Brain-based origins of change language: A beginning

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HIGHLIGHTS

- Nature of client language matters.
- It is not the words themselves, but the origin that influences brain response.
- Client language generated in a true MI was associated with more BOLD response (IFG, insula, superior temporal gyri).

ARTICLE INFO

ABSTRACT

Motivational interviewing (MI) is a promising treatment for heavy drinking. Client change talk (CT), a critical component of MI, has been associated with differential brain activation. The goal of this study was to begin to deconstruct how and why CT may affect the brain. Specifically, we sought to determine whether simply repeating statements in favor of change would cause differential brain activation, or whether client statements must be spontaneously generated within a therapeutic milieu in order to influence brain activation. We therefore examined blood oxygenation level dependent (BOLD) response following two types of client language (CT; and sustain talk, ST) across two conditions: (1) Self-Generated: CT and ST were elicited during an MI session vs. (2) Experimenter-Selected: a pre-established list of CT and ST was provided to the individual in the absence of an MI session. Across both conditions, participants' CT and ST were visually and aurally presented during fMRI. We enrolled 39 recent binge drinkers (41% male; M age = 19.9; n = 18 in Self-Generated group; n = 21 in Experimenter-Selected group). We found that both types of client language (CT and ST) elicited greater BOLD activation in the Self-Generated vs. the Experimenter-Selected group in the left inferior frontal gyrus/anterior insula and superior temporal gyri ($p \leq 0.001$). These findings indicate that the nature of client language matters. It appears that it is not just the words themselves, but the origin (naturally generated within a therapeutic session) that influences brain-based effects.

1. Introduction

Motivational interviewing (MI; Miller & Rollnick, 2013) is a client-centered approach focused on eliciting client language in order to *guide* clients towards behavior change. Not only is this brief (i.e., 1–2 sessions), empathic, and strength-based intervention highly effective across a number of substance use and health risk behaviors (e.g., Hettema, Steele, & Miller, 2005; Lundahl, Kunz, Brownell, Tollefson, & Burke, 2010), it is a particularly good fit with wary recipients, such as non-treatment-seeking emerging adults (McCambridge & Strang, 2004). This may be due to the non-judgmental, empathic,

and collaborative approach of MI (Miller, Villanueva, Tonigan, & Cuzmar, 2007), whereby the individual's own values, opinions, and arguments for change are the most valued and reflected part of the therapeutic discussion. However, despite the promise of MI with young problem drinkers (Larimer & Cronce, 2007), the range of observed effect sizes indicates that there is still substantial room for improvement (Carey, Carey, Maisto, & Henson, 2006). Evaluating salient treatment modulators offers one way to examine, and ultimately to target and strengthen, active treatment ingredients.

One innovative way to investigate potential modulators of treatment response is through a translational perspective. Translational investigations actively integrate brain-based and clinical approaches to facilitate a more sensitive measure of factors that might influence treatment response (Potenza, Sofuoglu, Carroll, & Rounsaville, 2011; Thayer & Hutchison, 2013). Functional neuroimaging appears to be a particularly promising avenue to identify salient treatment modulators (Hutchison,

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2010). Thus far, initial neurocognitive evaluations of behavioral treatments, including MI, have mirrored the psychosocial literature (Feldstein Ewing, Filbey, Sabbineni, & Hutchison, 2011; Feldstein Ewing et al., 2013; Houck, Moyers, & Tesche, 2013). These studies have shown the importance of client speech in favor of behavior change, or change talk (CT; *I'm worried about my drinking*), and the risks associated with client speech supporting the behavioral status quo (sustain talk, ST; *Drinking is fun*).

While psychosocial evidence highlights the relevance of CT as a treatment target across both the psychosocial (Miller & Rose, 2009) and the neurocognitive fields (Feldstein Ewing, Filbey, Sabbineni, & Hutchison, 2011; Feldstein Ewing, McEachern, et al., 2013; Houck et al., 2013), the *nature* of CT remains under-explored. More specifically, while it is clear that eliciting client statements in favor of change positively impacts treatment outcomes, it is unclear *where the power lies* - within the change statements themselves, or in their genesis. This is relevant to direct practice, as the MI treatment literature encourages certain clinician approaches and strategies to evoke more within-session client CT (Miller & Rollnick, 2013). However, if organic, within-session client CT (Self-Generated CT) catalyzes the same brain-based effects as simply stating or repeating what an interventionist might want to hear (Experimenter-Selected CT; e.g., *I will stop drinking*), then it stands to reason that a therapeutic session with a behavioral health professional might not, in fact, be necessary to successfully achieve behavior change. This would suggest that problem drinkers could simply repeat therapist-provided statements in the absence of a therapeutic interaction in order to arrive at the same clinical results. Furthermore, at this time, existing behavioral client language coding systems cannot discriminate between organic utterances that stem from the client, and statements that *sound like* CT, but which may in fact reflect repetitions of provider language (Glynn, Hallgren, Houck, & Moyers, 2012; Moyers, Martin, Manuel, Hendrickson, & Miller, 2005). Thus, a neurocognitive evaluation offers a unique way to access and evaluate whether CT must be elicited within the context of a therapeutic interaction in order to be effective.

This preliminary study sought to determine how the nature and origin of CT may influence brain response within non-treatment-seeking heavy drinkers, who have been shown to be highly responsive to MI (Larimer & Cronce, 2007). Consistent with our empirically-informed working translational model (Feldstein Ewing, Karoly, & Houck, 2014), we posited that the pattern of activation would follow the process of self-appraisal and perception observed within Bem's (1967) historic work in this area. Concretely, it is our position that as a person generates (and hears) their own thoughts, language and reasons for changing their drinking behavior (CT), they may re-evaluate their alcohol use, including their experienced benefits and costs of drinking, and its potential fit within their self-view and image. In terms of relevant brain regions, during a true therapeutic exchange, we suggest that individuals engage areas important to self-awareness and introspection, as well as regions critical to reward. Prior studies within both the addiction literature more broadly, and the emerging field of treatment response, suggest that those regions include the inferior frontal gyrus (IFG), (anterior) insula (Feldstein Ewing, Filbey, Sabbineni, & Hutchison, 2011; Krishnan-Sarin et al., 2013; Seo, Choi, Chung, Rho, & Chae, 2014; Stewart et al., 2014), and superior temporal gyri (Feldstein Ewing, McEachern, et al., 2013; Goudriaan, de Ruiter, van den Brink, Oosterlaan, & Veltman, 2010; Schacht, Anton, & Myrick, 2013).

Understanding how, where, and why MI activates relevant brain regions is critical to targeting and strengthening areas of response to make treatment more effective for this population. Thus, for this study, our goal was to begin to deconstruct these theoretical relationships, to concretely evaluate brain-based modulators. We posited that CT which was spontaneously generated by the individual within a therapeutic context (Self-Generated CT) would be associated with significantly greater blood oxygenation level dependent (BOLD) response in relevant self-awareness regions (e.g., IFG, insula, superior temporal

gyri), as compared to having clients read a list of pre-provided set of statements that "sound like" CT in the absence of an MI session (Experimenter-Selected CT).

2. Materials and Methods

2.1. Participants

Following other studies examining MI with non-treatment seeking, heavy drinking emerging adults (Walters, Vader, Harris, Field, & Jouriles, 2009), introductory psychology students were recruited to participate in return for class credit. All procedures were approved by the university Institutional Review Board and under the protection of a federal Certificate of Confidentiality. Similar to other studies (Carey, Henson, Carey, & Maisto, 2007; Carey et al., 2006), participants were required to be 18 to 25 years of age, report at least 4 episodes of binge drinking in the past month (defined as ≥4 drinks/occasion for females; ≥5 drinks/occasion for men), provide written informed consent, and meet fMRI safety criteria (e.g., no non-removable metal implants, claustrophobia, pregnancy/breastfeeding, and breath alcohol of 0 as verified by breathalyzer) (Filbey et al., 2008). To facilitate generalizability, exclusionary criteria were kept purposefully broad. Thus, youth were neither screened for nor excluded on the basis of potential co-occurring neuropsychiatric disorders, somatic conditions, or co-occurring substance use. Participants received $60 in return for participation.

Sixty-five participants were eligible, with 53 assigned to the Self-Generated condition (n = 26) and Experimenter-Selected condition (n = 27; see Fig. 1). Of the 48 with scan data, 39 had minimal head motion within the selected threshold (<3 mm translational and <3 degrees rotation). All analyses were therefore conducted with the final sample of 39. This sample was, on average, 19.9 years old (SD =1.64), 40.9% male, 52.9% Caucasian, 30.7% Hispanic, and 7.9% bi- or multi-racial (see Table 1 for demographics). There were no significant demographic differences between groups.

2.2. Procedures

This study was part of a larger treatment mechanisms investigation (Feldstein Ewing, Houck, Truitt, & McEachern, 2013). Within this component, participants completed a psychosocial assessment and an fMRI paradigm designed to assess the strength of CT and ST. The Self-Generated group completed a behavioral assessment and MI session during their first appointment. The Experimenter-Selected group completed a behavioral assessment during their first appointment, but did not receive an MI session. All fMRI sessions occurred within 1 week of the behavioral assessment.

2.2.1. Behavioral assessment

At the assessment session, participants completed measures of demographics and alcohol use. The demographics questionnaire queried age, gender, education, and race/ethnicity.

2.2.1.1. Problem Drinking. We evaluated the three drinking behaviors to characterized the spectrum of problem drinking within this age group (e.g., LaChance, Feldstein Ewing, Bryan, & Hutchison, 2009): average amount consumed per drinking occasion, hazardous drinking symptoms, and alcohol-related consequences.

2.2.1.2. Past Month Average Drinks Per Drinking Day (DDD) (TLFB; Sobell & Sobell, 1992). This interviewer-administered measure utilizes a calendar format to yield data regarding the type of alcohol most frequently consumed, quantity of alcohol use (drinks per drinking day), and frequency of alcohol use (alcohol use days) and hazardous drinking (binge drinking days) during the past month.