across a narrow range of populations has suggested that behavioral mimicry, or the nonconscious imitation of others' behaviors, may underly this adaptation of food intake to that of others (e.g., Bevelander et al., 2013; Hermans

et al., 2012; Koordeman et al., 2011; Larsen et al., 2009; Sharps et al., 2015; Shune & Foster, 2017). For example, both adults and children have been found to mimic their eating companions' food reaching and bite-taking behaviors (Bevelander et al., 2013; Hermans et al., 2012; Sharps et al., 2015) and young adults' have been found to match their eating companions' rate of consumption (Florack, Palcu, & Friese, 2013) and be more likely to take a sip of an alcoholic beverage immediately after observing either a peer or movie actor doing the same (Koordeman et al., 2011; Larsen et al., 2009).

Mimicry is inherently an implicit social phenomenon, allowing individuals to increase desired engagement and further promote quality interactions without any conscious cognitive effort or awareness (Bernieri & Rosenthal, 1991; Castelli et al., 2009). Given the central social role mealtimes play in daily life, intentional manipulation of behavioral mimicry may provide a viable mechanism for increased nutritional intake among at-risk individuals, such as those with dysphagia and dementia. However, only limited research involving healthy younger adults has specifically examined the manipulation of mimicry as a tool for targeting increased nutritional intake (Shune & Foster, 2017). This previous work specifically targeted increased water drinking behaviors among a group of 19 younger adults by experimentally manipulating the behavior of the participants' communication partner, a research assistant posing as another participant (the confederate). While completing picture description tasks (i.e., not related to eating or drinking), the confederate either frequently sipped from her water cup (drinking condition) or touched her cup but did not drink (cup touching condition). Significantly, participants spent more time drinking and had an increased drinking rate during the drinking condition as compared to the cup-touching condition, despite the task at hand having nothing to do with consumption.

Additionally, for a majority of the participants, drinking rate did increase during the drinking condition as compared to baseline, especially for those individuals who had the lowest drinking rates during the baseline period. This work supports that, at least among younger adults, behavioral mimicry may not only underlie the social modeling of food intake as has been previously suggested, but may also be a viable mechanism for therapeutically targeting increased intake.

Interestingly, research into the mirror neuron network has suggested a relative preservation of, and inability to inhibit, implicit imitation among individuals with mild to moderate Alzheimer's disease, at least for limb motor movement and perception-action matching (Bisio et al., 2012). Further, the capacity for more voluntary imitation has been found to be improved when provided with a human model of the target action (Bisio et al., 2016). The preservation of motor imitation, particularly imitation not reliant on conscious awareness, during non-goal directed limb movements suggests that behavioral mimicry may be particularly useful for this population during an everyday goal-directed activity, such as eating (Farina et al., 2020). Yet, this is not known. Given the necessity of identifying alternative strategies for improved nutrition and hydration intake among older adults with dysphagia and dementia, it is crucial to further characterize the rehabilitative role behavioral mimicry may play during mealtimes.

Taking advantage of individuals' inherent desire for interpersonal engagement by using behavioral mimicry in order to increase food and water intake during mealtimes may be a means to address the aforementioned limitations of current behavioral interventions and optimize therapeutic effects in older adults with cognitive impairments. Unfortunately, we do

not yet know whether there indeed is an influence of behavioral mimicry on the typical patterns of healthy older adults, a crucial step prior to a larger-scale intervention implementation within a vulnerable population (Thabane et al., 2010). Thus, the purpose of this proof of concept investigation was to explicitly test whether drinking behavior can be altered in healthy older adults as a result of behavioral mimicry. Participant water drinking behavior was monitored while they completed two picture description tasks. During one task, the participant's partner (a research assistant posing as another participant; the 'confederate') took frequent sips of water; during the other, the confederate frequently touched her cup, but did not drink. Based on previous studies of mimicry, we hypothesized that older adults would exhibit an increase in their drinking behaviors given the presence of increased drinking by their partner as compared to the presence of increased cup touching despite being unaware of the partner's increase in the target behavior (i.e., nonconscious mimicry).

Methods

Participants

Forty-two, self-reported healthy, community-dwelling older adults over the age of 60 were recruited to take part in a study examining the effects of different types of visual stimuli on conversational output (the 'cover study;' see further details below). Additional inclusion criteria, primarily as related to the cover study of an investigation of conversational output, included normal or corrected vision and hearing, being an English speaker, and no previous history of speech or language difficulties. The final sample ranged in age from 60 to 93 years old (M_{age} = 68.26 years, *SD* = 6.49) and included 25 females. The Institutional Review Board at the participating university approved the study. All participants signed written informed consent for

the cover study prior to participation and signed a debriefing form after completion of the task procedures.

Task procedures

The protocol followed that of Shune and Foster (2017), which was adapted from the methodology of Chartrand and Bargh (1999). To explicitly test the role of nonconscious mimicry in altering drinking behavior, it was necessary to place the drinking within a task that was not directly related to eating or drinking. Thus, participants were videotaped interacting with a female conversation partner, who unbeknownst to the participant was actually a member of the research team (a confederate), during two image description tasks (the cover study). Given the high speaking demands of the cover task, participants were provided with a cup of water, which remained with the participant throughout the study tasks. Participants were given a 12 ounce paper cup, filled approximately three quarters of the way full. There was one instance in which a participant declined a cup of water due to having brought his own water bottle, which was used for the study. No restriction was placed on quantity of water and refills were available if needed; however, no participants emptied their cup prior to the end of data collection.

The participant and confederate sat side by side at a single table, facing the experimenter who sat on the opposite side of the table. The participant and confederate took turns describing two different sets of pictures, one set of paintings and another of photographs, for approximately 10-15 minutes for each set. Task order was randomly assigned with some dyads describing the paintings first and others describing the photographs first. Two confederate behaviors were manipulated in the session: cup/water drinking and cup touching

(lifting the cup off the table and holding it without drinking). Order of the confederate behaviors was also randomly assigned.

Following both description tasks, a funneled debriefing based on Chartrand and Bargh (1999) occurred, in which participants filled out a questionnaire regarding the quality of the interaction and rapport felt with the partner to probe for any suspicion regarding the true nature of the study and conscious awareness of any specific mannerisms (i.e., cup drinking or touching) the confederate displayed. Participants were then fully debriefed. No participants indicated any suspicion regarding the true nature of the study or awareness of confederate mannerisms related to the cup.

Data collection and analysis

The entire experiment was video-recorded using two Canon VIXIA HF R52 camcorders. Two camcorders, one focused on the participant and the other on the confederate, were used in order to ensure that coders of the participant videos were blinded to confederate task behavior. The videos were then segmented into three conditions: baseline (from the time the cup of water was presented to the start of the first image description task, including a period of time where the participant was alone in the room while the researcher left to get the confederate; M = 8.88 minutes, SD = 5.46), confederate drinking (termed 'drinking condition'; M = 13.39 minutes, SD = 2.63), and confederate cup touching (termed 'cup touching condition'; M = 12.29 minutes, SD = 1.96). The recordings were then coded for the occurrence and duration of each participant and confederate drink and cup touch across the three conditions. Data was coded by two primary coders. Inter-rater reliability was calculated for approximately 25% of the data to ensure consistency across coders; reliability was 91.5% for occurrence of an

action, 100% for action classification into “drink” or “cup touch,” and 96.1% for duration of action. As needed, segments were reviewed by the two coders, discussed, and re-measured.

For each condition, four participant outcome measures were calculated (the dependent variables): number of drinks per minute, number of cup touches per minute, percentage of time spent drinking, and percentage of time spent touching the cup. The number of drinks and cup touches per minute for the confederate was also calculated for a manipulation check. Paired *t*-tests were used to quantify differences in mean drinking behavior between the manipulated task conditions and baseline as well as to test the effects of manipulated condition (drinking versus cup touching) on the dependent variables. To address the main hypothesis, the primary analyses of interest were the comparisons of drinks per minute and percentage of time spent drinking in the drinking versus cup touching conditions. A *p*-value of $< .05$ was considered statistically significant. Statistical analysis was performed using SPSS (Version 26, IBM Corporation, Armonk, NY).

Results

Manipulation check

In order to ensure that the confederates consistently performed the target behaviors in the target session more than in the non-target session, the number of times per minute spent drinking and touching the cup for both conditions were coded. The confederate video was not available for three participants’ trials, so the total videos analyzed was 39. The confederates spent more time drinking during the drinking condition ($M = 0.79$ drinks/min, $SD = 0.27$) as compared to the cup touching condition ($M = 0.01$ drinks/min, $SD = 0.05$; $t(38) = 17.33$, $p < .001$). Similarly, the confederate spent more time touching the cup during the cup touching

condition (*M* = 1.23 touches/min, *SD* = 0.73) as compared to the drinking condition (*M* = 0.05 touches/min, *SD* = 0.09; *t*(38) = 10.17, *p* < .001).

Drinking behaviors

Figure 1 illustrates the frequency of drinking (i.e., number of drinks per minute) at baseline plotted against the frequency of drinking during the two experimental conditions (i.e., drinking, cup touching) for each participant. Drinking rate did vary between baseline and the experimental conditions such that participants had a slightly higher drinking rate at baseline (*M* = 0.15 drinks/min) as compared to both the drinking (*M* = .08 drinks/min; *t*(41) = 2.79, *p* = .008) and touching conditions (*M* = .05 drinks/min; *t*(41) = 4.37, *p* < .001). While participants also spent more time drinking (i.e., percentage of time drinking) at baseline as compared to the touching condition (*t*(41) = 4.78, *p* < .001), there were no significant differences between the baseline and drinking conditions (*t*(41) = 0.88, *p* = .384). Of note, a sizeable percentage of participants did not drink during either experimental condition (15/42). Given the lack of drinking across both conditions for these 15 participants, we also examined drinking behavior as compared to baseline when those participants were excluded from the analysis. Nearly half of the remaining participants (13/27) drank more during the drinking condition as compared to baseline, and there was no statistically significant difference found in drinking rate between the baseline (*M* = .15 drinks/min) and drinking conditions (*M* = .13 drinks/min; *t*(26) = 0.74, *p* = .467).

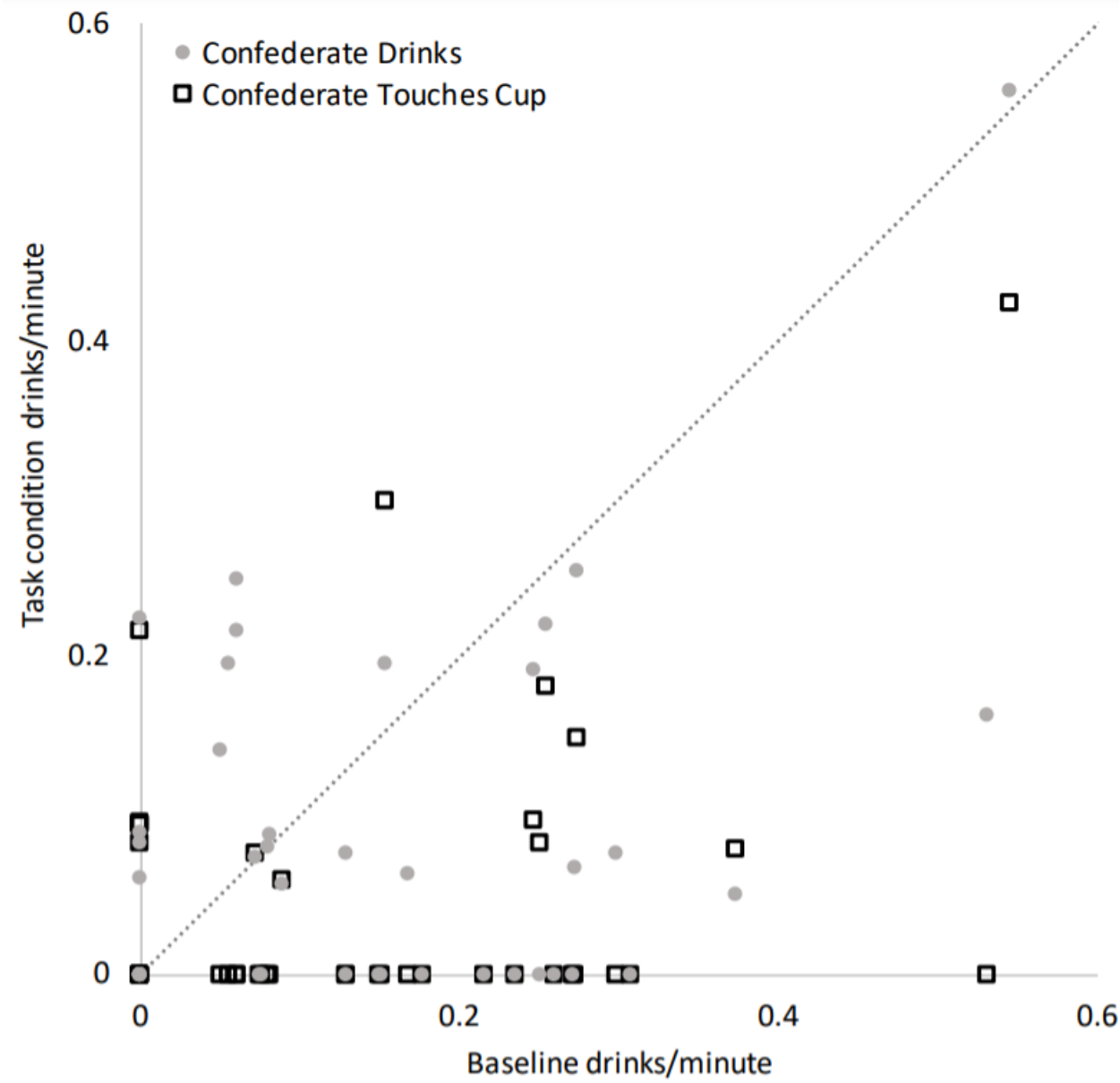

Figure 1. Participant drinks per minute for each condition (baseline, confederate drinking, confederate cup touching) plotted for all participants. Data points falling above the dotted reference line indicate a higher consumption rate during the task condition as compared to baseline, points falling below the reference line indicate a lower consumption rate during the task as compared to baseline, and points on or near the reference line indicate approximately the same consumption rate. Notably, a high number of participants did not drink during either task condition (n = 15).

In order to explicitly examine whether behavioral mimicry affected participant behavior, the results were further analyzed by comparing participant drinking behavior in the drinking and cup touching conditions. Participants drank more frequently during the drinking condition (*M* = 0.08 drinks/min, *SD* = 0.11) as compared to the cup touching condition (*M* = 0.05 drinks/min, *SD* = 0.09; *t*(41) = 2.40, *p* = .021; see Figure 2). Participants also spent more task time drinking during the drinking condition (*M* = 0.54%, *SD* = 0.76) as compared to the cup touching condition (*M* = 0.21%, *SD* = 0.47; *t*(41) = 2.78, *p* = .008; see Figure 3). In other words, participants drank more frequently and spent more time drinking when the confederate was also drinking as compared to when the confederate was touching her cup. This apparent mimicry effect was specific to drinking behaviors only as there were no differences between the drinking and cup touching conditions for frequency of participant cup touches (*t*(41) = 0.34, *p* = .735) or time spent touching the cup (*t*(41) = 0.36, *p* = .717).

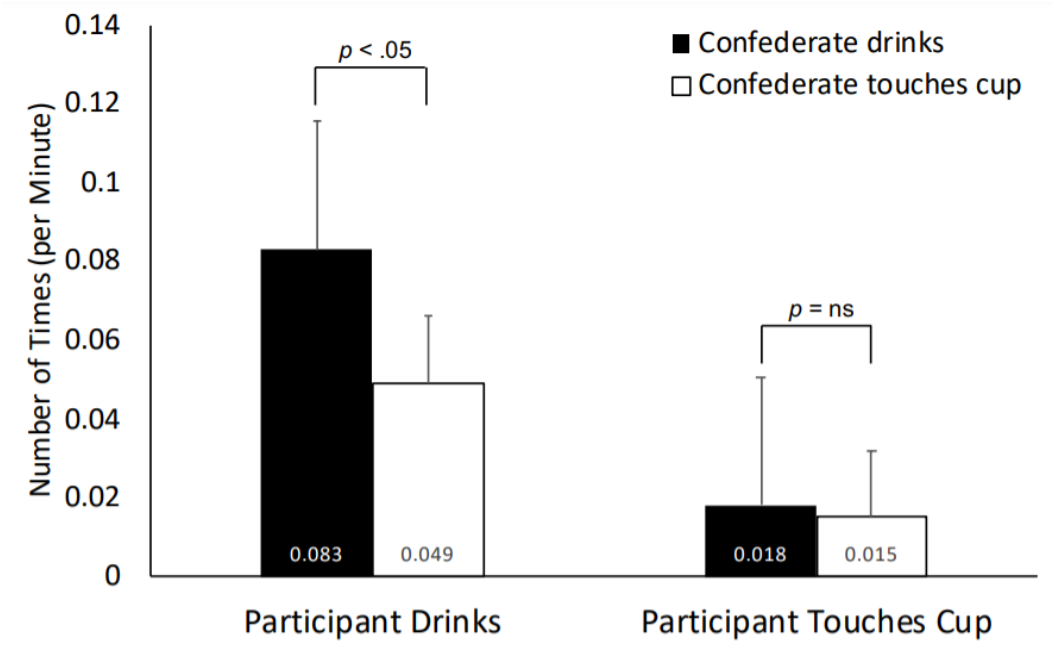

Figure 2. Number of times participants drank and touched their cup per minute for the two task condition.

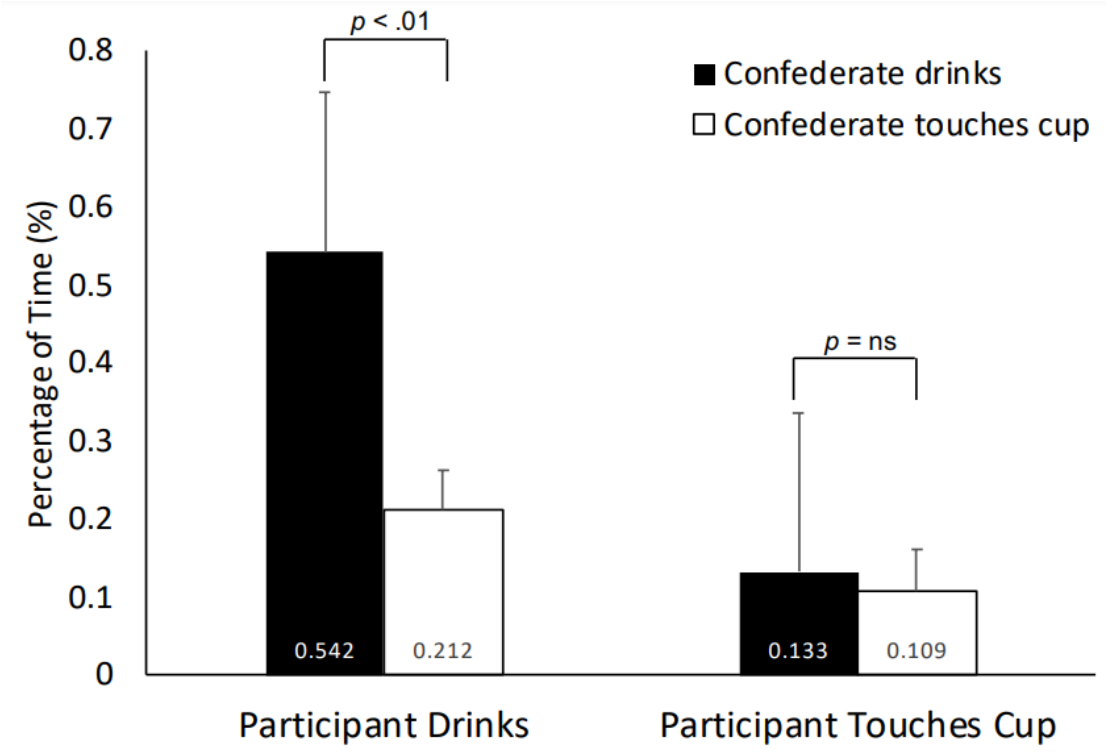

Figure 3. Percentage of task time participants spent drinking and touching their cup for the two task conditions.

Discussion

This study examined whether drinking behavior can be altered as a result of behavioral mimicry in older adults. It was hypothesized that older adults would increase their water consumption given the presence of increased drinking by their partner as compared to the presence of increased cup touching, despite being unaware of the partner's increase in the target behavior (i.e., nonconscious mimicry). Participants drank more frequently and spent more time drinking when the confederate was drinking as compared to when she was touching her cup; this pattern was not present when examining cup touching behaviors. Thus, the results of this proof-of-concept study support the presence of a behavioral mimicry effect among

healthy older adults, suggesting preliminary feasibility and appropriateness for next exploring this phenomenon in future studies of older adults with cognitive impairment.

Of note, the participants did have a higher drinking rate at *baseline* than in both the drinking or cup touching conditions and spent more time drinking at baseline than during the cup touching condition. There were no significant differences in time spent drinking during the baseline and drinking conditions. When removing those participants who did not drink during the experimental task conditions, for whom the mimicry effect may perhaps be less robust, there was similarly no difference between baseline and drinking conditions for drinking rate. Thus, while the explicit test of behavioral mimicry (i.e., drinking versus cup touching conditions) supported the presence of the effect, it may be necessary to consider other factors that may facilitate and/or impede this effect in a more real-world setting (e.g., individual-level factors influencing susceptibility, environmental factors).

The findings of the current study mirror those from the previous study of younger adults, who have also been shown to drink more frequently and spend more time drinking in the presence of partner drinking as compared to partner cup touching (Shune & Foster, 2017). However, somewhat unexpectedly, there were a number of differences between the results of the current study and the previous literature, which could have implications for the clinical implementation of mimicry-based strategies among clinical populations of older adults. A majority of younger adults demonstrated an overall higher rate of drinking in both experimental conditions as compared to baseline, although this finding did not reach statistical significance. Likely driving the lack of statistical significance, a number of younger adults demonstrated particularly high rates of drinking at baseline; when those individuals were

removed from visual analysis, the remaining participants did indeed demonstrate the pattern of increased rates of drinking during the experimental tasks. Conversely, a majority of older adults demonstrated decreased or similar rates of and time spent drinking during the experimental tasks as compared to baseline. Surprisingly, a greater proportion of older adults did not drink during the task conditions at all, despite drinking at baseline.

These differences in behavior between younger and older adults may be attributed to age-related changes in the factors that drive goal-directed behavior, particularly as related to their desired goals associated with social interaction. Younger adults and older adults differ in types of social interactions and social networks that they develop and seek out. According to the Socioemotional Selectivity Theory, developed by Carstensen (1992), social interactions and behavior in older adults is a discriminating choice between maximizing social and emotional gains and minimizing social and emotional risks. Older adults strategically cultivate their social networks to have more frequent, satisfying interactions while avoiding casual social contacts that provide fewer affective rewards and less satisfaction. Thus, the older adults in the current study may have been more interested in the social exchange of the picture description task. In fact, the content of the conversations between the older adult participants and the confederate was often tangential, focused on personally meaningful topics such as the participants' lives growing up and their activities of interest rather than just the pictures presented. As a result, the effects of nonconscious mimicry on drinking behaviors may have been decreased given the "competing" meaningful conversation task. It is plausible to suggest that during a more eating-focused task, such as an actual mealtime, the influence of mimicry may be more robust for this population; however, this has yet to be examined. This hypothesized negative influence of

competing task demands may be further supported by the increased water consumption at baseline, when the participants were generally alone in the study room, as compared to during the tasks themselves. Moreover, there is an extensive body of evidence affirming that familiarity and desire to increase rapport in a relationship increases coordination of behaviors of the interaction partners—rapport in a relationship increases behavioral mimicry and imitation increases rapport (Bavelas et al., 1986; Bernieri & Rosenthal, 1991; Chartrand & Bargh, 1999). Given the unique social selectiveness of older adults and the literature indicating that familiarity may result in a greater effect in behavioral imitation, the older adults in the current study may not have been as prone to mimic a stranger with whom they had no previous or expected future relationship. Thus, it is possible that the older adults preferred to increase meaning of the task conditions by drawing on social commonalities and increase engagement in the conversational aspects of the task itself.

Cognitive performance and capacity may have additionally contributed to the unexpected differences in outcomes between the older and younger adults. Studies investigating the impact of distractibility and aging have found that older adults have less inhibition and are more easily distracted (Zanto & Gazzaley, 2014). Older adults also have difficulties with task-switching, or disengaging attention from one task to refocus attention on another task. Behavioral mimicry is a nonconscious phenomenon. Yet, it is possible that the cognitive systems of the older adults were less likely to engage in processing the confederate drinking behaviors that would trigger the mimicry if they were more distracted by the conversation itself and/or they exhibited difficulty disengaging from the conversation. Drinking at baseline may have been interpreted as a single task, which was easily processed, while

drinking during the picture description activity may have been perceived as two tasks, which could be more difficult to process. Perhaps more plausible, the determinants of goal-directed behavior are likely complex, particularly when social components and attentional demands are combined. Ultimately, intention, socialization, and cognition were not targets of the current study and no definitive conclusions regarding the contributors to older adult behavior can be drawn. Thus, as part of the next step in moving toward intervention design and implementation, further investigations into possible facilitators and barriers to behavioral mimicry for eating and drinking behaviors among older adults, healthy and otherwise, are needed.

Clinical implications

This was a preliminary, proof-of-principle study to determine whether behavioral mimicry may be a viable strategy for increasing water consumption among older adults. The results suggest that behavioral mimicry is a phenomenon that occurs, at least to some degree, in the drinking behaviors of healthy, older adults. While water consumption did not increase during the drinking condition as compared to baseline among healthy older adults completing a non-eating related task, drinking rates were significantly higher when the confederate was drinking as compared to when she was only touching the cup. With the frequency and percentage of time drinking increasing 1.5-2.5 times during the drinking condition as compared to the cup touching condition, such a strategy could translate into a clinically significant increase in total consumption within the context of an actual meal where eating is the main focus. Furthermore, as motor resonance mechanisms and mirror neurons, which are not dependent on conscious awareness, have been found to be largely preserved in individuals with

Alzheimer's disease and Mild Cognitive Impairments, older adults with cognitive impairments may be just as influenced by drinking and/or eating behaviors as the healthy older adults in the current study were (Bisio et al., 2012; Farina et al., 2017). Thus, behavioral mimicry may be a viable strategy that should be further explored in the context of eating itself, particularly among individuals with dysphagia and cognitive impairments. If behavioral mimicry can actually increase oral intake in older adults with cognitive impairments, it may provide a powerful *supplement* to education, training, and environmental modification interventions that often lack consideration of the social components and needs of meals. As a potential therapeutic strategy, mimicry could take place during the actual mealtime setting and discreetly suggest drinking and feeding behaviors through a caregiver's own drinking and feeding behaviors. This implicit approach could help prevent the negative tension and conflict that can arise from direct, frequent verbal reminders of a caregiver or loved one to the patient. While mimicry would still require caregiver assistance, it may not require 1:1 feeding assistance as is typically required and may also not demand as much time commitment for training. These factors could further alleviate caregiver burden, particularly for aides in institutional settings, potentially supporting positive relationships between patient and caregiver. In addition, the current study found that behavioral mimicry impacts drinking behaviors amongst strangers. Given high staff turnover rates and personnel shift changes, a resident of a long-term or nursing care facility may not have the luxury of a consistent caregiver or family for meals. The findings of the current study suggest that the residents may still be influenced by the eating behaviors of staff with whom they may be less familiar with during mealtimes.

Limitations

This study was conducted in a controlled lab setting that eliminated other factors commonly involved in the mealtime process in order to isolate behavioral mimicry as an underlying mechanism for increased drinking behaviors. As expected, a lab setting is not representative of a typical eating or drinking experience, lacking a degree of ecological validity, which may have influenced the findings. However, despite the controlled laboratory setting, participants did indeed demonstrate increased drinking behaviors in the presence of confederate drinking as compared to confederate cup touching, suggesting that the mimicry effect may be even more robust in the context of a typical meal. Relatedly, it was not possible to gather data on volume of water consumed given the need to for participants to not be aware of the true purpose of the study and the more naturalistic observation thus needed to be used for data analysis. The ability to increase quantity of consumption, which is likely related to duration and rate, warrants continued investigation. Further, while the length of the drinking and touching condition segments were controlled, the length of the baseline segments was less standardized. In fact, the shorter baseline segment lengths could have artificially increased the apparent rate of drinking during the baseline task. Additionally, the sample size of the current study was relatively small and was limited by location, which may not have yielded adequate representation of the entire population. As components of meal structure, the daily rhythm and social aspects of eating, and food choice vary across cultures (Manthorpe & Watson, 2003; Mellin-Olsen & Wandel, 2005), future work should incorporate such cultural considerations. Moreover, given the nature of the study, participants were not provided explicit instructions to not eat or drink anything prior to the study. Thus, participant level of thirst and/or dehydration was not controlled for and may have influenced the results, particularly during the baseline

data collection period. Similarly, additional medical factors, such as salivary flow and medication use, could also influence and interact with thirst and drinking behavior. Individual differences in participants' abilities to control their rate of consumption and in thirst recognition and satiation were not collected, yet they may influence the effect of behavioral mimicry (Hermans et al., 2012; Salmon et al., 2014). Further, an increased desire to drink specifically in the baseline condition may have actually been primed as a result of the experimenter directly providing the initial cup of water (Bargh et al., 1996).

Future directions

In order to further examine the clinical significance of a mimicry-based intervention, it is critical to first determine the factors that strengthen or attenuate the effects of nonconscious behavioral mimicry. The current study assessed the effects of behavioral mimicry using water in a lab setting; given the presence of an effect even under those conditions, it is likely that a greater magnitude of effect would be seen in a more naturalistic eating or drinking environment. It will also be useful to assess whether the increase in consumption can be expanded to different types of food/drink consistencies as well as modes of presentation. Further, given the potential role priming played in increasing baseline drinking behavior, examining the effects of priming the target behavior in conjunction with behavioral mimicry for increased consumption may be a valuable supplemental consideration (Bargh et al., 1996; Carver et al., 1983). Another crucial focus of future work needs to be investigating how different levels of social networks (e.g., familiarity) and varying group sizes (e.g., one caregiver/confederate with multiple individuals) affects behavioral imitation (Bavelas, et al., 1986; Bernieri & Rosenthal, 1991; Carstensen, 1992; Chartrand & Bargh, 1999). Lastly, this

study was designed to determine whether behavioral mimicry can influence the drinking behaviors of healthy older adults. In order to truly assess whether behavioral mimicry is a viable clinical strategy to increase nutritional intake in older adults with cognitive impairments who are at risk for malnutrition and dehydration, candidacy for future studies must be expanded to include a range of cognitive impairments and severities.

Conclusion

This preliminary, proof-of-principle study aimed to determine whether behavioral mimicry influences the drinking behaviors of healthy older adults. The findings support that drinking behaviors can be increased through behavioral mimicry in healthy older adults, although the effect may not be as robust among certain subsets of individuals, as suggested by a lack of drinking in any experimental condition for a portion of the participants. Thus, future work should investigate whether behavioral mimicry may be a useful, non-invasive supplemental mealtime strategy for increasing intake among those with lower consumption rates, including older adults with cognitive impairments. Additional research on the effects of behavioral mimicry during an actual meal, with different types of caregivers, in various group sizes, and with various clinical populations (e.g., individuals with varying severities of dysphagia and cognitive impairments) is needed. Together, the findings of the current and future research studies may lead to clinical strategies that facilitate a shift in the patient-care paradigm toward a more comprehensive, ecologically valid management model that could improve the overall functioning of older adults with cognitive impairments.

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