Vocal Control: Is It Susceptible to the Negative Effects of Self-Regulatory Depletion?

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Summary: Objectives. Self-regulation (SR) relies on the capacity to modify behavior. This capacity may diminish with use and result in self-regulatory depletion (SRD), or the reduced ability to engage in future SR efforts. If the SRD effect applies to vocal behavior, it may hinder success during behavioral voice treatment. Thus, this proof-of-concept study sought to determine whether SRD affects vocal behavior change and if so, whether it can be repaired by an intervention meant to replete SR resources.

Methods. One hundred four women without voice disorders were randomized into groups that performed either (1) a high-SR writing task followed by a high-SR voice task; (2) a low-SR writing task followed by a high-SR voice task; or (3) a high-SR writing task followed by a relaxation intervention and a high-SR voice task. The high-SR voice tasks in all groups involved suppression of the Lombard effect during reading and free speech.

Results. The low-SR group suppressed the Lombard effect to a greater extent than the high-SR group and high-SR-plus-relaxation group on the free speech task. There were no significant group differences on the reading task.

Conclusions. Findings suggest that SRD may present challenges to vocal behavior modification during free speech but not reading. Furthermore, relaxation did not significantly replete self-regulatory resources for vocal modification during free speech. Findings may highlight potential considerations for voice treatment and assessment and support the need for future research focusing on effective methods to test self-regulatory capacity and replete self-regulatory resources in voice patients.

Key Words: Self-regulatory depletion–Self-regulatory repletion–Lombard effect–Voice therapy.

Voice treatment may be defined as physical adjustments of the respiratory, laryngeal, and supralaryngeal musculature to achieve changes in vocal quality, pitch, and/or loudness.[1–3] This definition implies that individuals with functional voice problems are engaging in inefficient and uncoordinated phonation with little, if any, awareness.[4]

Patients in voice therapy are asked to make conscious changes to their phonation. To do this, they use self-regulation (SR). SR is defined as effort, exerted by the self, to modify or control cognitions, emotions, or outward behavior.[5] SR is conceptualized as relying on a limited resource or strength which, when weakened through use, can lead to what is known as self-regulatory depletion (SRD).[6] SR and SRD have been demonstrated in a broad range of everyday behaviors, from decision making to working with others to perform a task. In a typical SR experiment, the participant completes an initial task that has either a high or a low self-regulatory demand and then completes a second task that has a high self-regulatory demand. SRD is detected when performance on the second task declines after the completion of an initial high self-regulatory task versus a low self-regulatory task. For example, when university students were directed to eat only radishes in the presence of chocolate cookies and candies, they performed more poorly on a subsequent self-regulatory task (complex problem solving), in comparison to their peers who were allowed to eat these treats.[7] The healthy-eating group had depleted their self-regulatory resources by initially resisting temptation and thus had fewer resources for the subsequent problem-solving task.

There is ample evidence that SRD crosses task modalities, so that exerting SR on one task results in degraded performance on a subsequent unrelated self-regulatory task.[6,8–11] Such evidence supports the idea that SR is fueled by a general resource that can be consumed on any task that requires conscious behavioral, emotional, or cognitive modifications.[6] SRD also has been distinguished experimentally from the effects of sleep deprivation and fatigue.[12] Thus, SRD can be considered a unique cognitive resource independent of other factors that affect performance.

There are specific interventions that decrease the SRD effect, or in essence, improve performance on subsequent tasks requiring high SR. Brief periods of rest or relaxation,[13,14] priming acts of SR (ie, when a stimulus in the surrounding environment influences performance on a self-regulatory task),[15] affirming core values,[16] and the induction of positive affect (eg, via receiving a small unexpected gift or watching an amusing video clip)[17,18] have led to a reversal of SRD in many studies. This reversal is referred to as self-regulatory repletion (SRR).

Although studies of SR have spanned multiple behaviors from self-presentation[19] to coordinating communication,[20] to date, research has not addressed the role of SR in vocal behavior, voice disorders, or voice treatment. This is a critical gap in the literature because the need to regulate phonation may ultimately impinge on the generalization of new vocal

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behaviors.[21] SR may negatively affect patient adherence to practice schedules as well as vocal health recommendations (eg, drinking water, refraining from smoking). Similarly, regulating behaviors in daily life (eg, refraining from eating a desired food or suppressing emotions) may actually have a deleterious effect on a patient's ability to modify his or her vocal behavior inside and outside of voice therapy. Figure 1 is a proposed model of SRD effects on voice therapy outcomes.

Because there is no experimental design for examining self-regulatory processes related to vocal behavior or voice therapy, the current investigation used Lombard effect suppression (LES). The Lombard effect is the well-studied phenomenon in which individuals increase their vocal intensity in the presence of noise.[22–26] Background noise increases the difficulty of engaging in efficient communication and auditory self-monitoring and consequently results in greater vocal effort.[27–30] The Lombard effect is activated without conscious effort or awareness.[27,29–31] Maladaptive functional vocal behaviors such as speaking with increased muscle tension and poor respiratory support are analogous to the Lombard effect as they are typically produced automatically and with little attention. Thus, asking persons to explicitly inhibit increases in their vocal intensity may serve as a model for the modification of functionally maladaptive vocal behavior in voice therapy. Explicitly inhibiting the Lombard effect (ie, LES) and changing vocal technique require individuals to consciously override and replace habituated vocal behaviors.[32] Thus, in both cases, a relatively automatic behavior must be voluntarily controlled.

The purpose of the present study was to better understand the role of SR phenomena in vocal modification. Specifically, we wanted to determine whether SRD affects the voluntary alteration of automatic vocal behavior (LES) in reading and in free speech. If SRD does affect voluntary changes in automatic vocal behavior, we wondered whether a relaxation intervention (ie, SRR) could reverse the negative effects of SRD on vocal manipulations. On the basis of prior studies of SRD and SRR, we hypothesized that participants would exhibit (1) reduced LES when reading aloud after a high-SR task versus a low-SR task; (2) reduced LES when producing free speech after a high-SR task versus a low-SR task; and (3) improved LES when reading or producing free speech after a high-SR task followed by a guided relaxation task, versus a high-SR task followed by no relaxation task.

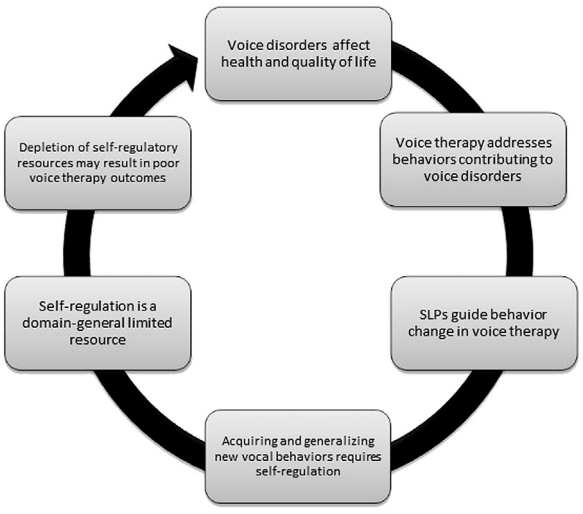

FIGURE 1. Proposed model of self-regulatory depletion effects on voice therapy outcomes.

METHODS

Participants

One hundred four female undergraduate students aged 18–23 years were recruited from the University of Wisconsin-Madison's Communication Sciences and Disorders subject pool. We recruited only female undergraduate students to minimize variability in the sample, given that SR may differ between women and men.[33] Participants were excluded from this research if they reported a diagnosed neurological or psychological condition that affected thinking, scored above 35% on the overall severity visual analog scale of the Consensus-Auditory Perceptual Evaluation of Voice (CAPE-V)[34,35] as rated by the first author (L.A.V.), or reported a current voice disorder or diagnosis of a voice disorder within the last 2 years. Participants were included in this research if they were fluent in English as indicated by self-report, passed a hearing screening, and scored below 10 on a depression screening questionnaire, the Patient Health Questionnaire-9 (PHQ-9).[36] Screening of depression took place because depressed mood may negatively affect SR.[17,18] One participant was excluded for scoring above threshold on this measure. Thus, the total number of participants included in analysis was 103.

Experimental protocol

This study used a between-subjects design. Participants were randomized into one of three groups by a predetermined randomization schedule. See Table 1 for task completion by group. The first group was a low self-regulation (LSR) group that engaged in a low self-regulatory writing task followed by high self-regulatory vocal tasks. The second group was a high self-regulation (HSR) group that engaged in a high self-regulatory writing task followed by the same high self-regulatory vocal tasks as the LSR group. The third group was a high self-regulation intervention (HSRint) group that engaged in the same high self-regulatory writing task as the HSR group and the same high self-regulatory vocal tasks as both other groups but received a relaxation intervention between the writing and vocal tasks. Both HSR and LSR groups did not receive a break between the writing and vocal tasks. In addition to the main experimental tasks, manipulation checks were conducted to ensure that experimental manipulations had their intended effects on participants.[7,13,15–17,20]

Tasks

Explanations of task procedures, in the order in which they were completed, are described in Table 2 and further detailed in the following:

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