A unique perspective on automaticity:

From theory to application in the management of chronic spontaneous urticaria

Rebecca Mina Oksenhendler

Department of Psychiatry

McGill University, Montreal

April 2015

A thesis submitted to McGill University in partial fulfillment of the requirements of the degree of Master of Science

Table of Contents

General Introduction

The present thesis comprises two original manuscripts that focus on intersecting areas of research. The first manuscript explores the theme of automaticity—and perhaps more importantly, derailing this automaticity—inherent in a plethora of cognitive and behavioural processes. A common view posits that controlled processes can become deeply ingrained as a result of considerable practice (Schneider & Shiffrin, 1977). Once automatized, however, these processes appear resistant to control. Accordingly, achieving automatization seems to entrench the process and recast it as difficult if not impossible to undo. While some researchers have investigated how controlled processes may become automatic, experimental evidence for the reverse—i.e., how automatic processes can deautomatize—is nascent. Spanning hypnosis, meditation, and clinical psychology research, we explore the mechanisms supporting the modulation of automaticity and propose that blurring the line between controlled and automatic processes holds implications for conceptions of the mind.

The first manuscript lays the foundation for the second manuscript, which encompasses the research I conducted these past two years. I apply the notion that automatic modes of thinking adversely impact the mental and physical health of individuals suffering from chronic spontaneous urticaria (CSU), an idiopathic form of hives consisting of transient itchy wheals. CSU resolves naturally within five years in 30-55% of cases, but can persist for years to come (Kozel & Sabroe, 2004). The reflexive cognitive patterns that develop over time in response to living with a chronic condition may contribute to the reported association between CSU, stress, and psychiatric symptoms (Gupta, 2009; Wiers et al., 2010). This hypothesis seems likely considering that CSU patients have higher levels of somatization, obsessive-compulsiveness, internal sensitivity, depression, anxiety, and insomnia, compared to the general population

(Sperber, Shaw, & Bruce, 1989; Yang, Sun, Wu, & Wang, 2005). Consequently, we examine whether a complementary psychological treatment addressing the unhelpful beliefs that influence disease perception and quality of life can improve physical and mental well-being.

References

Gupta, M. A. (2009). Stress and urticaria. In R. D. Granstein & T. Luger (Eds.), *Neuroimmunology of the skin: Basic science to clinic science*. Berlin, Germany: Springer

Kozel, M. M. A., & Sabroe, R. A. (2004). Chronic urticaria: Aetiology, management and current and future treatment options. *Drugs, 64*(22), 2515-2536.

Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological Review, 84*(1), 1-66.

Sperber, J., Shaw, J., & Bruce, S. (1989). Psychological components and the role of adjunct interventions in chronic idiopathic urticaria. *Psychotherapy and Psychosomatics, 51*(3), 135-141.

Wiers, R. W., Houben, K., Roefs, A., de Jong, P., Hofmann, W., & Stacy, A. W. (2010). Implicit cognition in health psychology: Why common sense goes out the window. In B. Gawronski & B. K. Payne (Eds.), *Handbook of Implicit Social Cognition* (pp. 463-488). New York: Guilford Press

Yang, H. Y., Sun, C. C., Wu, Y. C., & Wang, J. D. (2005). Stress, insomnia, and chronic idiopathic urticaria - A case-control study. *Journal of the Formosan Medical Association, 104*(4), 254-263.

Contribution of Authors

Manuscript 1: *Unringing the bell: How to override automatic processing*

Rebecca Oksenhendler: Analyzing and interpreting Stroop data, and writing of manuscript.

Mathieu Landry: Writing of manuscript.

Amir Raz: Collecting and analyzing Stroop data, commenting on manuscript and providing guidance.

Manuscript 2: *Using psychosocial factors to mediate chronic hives: A preliminary report*

Rebecca Oksenhendler: Leading and organizing the research effort, providing CBT and hypnosis to participants, collecting and analyzing data, writing up the results, and discussing the findings.

Moshe Ben-Shoshan: Designing the experimental protocol and assessing disease activity in participants.

Amir Raz: Designing experimental protocol and training study interventionists.

Acknowledgments

First, I would like to thank my supervisor, Dr. Amir Raz, for his generosity with his patience and support. I would also like to extend my gratitude to Dr. Moshe Ben-Shoshan for guiding me through the field of allergy in both research and clinical applications. I felt confident in this process knowing that your help was only a quick email away. Furthermore, this thesis would not have been possible without the encouragement of other members in the lab. A special thanks goes to Claire, Liana, and Jenilee—the best office mates I could have hoped for. Jenilee and Catherine, thank you for waking up early to see participants. The CSU project would not have been a success without you. Rémi, your attention to detail and exemplary work ethic were instrumental in getting this project off the ground. Mathieu, thank you always for bringing a fresh perspective to our work. Lastly, I would not be where I am today without the love and support of my family.

Abstract

Automaticity permeates much of our thoughts, feelings, and behaviour. An enduring tenet in cognitive neuroscience proposes that although controlled processes can become automatic, automatic processes are inflexible and cannot be returned to the purview of control. Drawing on the modulatory power of top-down parameters, such as attention, expectation, and suggestion, we propose that individuals can govern involuntary processes in specific contexts. We provide an overarching framework that capitalizes on research investigating the mechanisms by which hypnosis, meditation, and psychotherapy derail various involuntary processes. Furthermore, we explore how ingrained colour associations learned over a lifetime differentially influence the Stroop effect, the "gold standard" of attentional measures. Support for deautomatization in these domains paves the road for clinical interventions that work to modify pervasive and entrenched cognitions present in chronic medical conditions. Through the mind-body connection, we examine how psychosocial factors—which encompass how we think about ourselves in relation to our health—affect disease activity and quality of life in individuals with chronic spontaneous urticaria (CSU), a common skin condition that can be disabling and severe for many patients. We set out to provide a combination of cognitive behavioural therapy and hypnosis or emphatic listening and progressive muscle relaxation in addition to standard-of-care treatment over a ten-week period. Although disease severity did not change in our sample, our findings indicate that quality of life improved in both groups. Adjusting to life with CSU poses a challenge to many individuals and can undermine their ability to participate in activities and interact with friends and family. As quality of life issues become increasingly more important in healthcare practice and research, therapeutic strategies must focus not just on treating the disease, but also on the physical, mental, and social aspects of well-being.

Abrégé

L’automaticité imprègne la plupart de nos pensées, sentiments et comportements. Un principe durable en neurosciences cognitives propose que, bien que les processus contrôlés puissent devenir automatique, les processus automatiques sont rigides et ne peuvent pas être retournés aux champs de contrôle. En s’inspirant de la puissance des paramètres ascendants, comme l'attention, l'attente, et la suggestion, nous proposons que les individus peuvent gouverner les processus involontaires dans des contextes différents. Nous fournissons un cadre qui englobe la recherche étudiant les mécanismes par lesquels l'hypnose, la méditation et la psychothérapie déraillent divers processus involontaires. En outre, nous explorons comment les associations de couleurs apprises au cours de la vie influencent différemment l'effet Stroop, l’étalon-or de mesures attentionnelles. Le support pour la déautomatisation dans ces domaines ouvre la porte pour les interventions cliniques qui œuvrent à modifier les cognitions envahissantes et enracinées présentes dans des conditions médicales chroniques. Grâce à la connection corps-esprit, nous examinerons comment les facteurs psychosociaux, qui incluent la façon dont nous pensons de nous-mêmes par rapport à notre santé, affectent la maladie et la qualité de vie des personnes atteintent d’'urticaire chronique spontanée (UCS), une condition commune de la peau qui peut être très invalidante et grave. Dans cette étude, nous avons fourni une combinaison de psychothérapie cognitivo-comportementale et l'hypnose ou l'écoute emphatique et la relaxation musculaire progressive en plus de la qualité des soins pour une période de dix semaines. Bien que la gravité de la maladie n’ait pas changé dans notre échantillon, nos résultats indiquent que la qualité de vie s’est améliorée dans les deux groupes. S’adapter à la vie avec l’UCS constitue un défi pour de nombreux patients et peut compromettre leur capacité de participer à des activités et d'interagir avec leurs amis et familles. Puisque la qualité de vie devient de plus en

plus importante dans les services de santé et dans la recherche, des stratégies thérapeutiques doivent se concentrer non seulement sur le traitement de la maladie, mais aussi sur les aspects de bien-être physique, mental et social.

Manuscript 1

Unringing the bell:

How to override automatic processing

Rebecca Oksenhendler[a]*, Mathieu Landry[b]*, & Amir Raz[a,c]

* Authors contributed equally.

[a] Department of Psychiatry, Faculty of Medicine, McGill University, Montreal, Canada

[b] Integrated Program in Neuroscience, Faculty of Science, McGill University, Montreal, Canada

[c] Departments of Psychology, Neurology & Neurosurgery at McGill University and the Lady Davis Institute at the SMDB Jewish General Hospital, Montreal, Canada

Abstract

Automaticity forms a central tenet in contemporary conceptions of the mind. In both theoretical and experimental research, scientists typically contrast controlled and automatic mental processes as distinct phenomena with opposing features. Many scholars study how controlled processes become automatic; fewer investigate the mechanisms that derail automatic processing. Drawing on top-down strategies such as attention, expectation, and suggestion, we argue for a theory of deautomatization where findings hailing from various domains of research combine and mount this novel framework. First, we critically review the strategies used by past theorists to define automaticity. Considering the weaknesses in these traditional approaches, we propose that automaticity represents a continuum, whereby changes in executive control that rely heavily on frontal lobe activity represent a core mechanism in which automatic processes return under the purview of control. Second, we investigate how hypnosis and meditation provide two methods to modulate executive control and thus override certain automatic processes. Third, we assess a number of deeply ingrained processes, such as the Stroop, McGurk, Simon, and flanker compatibility effects and expose how (hypnotic) suggestions may drastically reduce the inherent competition between automatic and controlled processes. Fourth, we analyze Stroop data from a large cohort comprising highly- and less-hynotizable individuals with a special emphasis on how entrenched colour associations differentially influence the Stroop effect. Finally, we evaluate how importing these top-down strategies into the realm of clinical psychology derails adverse cognitive patterns and reduces maladapted behaviours. Overall, unringing the proverbial bell represents an experimental trajectory that paves the road to a better scientific understanding of deautomatization.

Introduction: Once the bell has rung, can we unring it?

When we ring a bell, sound quickly spreads out. Unringing the bell—reversing the process by withdrawing the disseminated din—seems intractable. Likewise, an enduring tenet in cognitive psychology posits that automatic processes are largely inflexible and lie beyond the purview of control. According to this framework, achieving automatization seems to entrench the process and recast it as difficult, if not downright impossible, to undo. However, in this paper we demonstrate that in certain circumstances and for specific people, the unringing of the proverbial bell may be possible. This unusual feat holds theoretical as well as practical implications associated with the notion of automaticity. Here we explore this scantily reported prospect and provide an integrative synthesis of the trailblazing science, both basic and clinical, that subserves such dramatic phenomena.

Automaticity occupies a central role in contemporary models of the mind; therefore, a more comprehensive understanding of the nature of the relationship between controlled and automatic processes seems essential for the advancement of cognitive psychology. Traditional positions consider controlled and automatic cognitive processes as discrete mental operations at opposite ends of the spectrum with contrasting attributes: controlled tasks are voluntary, effortful, and attention-demanding, while automatic tasks are involuntary and effortless, and require minimal attention (Evans & Frankish, 2009; Kahneman, 2011; Posner & Snyder, 1975a; Schneider & Shiffrin, 1977).

With extensive practice, controlled processes can become deeply ingrained (Schneider & Shiffrin, 1977). Consequently, development and learning can turn effortful tasks effortless and automatic. This adaptive shift frees up valuable cognitive resources during the execution of habitual daily tasks. Once automatized, however, these processes appear resistant to control.

Drawing on top-down strategies, such as attention, expectation, and suggestion, the prospect of deautomatization exposes the greater complexity that characterizes the interactions between controlled and automatic processes, going beyond the simplistic controlled versus automatic comparison.

From low-level sensory processing to well-coordinated complex behaviour, automatic processes denote a wide range of phenomena, such as subliminal perception (Dixon, 1971), procedural knowledge (Cohen & Bacdayan, 1994), face perception (Todorov, Pakrashi, & Oosterhof, 2009), moral judgments (Haidt, 2007), implicit attitudes (Petty, Fazio, & Briñol, 2012), as well as reflexive cognitive patterns in social anxiety and depression (Ingram, 1989; Teachman, Joormann, Steinman, & Gotlib, 2012). In the advertising industry, for example, marketing strategies exploit our habitual inclination to associate price with product quality. In one study, participants tasting what they believed to be a variety of wines at different prices reported greater enjoyment for the expensive brands even though the wine was the same for each trial (Plassmann, O'Doherty, Shiv, & Rangel, 2008).

In non-human research, animals also exhibit indefatigable behaviours that cannot adapt to a changing environment. Removing an egg from under a goose while it rolls it back to its nest will not prevent it from continuing this rolling behaviour as if the egg is still underneath its beak (Lorenz, 1970; Ray & Tucker, 2003). Interrupting one single step while the digger wasp lays its eggs leads to an ongoing repetition of the stage at which it was stopped (Dennett, 1984). It would seem that once the bell has rung, one cannot unring it—from judgements acquired over a lifetime to simple behaviours, automatic processes influence how we react to people, objects, and events.

In general, two lines of evidence support the need for a theoretical shift concerning the prevalent notion of automaticity that pits controlled against automatic processes. First, research

on the development of greater cognitive control emphasizes how lasting modifications of the executive control system substantially modulate the influence of self-regulation mechanisms over automatic processes (Kubler, Dixon, & Garavan, 2006). These significant changes in cognitive control facilitate flexible behavioural responses by implementing adaptive cognitive strategies. For example, reliable attention training induces cognitive and behavioural alterations in preschool children, reflecting to a large degree the inhibition of impulsive reactions (Dowsett & Livesey, 2000; Rueda, Checa, & Combita, 2012). Second, both implicit and explicit suggestions that produce the placebo effect largely shape automatic responses. In particular, the clinical environment comprises a wealth of cultural codes and inconspicuous suggestions that can trigger a beneficial treatment response in patients. For example, the sight of the pristine white coat belonging to the physician, the smell of disinfectant, and the voice of the nurse, all represent instances of how environmental stimuli may symbolically relate to pain relief (Fields & Price, 1999). These placebo effects rely heavily on modulation of top-down expectations that foster individual well-being, which may activate or repress automatic responses. In addition, explicit suggestions can also derail deeply ingrained automatic processing, such as reading. In the Stroop task, participants highly amenable to suggestion who are instructed to view words as gibberish or in a foreign language show a reduction in the Stroop effect (Lifshitz, Aubert Bonn, Fischer, Kashem, & Raz, 2013). These suggestions serve as communicable representations capable of transforming beliefs as well as subsequent thoughts and actions. Thus, the deployment of controlled processes seems capable of superseding the utmost of automatic processes.

This paper challenges the strict dichotomy that currently exists between controlled and automatic processes and demonstrates how individuals can harness the powerful effects of top-down regulation to influence and even derail automatic processes. First, we critically revise past

theories of automaticity. Second, we discuss the novel conceptualization of automaticity wherein top-down processes not only modify but also suppress ballistic responses through the executive network. We draw our support from the science of top-down modulation, which encompasses mechanisms engaged during hypnosis and meditation. Numerous studies indicate that, under a hypnotic or posthypnotic suggestion, participants amenable to hypnotic induction may overcome automatic processing with increased exertion of cognitive control. In addition, many long-term meditators from a variety of practices can inhibit spontaneous, involuntary thoughts and perform better on attention conflict tasks, compared to short-term practitioners or their non-practicing counterparts. Third, findings concerning the mechanisms responsible for inhibiting maladaptive automatic behaviours provide strong ecological validity in clinical contexts. We address mental and physical health issues from this side of the spectrum—i.e., regaining control over automatic processes—for the treatment of certain disorders characterized by involuntary maladaptive responses, such as phobias, anxiety, depression, and post-traumatic stress disorder (PTSD).

Defining automaticity: A blurry picture

Despite its long-standing history in psychology, automaticity remains an ill-defined construct. With the advent of dual-process theories, the prevailing distinction between controlled and automatic processes emerged amid the revolution and rise in cognitive science research (Evans & Stanovich, 2013). In general, investigators describe automatic processing through various combinations of the following features: fast, unconscious, unintentional, autonomous, efficient, and contextualized. However, as studies continue to reveal the subtle nuances and singularities of automatic processes, scholars face the increasingly daunting task of adopting a consensually parsimonious definition. In this section, we critically assess the strengths and flaws of past categorizations.

Categorizing automatic and controlled processes

Early cognitive psychologists primarily contrasted automatic processes to intentionally controlled processes based on learning studies wherein repetition yielded automatization of specific procedures (J. R. Anderson, 1982; Logan, 1985). From this perspective, extensive practice induces significant changes in attention processing to reflect automatization of certain cognitive processes. Thus, repetition of certain tasks leads to a decreased demand for attention resources whereby task completion can occur in the absence of cognitive control (Hasher & Zacks, 1979; Kahneman, 1973; Posner & Snyder, 1975a, 1975b).

Many investigators have incorporated this point-of-view into their definitions, characterizing automatic processes in terms of minimal attention requirements for process implementation. One prominent view, for example, argues that automatic processes represent knowledge acquired via a single-step retrieval procedure (Logan, 1988). Rather than searching for a fundamental feature, this definition critically avoids the burden of settling for a specific trait and focuses on the mechanisms underlying automaticity. However, as Moors and De Houwer (2006) have noted, this definition conflates the *explanandum* (the phenomenon that requires an explanation) with the *explanans* (the explanation of the phenomenon). As a result, this approach relies on circular reasoning, whereby the description of the phenomenon—in this case, automaticity—already encompasses the explanation of that phenomenon.

Other researchers often describe automaticity by incorporating a set of necessary and sufficient features into the definition (Bargh, 1994). These accounts focus on identifying common fixed descriptions that characterize this class (Moors & De Houwer, 2006). Accordingly, this position proposes that all automatic processes belong to a conceptual space outlined by a set of necessary attributes. One influential theory promotes the idea that automatic

processes share the following features: unconscious, unintentional, efficient, and uncontrollable (Bargh, 1994). In addition to the difficulties inherent in the search for a consensual set of features, this features-based approach faces the challenge of adapting these attributes to a continuous view of automaticity (Logan, 1985). Indeed, few dispute the principle that automatic and controlled mental operations vary along a continuum (Moors & De Houwer, 2006). In this regard, postulating a spectrum of automaticity implies that there exists no distinct quality between these two processes, thus compromising the search for a decisive set of features.

Adopting a single feature that lies along a spectrum addresses the challenge posed by the continuous model. For example, we might consider autonomy—cognitive processing without conscious guidance or supervision—a viable candidate (Bargh, 1992; Evans & Stanovich, 2013). As such, autonomy constitutes a spectrum wherein practice progressively makes a process more independent of conscious control. However, despite its strong conceptual appeal, this single-feature approach faces certain epistemological issues. Searching for a sole criterion supposes that such a criterion exists and that this single dimension unites the complexity and variability under a unique domain. With a heterogeneous multitude of automatic mental operations, this strong assumption seems untenable (Bargh, 1989). Moreover, we must consider whether this strategy simply reduces to semantic wordplay (e.g., replacing "autonomy" with "automaticity") that merely transposes the same problems to a different label.

Adopting a negative definition of automaticity may provide a more fruitful strategy. In a recent assessment of dual-process theory, Evans and Stanovich (2013) advanced working memory as a core characteristic of controlled processes, whereby automaticity constitutes a process that proceeds in the absence of working memory. While this approach might provide a better understanding of the nature of automaticity, explaining a phenomenon from a negative

conceptual space implies that a prescribed dichotomy captures the entire realm of cognitive processing. As a solution, certain researchers have entertained the prospect of a third class of cognitive processes (Evans, 2009; Wilkinson & Ball, 2010). Thus, the idea that cognition only comprises two contrasting processes might better serve as a research heuristic rather than a valid and parsimonious description of cognitive performance.

Deautomatization offers a novel perspective on automaticity

Rather than determining the absolute trait(s) of automaticity, we propose that researchers should focus on gaining a better understanding of how certain features typically pertaining to automaticity vary as a function of tasks and contexts. This perspective affords a valuable approach for analyzing and comparing automatic processes across all features in diverse contexts. Comparably, this approach has proven useful in hypnosis research; despite the debate concerning the essence of hypnosis (Wagstaff, 2014), investigators continue to study its underlying mechanisms and promote its many clinical applications (Kihlstrom, 2013; Oakley & Halligan, 2011, 2013). Drawing from a large body of evidence, the current framework demonstrates how the executive network can modulate cognitive control and self-regulation to deautomatize ballistic mental operations. Certain processes, for example, that we define as involuntary and autonomous may become more voluntary and less autonomous under certain conditions.

Critically, re-establishing control over automatic processes requires the deployment of the executive network (Kubler et al., 2006). Various reports intimate that cortico-basal-ganglial connections mediate the shift from automatic to controlled behavioural responses (Hikosaka & Isoda, 2010; Isoda & Hikosaka, 2011). Presumably, this network disengages automatic schemas and activates the executive system in situations that require greater cognitive flexibility. For

instance, overlearned schemas represent maladaptive behavioural responses in novel situations; thus, responding appropriately in such contexts calls for the engagement of the executive control system (Schneider & Chein, 2003).

To perform this feat, the network comprises three primary functions: first, to hold and modify transient information—i.e., working memory; second, to react appropriately and inhibit prepotent responses—i.e., behavioural inhibition; and third, to efficiently adjust behaviour to the changing environment—i.e., task switching (Hofmann, Schmeichel, & Baddeley, 2012; Miyake et al., 2000). These functions rely heavily on frontal lobe activity (Stuss & Alexander, 2000). In particular, the anterior cingulate cortex (ACC) contributes to the supervision of the allocation of controlled resources (Shenhav, Botvinick, & Cohen, 2013), the dorsolateral prefrontal cortex (DLPFC) is responsible for selecting, monitoring, and manipulating relevant information (Nee et al., 2013; Petrides, 2005), and the orbitofrontal cortex (OFC) plays a substantial role in information evaluation and action planning (Rolls & Grabenhorst, 2008; Wallis, 2007). The ACC is highly involved in conflict monitoring, comparing actual behaviour to the intended outcome and feeding this information back to the DLPFC (Kerns et al., 2004). Altogether, executive control allows people to overcome impulses and override automatic behaviour through top-down modulation.

In order to discuss how top-down regulation facilitates and inhibits cognition and behaviour, we must first clarify the similarities and differences between executive control and self-regulation—two distinct yet overlapping concepts (Hofmann et al., 2012). Self-regulation refers to the mental capacity that allows individuals to exert control over behaviour and cognition based on a goal set (Hofmann, Friese, & Strack, 2009). Successful self-regulation relies on top-down processes that select appropriate goal-relevant information, inhibit irrelevant and

distracting responses, and engage flexible mental sets with the goal of cultivating adaptive cognitive strategies (Hofmann et al., 2012). Executive control subserves self-regulation. In line with this proposed relationship, training programs designed to strengthen executive control and working memory improve self-regulation and reduce maladaptive behaviours (Guerrieri, Nederkoorn, & Jansen, 2012; Houben & Jansen, 2011; Houben, Wiers, & Jansen, 2011; Rueda et al., 2012). Therefore, deautomatization reflects the means by which top-down modulation increases cognitive control in order to derail ballistic processing.

In sum, deautomatization alters current thinking on automaticity. The possibility of derailing automatic processes directly challenges the notion that such processes lie well beyond voluntary influence. In line with recent findings (D'Angelo, Milliken, Jimenez, & Lupianez, 2013; Hassin, Bargh, & Zimerman, 2009), we should refrain from viewing automaticity as fixed and inflexible. By integrating findings spanning several areas of research, we demonstrate how deautomatization represents an overarching concept that advances current conceptions of automaticity.

Hypnosis as a means for deautomatization

Despite its chequered history and the surrounding popular mythology, the scientific study of hypnosis has experienced a resurgence in research in the last three decades (Raz, 2011). Drawing on top-down processes, hypnosis produces a vast repertoire of astonishing mental and behavioural phenomena (Nash & Barnier, 2008). Among the documented effects of hypnosis, research from our lab and other independent groups clearly establishes the striking capability of suggestion to modulate ballistic processes. Critically, these effects reproduce across different tasks (Lifshitz et al., 2013). In this section, we explore the influence of hypnosis and suggestion over automatic cognitive processes. This overview demonstrates how key elements of the

hypnotic phenomenon—namely individual hypnotizability, the induction procedure, and the context of the hypnotic and posthypnotic suggestion—offer a fertile experimental paradigm to investigate deautomatization phenomena and illustrate the ability of executive function to override automaticity.

Imaging studies indicate that hypnotizability levels relate to structural and functional differences within brain regions related to cognitive and emotional regulation (Hoeft et al., 2012; Huber, Lui, Duzzi, Pagnoni, & Porro, 2014; Nee et al., 2013; Shenhav et al., 2013). Accordingly, hypnotizability, which refers to stable inter-individual differences in susceptibility to hypnosis (Heap, Brown, & Oakley, 2004; Piccione, Hilgard, & Zimbardo, 1989), appears to stem from ways in which higher order cognitive functions engage hypnotic or posthypnotic suggestions. During recruitment, researchers typically classify participants as either highly hypnotizable (HH) or less hypnotizable on the basis of standardized scales (Laurence, Beaulieu-Prévost, & Du Chéné, 2008; Woody & Barnier, 2012). Although this classification is highly reliable (Piccione et al., 1989), transcultural considerations draw attention to common flaws associated with measuring and assessing hypnotizability (Champigny & Raz, 2014). Moreover, individuals within the HH group represent a heterogeneous sample that may further divide into sub-types (Terhune, Cardeña, & Lindgren, 2011a, 2011b). This within-group variability suggests that HHs may channel different cognitive strategies that lead to a similar hypnotic response (Cardeña, 2014), highlighting the difficulty of finding commonalities between grouped individuals.

The hypnotic induction that occurs prior to the given suggestion typically engenders a heightened level of attentional absorption, putatively accompanied by a greater preparation to respond to a given stimulus and limited spontaneous cognitions. A prevalent interpretation posits that this initial procedure results in an altered plane of consciousness and considers the hypnotic

trance as the defining quality of hypnosis (Kallio & Revonsuo, 2003). In contrast, other theorists contend that the hypnotic phenomenon reduces to socio-cognitive factors, such as attitudes, motivation, and expectancies, rather than a special psychological state (Kirsch & Lynn, 1995; Wagstaff, 2004). In line with this latter view, induction appears unnecessary to induce impressive feats in HHs (Mazzoni et al., 2009; Raz, Kirsch, Pollard, & Nitkin-Kaner, 2006).

Although it does not comprise an indispensable component of hypnosis, hypnotic induction facilitates the hypnotic response to augment the level of receptiveness to suggestion by increasing attentional absorption (Oakley, 2008). Correspondingly, at the brain level, studies report increased activity of the dorsal attention network and reduced activity in the anterior default mode network (DMN) following induction (Deeley et al., 2012; McGeown, Mazzoni, Venneri, & Kirsch, 2009). McGeown and collegues (2009) observed this decrease in activity in anterior DMN activity in HHs compared to LHs during a fMRI block-design approach, alternating between conditions of rest, active task, and passive task. However, when a different group of researchres examined mind-wandering in hypnosis "virtuosos" (i.e., very highly hypnotizable individuals) in and out of pure hypnosis, they observed opposite results with increased acitvity in posteiror regions of the DMN and decreased matabolic activity in anteiror DMN areas (Lipari et al., 2012). The depth of hypnosis and the type of spontaneous mental content experienced by these sets of participants may in part explain this discrepancy. Overall, DMN activity correlates to the spontaneous generation of self-relevant thoughts (Buckner, Andrews-Hanna, & Schacter, 2008); therefore, induction-related reduction of DMN activity facilitates the hypnotic response by tuning attentional absorption towards external directives and away from the self.

Hypnotic and posthypnotic suggestions account for a mere fraction of the vast realm of suggestions capable of generating a wide spectrum of vivid experiences and remarkable behaviours (Halligan & Oakley, 2014). Suggestions—under, after, or without hypnosis—chiefly engage higher-level cognitive processes involved in top-down regulation and response expectations (Halligan & Oakley, 2014; Michael, Garry, & Kirsch, 2012). The outcomes ensuing from suggestions result from a cascade of top-down effects that modulate perceptual, cognitive, and behavioural events. For example, after just a few words of suggestion, hypnotized individuals may hallucinate (Kosslyn, Thompson, Costantini-Ferrando, Alpert, & Spiegel, 2000; Mazzoni et al., 2009; McGeown et al., 2012; Szechtman, Woody, Bowers, & Nahmias, 1998), fail to remember conspicuous stimuli (Barnier, 2002; Kihlstrom, 1997, 2014; Mazzoni, Laurence, & Heap, 2014), or lose control over voluntary motor functions (Blakemore, Oakley, & Frith, 2003; Halligan, Athwal, Oakley, & Frackowiak, 2000; Polito, Barnier, Woody, & Connors, 2014). Suggestions can also come in different forms, originate from individuals or the environment, with or without intent, and draw upon cultural or some other form of near-universal meaning (Michael et al., 2012). In the clinic, for instance, physicians appreciate how the medical context conveyed by treatments and care may promote faster recovery and greater well-being in patients (Kaptchuk, 2002; Moerman & Jonas, 2002; Raz, Keller, Norman, & Senechal, 2007).

Together, the complex interaction between hypnotizability, the induction procedure, and the content conveyed by the suggestion produces the astonishing effects of hypnosis (Nash & Barnier, 2008). At the root of the hypnotic phenomenon, the prefrontal cortex (PFC) implements the response to suggestion through executive processes (Del Casale et al., 2012; Kihlstrom, 2013; Landry & Raz, 2015; Oakley & Halligan, 2009, 2013). Individuals under hypnosis often report these experiences as involuntary and effortless (Lynn, Rhue, & Weekes, 1990)—a

defining feature of hypnosis that supports some form of mental dissociation (Woody & Sadler, 2008). Accordingly, hypnosis prevents susceptible individuals from becoming aware of mental content that would otherwise arise in consciousness. One widespread view theorizes that hypnosis relies foremost on the decoupling of control and monitoring processes (Jamieson & Woody, 2007; Woody & Farvolden, 1998), which produces this common feeling of involuntariness and effortlessness. Impaired monitoring provides a compelling framework that accounts for a wide range of hypnotic phenomena, including altered conscious perception (Bryant & Mallard, 2005), unreliable access to stored memory and semantic knowledge (Kihlstrom, 1994), as well as modified feelings of agency (Bell, Oakley, Halligan, & Deeley, 2011; Blakemore et al., 2003). In a sense, we can compare hypnosis to self-deception, wherein one must relinquish metacognition in order to create an illusory reality congruent with the suggestion. Therefore, it is possible that hypnotic and posthypnotic suggestions may derail involuntary behaviours by requiring participants to embody the idea that their routine practices are no longer automatic.

Hypnosis represents a reliable, testable paradigm to investigate the range of regulatory processes over automaticity. A body of evidence demonstrates how hypnotic suggestion selectively influences specific dimensions of consciousness and the corresponding neural correlates (Landry, Appourchaux, & Raz, 2014; Landry & Raz, 2015). For example, suggestions intended to modify visual perception in HHs prompt altered visual experiences and corresponding fluctuations in visual processing areas of the brain (Kosslyn et al., 2000; McGeown et al., 2012; Raz, Fan, & Posner, 2005). Thus, by targeting perceptual, cognitive, or motor systems, suggestion can harness top-down processes and modulate automatic responses that normally lie beyond the purview of control.

Using the Stroop paradigm to elucidate deautomatization

The Stroop task provides a robust experimental demonstration of automaticty: proficient readers cannot withhold accessing the word meaning despite clear instructions to attend only to the font colour (Macleod, 1992; Stroop, 1935). In this paradigm, researchers manipulate stimuli across two reliable dimensions, the colour word and the font colour. The Stroop task comprises three experimental conditions: the congruent condition, where both dimensions converge (e.g., the word "blue" in blue font); the incongruent condition, where both dimensions diverge (e.g., the word "red" in blue font); and the neutral condition, where both dimensions are independent of one another (e.g., the word "chair" in blue font). On congruent trials, participants typically react faster with better accuracy compared to neutral trials, leading to a facilitation effect. Conversely, on incongruent trials participants are often slower and less accurate compared to neutral trials, leading to a cost effect.

The Stroop effect represents the difference in response time between congruent and incongruent trials. According to the perceptual conflict hypothesis, this phenomenon arises because the meaning of the word dimension conflicts with the meaning of the colour dimension. This semantic conflict overburdens the limited-resources information processing system, resulting in a longer reaction time. Therefore, the Stroop effect occurs as a result of the conflict created by the stimulus condition during perception (Bekci & Karakas, 2009).

Studies have validated other means besides hypnotic suggestion to reduce the Stroop effect. For example, strategies that separate the word from the task-relevant colour stimulus interfere with the automaticity of reading (Ganor-Stern, Tzelgov, & Meiran, 2013; Macleod, 1998). In addition, inserting a colour-neutral word elsewhere in the visual field or a row of Xs interferes with reading and thus reduces the Stroop effect (Kahneman & Chajczyk, 1983).

Therefore, reading is not entirely automatic—it requires attention resources that we can disrupt by spreading visual attention over a larger area. Narrowing visual attention also dilutes the Stroop effect. When researchers coloured only one letter of the word, participants reduced and even eliminated any interference effects (Besner, 2001). These studies used different methods to ultimately minimize activation caused by reading by diffusing attention normally focused on the distracting word stimulus.

Interestingly, social priming represents another approach to derail reading. Rather than instructing participants to avoid reading the word stimulus, researchers suppressed the Stroop effect by priming them with the social concept of "dyslexia" (Goldfarb, Aisenberg, & Henik, 2011). The authors concluded that producing a conflict between two automatic behaviours—in this case, dyslexia and reading—dampened the latter ballistic response. These findings suggest that automatic processes play an important part in governing behaviour under normal social situations.

Over a decade ago, our research group set forth on a research trajectory to explore the modulatory effects of suggestion over automaticity. By perturbing the plane of attention, our work as well as the work of other independent groups has led to discoveries concerning the influence of controlled processes over automatic responses (Lifshitz et al., 2013). In a series of Stroop experiments, we have examined the effects of non-hypnotic and posthypnotic suggestion in altering automatic processing (Campbell, Blinderman, Lifshitz, & Raz, 2012; Campbell & Raz, 2012; Raz & Campbell, 2011; Raz et al., 2005; Raz et al., 2006; Raz et al., 2003; Raz, Shapiro, Fan, & Posner, 2002). These findings demonstrate that suggestion engages top-down cognitive control and obviates robust ballistic responses. A suggestion to construe the presented words as meaningless symbols even without the mention of hypnosis considerably reduces

Stroop effect in HHs, compared to LHs (Parris & Dienes, 2013). Moreover, the contrast in performance with and without a suggestion following an induction in HHs shows the remarkable extent to which hypnosis exploits the influence of suggestion (Sheehan, Donovan, & MacLeod, 1988).

Neuroimaging and neurophysiological studies provide converging evidence for these effects at the brain level. Incongruent trials generally engage the ACC, which serves to detect and signal the occurrence of an information processing conflict (Botvinick, Nystrom, Fissell, Carter, & Cohen, 1999). Under a posthypnotic suggestion, however, HHs exhibit reduced ACC activity, compared to no-suggestion and LH controls (Raz et al., 2005). In addition, these HH participants showed reductions in activity of the early occipital cortex. Thus, a posthypnotic suggestion is capable of modulating orthographic decoding to reduce conflict, representing a reliable means of deautomatization. These results intimate that suggestions—especially the kind associated with hypnosis—may play a pivotal role in gaining control over seemingly automatic processes.

Besides altered brain activity, investigators have proposed that a significant change in optical accommodation (Leibowitz & Owens, 1978) might constitute another way by which suggestion influences the Stroop effect. Accordingly, suggestion might change the muscle tone and resting state of the eye in order to dampen down the visual input. However, when researchers controlled for accommodation by paralyzing the ciliary muscles of the eye, they still replicated the influence of suggestion on diminishing the Stroop effect (Raz et al., 2003). Moreover, efforts to eliminate the Stroop effect with hypnotic suggestion for other optical conditions, such as colour blindness, have generally proved unsuccessful (Harvey & Sipprelle, 1978; Mallard & Bryant, 2006). Yet, suggestion can have profound effects on both the experience of colour and

neural activation of the visual cortex, whereby hypnosis experiments of colour hallucinations have reported corresponding modulation of the visual areas (Kosslyn et al., 2000; Mazzoni et al., 2009; McGeown et al., 2012). Therefore, deautomatization in the Stroop paradigm ensues from top-down modulation of sensory processing and does not follow from reduced or supressed sensory inputs.

Separate accounts contend that the word blindness suggestion does not necessarily prevent or control reading but rather diminishes the response competition in order to deal with conflict more effectively. This hypothesis proposes that the Stroop effect arises from the simultaneous activation of two opposing response tendencies, and not from an overworked information processing system (Augustinova & Ferrand, 2014). While the colour stimulus requires transformation from a perceptual to a verbal code, no such transformation is required for the word stimulus. Thus, the irrelevant word information reaches the response-initiation stage before the relevant colour information, which leads to the Stroop effect (Doehrman, Landau, & O'Connell, 1978). This discussion invites the possibility that similar automatic procedures might be considered resistant to such top-down influences.

Beyond the Stoop effect

Suggestions may allow individuals to alter the automaticity of a range of ingrained cognitive processes beyond the Stroop paradigm. Such studies can contribute to mapping the scope of deautomatization as a function of automaticity and provide significant evidence to better assess automatic processes. Reports indicate that hypnotic and posthypnotic suggestions can, at least partially, derail the McGurk (Dery, Campbell, Lifshitz, & Raz, 2014), Flanker (Iani, Ricci, Gherri, & Rubichi, 2006), and Simon effect (Iani, Ricci, Baroni, & Rubichi, 2009).

The auditory illusion present in the McGurk task exemplifies the influence of vision on speech perception (McGurk & MacDonald, 1976). Individuals watching a video of a person silently mouthing /*ga*/ while hearing the phoneme /*ba*/ will report hearing /*da*/—a combination of these two inputs. Researchers consider the McGurk effect a fast, automatic, and multisensory process that people are unable to overcome regardless of practice (Summerfield & McGrath, 1984) or knowledge of dubbing (McGurk & MacDonald, 1976). This deeply ingrained process is also apparent in non-human primates (Ghazanfar & Logothetis, 2003) and human infants (Kushnerenko, Teinonen, Volein, & Csibra, 2008). In contrast to reading, which only takes place in specific situations, perceptual processing represents a hardwired phenomenon that constantly occurs. Therefore, the multimodal integration responsible for the McGurk effect constitutes a more deeply ingrained response than the Stroop effect. However, a posthypnotic suggestion to view the auditory and visual components of the stimulus as disparate information streams allows HHs, but not LHs, to correctly identify the presented sound (Dery et al., 2014). This suggestion in a non-hypnotic context does not produce the same effect in HHs. These findings suggest that the posthypnotic suggestion may function through top-down regulation of low-level sensory integration (Beauchamp, Nath, & Pasalar, 2010).

The Flanker task represents a paradigm that presents a cognitive conflict between two competing responses (Eriksen & Eriksen, 1974). This task simultaneously depicts a central target stimulus with two distracter stimuli (i.e., the flankers) that are either pointing in the same or opposite direction as the target. To correctly identify the target, participants must select the relevant information and inhibit the irrelevant information. Researchers can evaluate the flanker compatibility effect (FCE) by comparing the reaction time between congruent (i.e., flankers in the same direction as the target) and incongruent (i.e., flankers pointing in opposite direction as

target) trials. Results show that reaction times tend to be faster on congruent trials and slower on incongruent ones because participants cannot ignore the flankers despite instructions to do so. Therefore, the FCE occurs due to a failure in focused attention because the close proximity of the target and flankers makes it difficult to restrict attention to the target in order to process only the relevant stimuli (Iani et al., 2006). However, a posthypnotic suggestion to attend to the target and perceive the flankers as out of focus significantly reduces the FCE in HHs compared to LHs. Suggestion alone does not seem to modulate the FCE in HHs or LHs (Iani et al., 2006). Thus, automatic processing of irrelevant visual information in the FCE may show greater resistance to top-down influences, compared to the Stroop effect.

Finally, the Simon effect refers to the phenomenon where people respond faster and more accurately when a stimulus occurs in the same relative location as the response, even if the stimulus location is irrelevant to the task, compared to when the positions do not correspond (De Jong, Liang, & Lauber, 1994). Researchers commonly attribute the Simon effect to an automatic tendency to respond towards the source of stimulation, which interferes with actions away from the stimulus (Hommel, 2011; Simon, 1969). Like the other tasks that exemplify ballistic processing, under suggestion HHs can significantly reduce the Simon effect compared to LH controls (Iani et al., 2009).

While methodological discrepancies between these studies might partially explain these divergent results (Lifshitz et al., 2013), these outcomes expose critical distinctions between the mechanisms responsible for each effect. In sum, the diverse mechanisms ascribed to deautomatization represent a reliable research tool to investigate and compare the different types of ballistic processes.

Colour perception as an ingrained process

As the gold standard of attention measures (Macleod, 1992), the Stroop task can help elucidate the effect that colour may have on attention. Light does not solely convey wavelength information—different colours can shape perceptions and expectations to ultimately influence thought and behaviour. Indeed, we learn early on that colours can serve as effective cues in separating salient visual information from distractions. The discrepancy between findings supporting the favourable effects of colour on attention attests to the large gap between the psychology of attention and colour.

While numerous accounts report that a wide range of techniques can reduce the Stroop effect (e.g., Besner, 2001; Ganor-Stern et al., 2013; Kahneman & Chajczyk, 1983), researchers have yet to explore this phenomenon with respect to the printed colour. If certain colours facilitate focused attention, then differences in reaction time should be evident between printed colours. In this section, we present results from a large cohort of HHs and LHs performing the Stroop paradigm with and without a posthypnotic suggestion for word blindness. Based on our analysis, we discuss how entrenched colour representations modulate reaction time and accuracy rates in this task. Moreover, we explore the relevance of this research by suggesting a new method for analyzing deautomatization within conflict tasks.

To examine the influence of colour on attention, we collected data on a classic Stroop task consisting of 49 HHs and 34 LHs. Participants completed four blocks of 144 trials. Blocks alternated between the no-suggestion and word blindness suggestion condition. Order was counterbalanced (See Appendix A for a detailed description of the methods).

We performed a repeated-measures omnibus ANOVA to investigate reaction time and accuracy effects using Group (HHs, LHs) as a between-subject factor and Colour (Red, Blue,

Green, Yellow), Suggestion (With, Without), and Congruency (Congruent, Neutral, Incongruent) as within-subject factors. Administration order (Suggestion-first, Suggestion-second) was not significant and the data was accordingly collapsed. For the reaction time analysis, main effects of Colour ($F(3,246) = 225.35$, $p < 0.0001$), Congruency ($F(2,162) = 292.45$, $p < 0.0001$), Group ($F(1,81) = 116.14$, $p < 0.0001$), and Suggestion $F(1,71) = 195.79$, $p < 0.0001$) were significant. The following interactions were significant: Colour x Suggestion ($F(3,216) = 5.51$, $p < 0.01$), Group x Congruency ($F(2,162) = 6.30$, $p < 0.01$), Suggestion x Congruency ($F(2,142) = 95.88$, $p < 0.0001$), Suggestion x Group ($F(1,71) = 24.94$, $p < 0.0001$), and Suggestion x Group x Congruency ($F(2,142) = 4.27$, $p < 0.05$). Accuracy analysis with GENMOD revealed a significant main effect of Congruency ($\chi^2(2) = 24.02$, $p < 0.0001$) and Colour ($\chi^2(3) = 35.99$, $p < 0.0001$), as well as significant interactions of Congruency x Colour ($\chi^2(6) = 15.07$, $p < 0.05$) and Congruency x Suggestion ($\chi^2(2) = 13.27$, $p < 0.01$).

Ink colour order—yellow, red, blue/green—applies to reaction time (fastest to slowest) and accuracy (most to least) across the three congruency conditions (see Tables 1 and 2). This order remains stable as a function of suggestion and group and appears to characterize responses regardless of the actual word stimulus. At the experimental distance of 2/3 meter, all four colours fall behind the retina, with blue being closest to the retina (i.e., clearest to perceive), followed by green, yellow, and red increasingly further away. Moreover, yellow was the brightest, with red, blue, and green in descending brightness.

Golden yellow is reportedly the most easily visible colour under all testing conditions. Ecologically, for example, studies elucidating the visibility of fire trucks reported that yellow or greenish-yellow vehicles minimized road accidents, compared to vehicles coloured in red (Solomon & King, 1995). In addition, the lateral peripheral vision for detecting yellow is 1.24

times greater than that for red (Traquair, 1949); hence, yellow has a strong advantage for reducing reaction times compared to the other colours.

Table 1.

Congruent	Neutral	Incongruent	Color	Group	Suggestion
626 (144)	634 (161)	630 (174)	RED	HHs	With
625 (167)	665 (190)	741 (257)			Without
660 (204)	677 (214)	714 (249)		LHs	With
630 (197)	675 (206)	758 (297)			Without
662 (174)	662 (188)	684 (190)	BLUE	HHs	With
680 (197)	703 (195)	789 (269)			Without
687 (214)	704 (222)	731 (260)		LHs	With
697 (230)	714 (206)	804 (289)			Without

Mean RT scores per colour.

671 (176)	694 (184)	706 (213)	GREEN	HHs	With
672 (185)	709 (201)	791 (286)			Without
702 (205)	706 (202)	766 (244)		LHs	With
709 (230)	710 (215)	815 (310)			Without
591 (148)	597 (141)	594 (158)	YELLOW	HHs	With
595 (153)	652 (180)	720 (255)			Without
609 (165)	635 (179)	649 (216)		LHs	With
620 (181)	649 (192)	741 (266)			Without

Note. * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$, **** = $p < 0.0001$. Differences between HHs and LHs appear with dashed and dotted lines, dashed lines depict differences as a function of suggestion. Solid lines depict differences for Stroop (Incongruent – Congruent), Interference (Incongruent – Neutral) and Facilitation (Neutral – Congruent) effects. Standard deviations appear in parentheses.

Table 2.
Mean accuracy scores per colour.

Congruent	Neutral	Incongruent	Color	Group	Suggestion
95.8 (20.0)	95.2 (21.4)	96.3 (19.0)	RED	HHs	With
97.5 (15.8)	97.1 (16.9)	94.2 (23.3)			Without
95.8 (20.0)	91.5 (28.0)	92.9 (25.8)		LHs	With
96.8 (17.6)	94.9 (22.1)	93.8 (24.1)			Without
91.5 (27.9)	91.6 (27.7)	90.0 (30.0)	BLUE	HHs	With
93.8 (24.1)	92.4 (26.6)	91.2 (28.4)			Without
91.9 (27.4)	93.7 (24.4)	91.9 (27.4)		LHs	With
94.5 (22.8)	94.3 (23.2)	91.3 (28.2)			Without
90.4 (29.4)	91.8 (27.5)	92.1 (27.0)	GREEN	HHs	With
94.8 (22.3)	94.2 (23.3)	91.0 (28.6)			Without
93.7 (24.4)	91.9 (27.4)	93.1 (25.4)		LHs	With
93.1 (25.4)	91.1 (28.4)	90.6 (29.2)			Without
98.5 (12.1)	97.6 (15.3)	96.7 (17.8)	YELLOW	HHs	With
98.5 (12.1)	97.2 (16.5)	95.6 (20.6)			Without
97.6 (15.3)	97.8 (14.6)	96.2 (19.1)		LHs	With
97.9 (14.4)	97.9 (14.4)	94.5 (22.8)			Without

Note. * = $p < 0.05$, ** = $p < 0.01$. Dashed lines depict differences as a function of suggestion. Solid lines depict differences for Stroop (Incongruent – Congruent), Interference (Incongruent – Neutral) and Facilitation (Neutral – Congruent) effects. Standard deviations appear in parentheses.

Optical parameters account for only part of perception because psychological influences, including learned colour associations, likely govern such processing as well. Our results indicate that participants perceive red more quickly than blue or green, thus reducing the Stroop effect to a greater degree. In particular, this finding illustrates the biased effect that colours may have on

task performance. For example, people living in Western society associate red with danger (e.g., emergency situations). However, the question remains whether this danger signal evokes a motivational tendency to avoid that event and thus undermine performance or leads to heightened vigilance and improves performance (Elliot, Maier, Moller, Friedman, & Meinhardt, 2007; Elliot, Shell, Henry, & Maier, 2005; Tanaka & Tokuno, 2011). Our results suggest the latter: visual exposure to red enhances performance on cognitive tasks involving focused attention. Overall, it is important to better operationalize the optical parameters of this task and replicate the present experiment while controlling for both equiluminant colours and the possibility of parafoveal vision.

The present findings hold implications for research investigating the spectrum that ranges from automatic to controlled cognitive processes. In addition to confirming that posthypnotic suggestion can reduce the Stroop effect in HHS, this analysis probes the subtle relationship between the colour of the word stimulus and faster responses, contributing to our understanding of top-down influences on cognitive control. Our findings suggest that by breaking down the data into its basic physical components, we can add another level of information to the current literature. Indeed, future studies may benefit by pushing for a more detailed examination of the results. As noted in the McGurk task, for example, a posthypnotic suggestion to view the auditory and visual components of the stimulus as disparate streams of information allows HHs, but not LHs, to reduce the McGurk effect. If researchers conducted a more detailed analysis, they may find that HHs are more capable of reducing the McGurk effect in trials where they hear certain phenomes, perhaps those that we frequently say or hear in day-to-day life. With these new possibilities, investigators are in a position to study how our experiences, such as colour

associations, play a role in the top-down modulation of both automatic and controlled cognitive processes.

Meditation: Long-term changes in cognitive control

Support for deautomatization emerges from meditative traditions with attention regulation as a central objective. Meditators from a variety of practices learn to divest their attention from routine modes of thought and reinvest it into new ways of experiencing themselves and the world around them (Deikman, 1966). Meditation enhances executive function because it in and of itself represents a form of performance monitoring by requiring practitioners to monitor their minds and return their focus to the present moment (Teper & Inzlicht, 2013). Over time, meditation alters cognitive, emotional, and sensory processing, which allows meditators to override automatic thoughts behaviour.

Meditation encompasses a diverse array of mental training practices with different techniques and aims. Research focuses primarily on two types of meditation: focused attention (FA), wherein one maintains concentration on specific physical sensations (e.g., breathing), and open monitoring (OM) or mindfulness, wherein one attends to the entire context of the experience without emotionally responding or focusing on one specific dimension (Lutz, Slagter, Dunne, & Davidson, 2008). Once practitioners have succeeded in sustaining attention on their breathing, they move on to cultivating a non-judgemental awareness of the environment.

FA actively engages differential attention subnetworks when individuals become aware of mind-wandering, shift away from mind-wandering, and focus on breathing (Harvey & Sipprelle, 1978; Hasenkamp & Barsalou, 2012; Hasenkamp, Wilson-Mendenhall, Duncan, & Barsalou, 2012). In particular, remaining constantly vigilant of breathing to prevent mind-wandering recruits brain structures that bring attention under the domain of top-down control.

When Kundalini meditators focused their attention on breathing rather than on generating random list of animals, researchers observed a strong activation of the lateral prefrontal and parietal cortices (Lazar et al., 2000). This activity increase in the fronto-parietal executive network reflects the exertion of voluntary control needed to concentrate on breathing without distraction (Hasenkamp & Barsalou, 2012).

In contrast, OM guides meditators to passively attend to every moment of the experience without passing judgement (Lutz et al., 2008). These individuals learn to not react to automatic cognitive and emotional interpretations of the surrounding stimuli. In an electroencephalogram study, expert meditators performed better on the Stroop task than non-meditators (Teper & Inzlicht, 2013). Furthermore, when these experts made a mistake on a trial, they showed a stronger error-related negativity (i.e., a neurophysiological response that occurs within 100 msec of error commission) but did not exhibit a stronger error positivity (i.e., a conscious reaction to errors) compared to controls. Thus, expert OM meditators can efficiently detect and accept their errors, leading to greater executive control.

Many meditative practices aim to minimize spontaneous, often self-referential thoughts—also known as mind-wandering. As previously stated, mind-wandering correlates with activity in the DMN, a circuitry of midline cortical regions that include the medical prefrontal and posterior cingulate cortices (Buckner et al., 2008; Mason et al., 2007). Self-reflection activates the ventral medial prefrontal cortex while explicit self-reference engages the dorsal medial prefrontal cortex (Whitfield-Gabrieli et al., 2011). However, mind-wandering does not solely occur in the absence of goal-directed activity; even when individuals are engaged in attention-demanding tasks, the mind still exhibits a tendency to wander (Mooneyham & Schooler, 2013). Mind-wandering can interfere with task performance by reducing working memory resources. However, this

phenomenon does not necessarily lead to poor performance if the task does not require substantial attention (Smallwood & Schooler, 2006). When researchers administered practiced and novel task sequences to participants, they found that a reduction in processing demands during the practiced task was accompanied by increases in the generation of spontaneous thoughts and DMN activity (Mason et al., 2007). To a certain extent, we can conceptualize mind-wandering as a failure of executive control, whereby it is determined by the presence of automatically generated thoughts and the inability of the executive system to deal with this interference (McVay & Kane, 2010).

Meditators who regularly engage in mindfulness exercises display diminished mind-wandering by either minimizing spontaneous mentation or increasing their awareness of mind-wandering (Mrazek, Smallwood, & Schooler, 2012). Compared to novice controls, expert practitioners of mindfulness meditation show a weaker functional connectivity between DMN regions involved in self-referential processing and emotional appraisal. This finding is consistent with the view that mindfulness aims to promote acceptance of thoughts, perceptions, and feelings (Taylor et al., 2012). Furthermore, meditators exhibit a stronger coupling between structures involved in self-monitoring and cognitive control, which may account for this decrease in self-referential processing (Brewer et al., 2011). Notably, this disengagement from automatic self-referential processing and engagement in attentional control may occur in the early stages of training (Berkovich-Ohana, Glicksohn, & Goldstein, 2012).

Activation of the executive system during meditation can lead to functional and behavioural changes outside the meditative context. Research investigating individual variations in achieving the meditative state demonstrates differential activity in the ACC, a region belonging to the executive network (Tang & Posner, 2009). The ACC, along with the anterior

insula, basal ganglia, and lateral PFC, is instrumental in monitoring and resolving response conflict in a variety of conflict tasks (Fan et al., 2012; Posner & Fan, 2008). Studies report increases in ACC activity during the early stages of meditation to enhance self-regulation and thus decrease mind-wandering (Tang & Posner, 2009). Four weeks of Integrative Mind-Body Training (IBMT), a combination of body and mind techniques that emphasize attaining a balance between relaxation and focused attention, improved white matter efficiency in areas surrounding the ACC, compared to relaxation training controls (Tang, Lu, Fan, Yang, & Posner, 2012; Tang et al., 2010). Even just five days of IBMT resulted in superior control of the ACC over the parasympathetic nervous system, as exemplified by better physiological reactions, greater body relaxation, and a calm state of mind (Tang et al., 2009). Moreover, the IBMT group showed a reduction in DMN activity after training, suggesting that a reorganization of the brain network takes place during this short period of time.

Overall, meditation can improve brain functions related to executive attention in healthy subjects across the life span (Tang, Posner, & Rothbart, 2014). Research intimates that the ability to stay in the present moment enables meditators to ignore distractors and ruminate less (Jain et al., 2007). These distractors can come in the form of spontaneous, task-unrelated thoughts or salient stimuli that automatically attract attention. As novices become expert meditators, the benefits for the mind, brain, and body become more distinct.

Overriding automaticity in the clinic

The prospect of deautomatization holds implications for a wide range of psychological phenomena within the clinical context. Many automatisms related to disorganized and maladaptive responses are strongly associated with different psychiatric complaints and disorders, including chronic pain, phobias, anxiety, depression, and PTSD. These pervasive

cognitive patterns often trigger a feeling of helplessness, whereby individuals feel powerless over their own thoughts and emotions, and cause a significant amount of distress. To treat these disorders, psychotherapists have devised interventions to promote self-regulation. This approach aims to drastically reduce, and even suppress, the detrimental effects that accompany reflexive and habitual responses by targeting and facilitating superior executive functioning. Accordingly, these strategies strive to override the controlling grip that these recursive patterns possess over thought processes.

Studies intimate that derailing automaticity for specific mental disorders relies on modification of the executive control system. These changes mainly comprise better control over selective attention and inhibitory processes, as well as enhanced metacognitive skills and self-awareness. Therefore, strengthening executive control promotes effective emotional and self-regulation, which induces cognitive restructuring along with a significant reduction in maladaptive automatic responses. It would follow that efficacious therapeutic interventions must engage this network.

Clinical hypnosis is generally considered an adjunct intervention to many psychological interventions (Alladin, 2012a). The combination of hypnosis with other psychotherapies has led to favourable outcomes for a number of mental disorders (Kirsch, Montgomery, & Sapirstein, 1995; Moore & Tasso, 2008). Part of this success hinges on the ability of hypnotic and posthypnotic suggestions to selectively target specific aspects of the subjective experience and related cognitions. As a result, this regulation changes how individuals experience certain sensations, in addition to modifying thought processing and subsequent reactions and behaviours. Such interventions involve alterations of automatic perceptual, cognitive, and motor responses. In the case of depression, carefully designed posthypnotic suggestions diminish the

frequency of ruminations—a particular form of recursive thinking (Alladin, 2006, 2009). These suggestions aim to augment attention regulation and deautomatize these fixed negative thought patterns (Alladin, 2007; Yapko, 1992). Depending on the nature of the disorder and the individual, psychotherapists employ various hypnotic techniques to reach similar goals for each specific maladaptive automatic response.

Pain management represents a well-established area of application for hypnotic deautomatization. Empirical investigations demonstrate that potent suggestions have the ability to drastically modulate pain intensity and unpleasantness (Jensen & Patterson, 2006; Patterson & Jensen, 2003) for both acute and chronic pain (Jensen & Patterson, 2014). Following noxious sensations, pain-related neurocognitive processes maintain pain perception (Grumm, Erbe, von Collani, & Nestler, 2008). In other words, noxious sensations engage reflexive attention, amplifying and thus maintaining the painful signal (Legrain et al., 2009). Therefore, hypnotic analgesia may suppress this involuntary response, preventing the pain signal from reaching the threshold of consciousness (Landry et al., 2014). Accordingly, findings suggest that hypnotic suggestions can alter early sensory processing (Abrahamsen et al., 2010; Derbyshire, Whalley, & Oakley, 2009; Derbyshire, Whalley, Stenger, & Oakley, 2004; Hofbauer, Rainville, Duncan, & Bushnell, 2001; McGeown et al., 2012; Raij, Numminen, Narvanen, Hiltunen, & Hari, 2005, 2009; Raz et al., 2002; Roder, Michal, Overbeck, van de Ven, & Linden, 2007). In addition, neurocognitive factors, such as attention, expectation, and appraisal, modulate pain perception (Ploghaus, Becerra, Borras, & Borsook, 2003; Wiech, Ploner, & Tracey, 2008). These cognitive processes constitute potential mediators of hypnotic analgesia. By acting on these processes, hypnosis can inhibit ingrained automatic responses responsible for perpetuating the processing of noxious stimuli and the perception of pain.

Clinical hypnosis also applies to a spectrum of mental disorders that comprise automatic, overlearned cognitive and behavioural patterns, including phobias, anxiety, depression, and PTSD (Lynn, Barnes, Deming, & Accardi, 2010). In the case of phobias, individuals experience disproportionate levels of persistent fear and anxiety in response to a threatening stimulus or situation (A. T. Beck, Emery, & Greenberg, 2005). In other words, the flight-or-fight response goes awry, whereby these reactions occur automatically and remain beyond voluntary control (Mineka & Öhman, 2002; Öhman & Soares, 1993). Moreover, anticipation of aversive stimuli and situations exacerbates anxiety, deregulating the normal functioning of the limbic system (Simmons, Strigo, Matthews, Paulus, & Stein, 2006). Effective phobia treatments challenge irrational beliefs toward the object of fear and coordinate some form of systematic desensitization through gradual exposure (Choy, Fyer, & Lipsitz, 2007; Wolitzky-Taylor, Horowitz, Powers, & Telch, 2008). Hypnosis can facilitate this intervention by: helping to prepare patients for exposure and reducing the adverse impact of anticipation; increasing control over the fear response during the therapeutic or real-life exposure; and providing vivid imagery suggestions as a controlled desensitization tool during exposure (Crawford & Barabasz, 1993; Kraft, 2013; Spiegel, 2013).

After undergoing a traumatic event, individuals diagnosed with PTSD experience various pathological symptoms, including flashbacks and amnesia, resulting in considerable distress, anxiety, and depression. A body of work emphasizes that reliving these undesirable memories may reflect inter-individual variability in executive control (Levy & Anderson, 2002, 2008). According to this position, deficits in executive control relate to the impoverished ability in suppressing recall of unwanted memories. Neuroimaging findings reveal that the level of recruitment of the DLPFC predicts the ability to inhibit these memories (M. C. Anderson et al.,

2004). Furthermore, attempts to suppress unwanted thoughts yield a rebound effect, thus increasing their resurgence (Wenzlaff & Wegner, 2000). As a result, efforts to suppress unwanted thoughts of past experiences may in fact contribute to maintaining these intrusions (J. G. Beck, Gudmundsdottir, Palyo, Miller, & Grant, 2006; Shipherd & Beck, 2005). Hypnosis enhances cognitive control, which aids PTSD patients to gain control over their spontaneous, flooding traumatic memories (Barabasz & Barabasz, 2013). In particular, this hypnotic intervention aims to deautomatize the potent affective reaction connected to that memory, thereby facilitating the reinterpretation of that event—a critical aspect of effective therapy in the treatment of PTSD.

People with anxiety and depression frequently suffer from undesirable intrusive thoughts (Brewin, Gregory, Lipton, & Burgess, 2010; Nolen-Hoeksema, 2000). These behavioural and cognitive patterns reflect ballistic orienting of attention towards experiences, thoughts, and feelings, as well as difficulties in disengaging from them (Ingram, 1984; Joormann & Gotlib, 2008; Nolen-Hoeksema, 1991, 2000; Nolen-Hoeksema, Morrow, & Fredrickson, 1993). Indeed, neuroimaging studies of depression report atypical limbic and DLPFC activity, which suggests poor cognitive control over emotional thought processes (Gotlib & Hamilton, 2008). Similarly, neuropsychological assessments of remitted major depression patients demonstrate that these individuals possess deficits in attention and executive control compared to healthy participants (Paelecke-Habermann, Pohl, & Leplow, 2005).

Combined with cognitive behavioural therapy, hypnosis may help to overcome the detrimental effects of rumination by increasing cognitive and self-regulation. This approach trains patients to shift attention away from ruminative patterns and towards adaptive cognitions that promote well-being (Lynn et al., 2010). This technique capitalizes on hypnotic and

posthypnotic suggestions to reinforce self-esteem and self-efficacy, in addition to enhancing executive control to overcome ruminative thinking (Alladin, 2009, 2012b). Again, this type of intervention demonstrates how suggestion can promote cognitive control and disrupt automatic thought patterns.

In sum, some of the inherent benefits of hypnosis follow from enhanced self-regulation capacities, which in turn enable deautomatization of different emotional, cognitive, and behavioural reactions. These examples demonstrate how theoretical notions developed through laboratory research can translate into a reliable application in the clinical realm. In addition to elucidating the aetiology of certain mental illnesses, gaining a better understanding of the mechanisms underlying this intervention will assist professionals in tailoring their intervention to the patient.

Conclusion

The automaticity of thinking appears ubiquitous in daily life, extending from simple impressions and mind-wandering to pain perception and mental illness. We have shown that, under the right conditions, a seemingly automatic process can appear to deautomatize. Deautomatization challenges prevalent views on automaticity because it intimates that once the bell has rung, we can actually unring it. Instead of framing automatic processes as necessary juggernaut, we draw from the science of top-down processes to highlight a novel conception of automaticity wherein top-down processes can not only modulate but also inhibit ballistic responses. This prospect holds fundamental implications for clinical interventions, as well as for furthering our understanding of deeply ingrained processes and how they impinge on the neural correlates of consciousness. Such efforts would need to carefully navigate the underlying ethics as they pave the road to better scientific understanding of applied and therapeutic prospects.

References

Abrahamsen, R., Dietz, M., Lodahl, S., Roepstorff, A., Zachariae, R., Ostergaard, L., & Svensson, P. (2010). Effect of hypnotic pain modulation on brain activity in patients with temporomandibular disorder pain. *Pain, 151*(3), 825-833.

Alladin, A. (2006). Cognitive hypnotherapy for treating depression. In R. Chapman (Ed.), *The clinical use of hypnosis with cognitive behavior therapy: A practitioner's casebook*. New York: Spring

Alladin, A. (2007). *Handbook of cognitive hypnotherapy for depression: An evidence-based approach*. Philadelphia, PA: Lippincott Williams & Wilkins.

Alladin, A. (2009). Evidence-based cognitive hypnotherapy for depression. *Contemporary Hypnosis, 26*(4), 245-262.

Alladin, A. (2012a). Cognitive hypnotherapy for major depressive disorder. *American Journal of Clinical Hypnosis, 54*(4), 275-293.

Alladin, A. (2012b). Cognitive hypnotherapy: A new vision and strategy for research and practice. *American Journal of Clinical Hypnosis, 54*(4), 249-262.

Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological Review, 89*(4), 369-406.

Anderson, M. C., Ochsner, K. N., Kuhl, B., Cooper, J., Robertson, E., Gabrieli, S. W., . . . Gabrieli, J. D. (2004). Neural systems underlying the suppression of unwanted memories. *Science, 303*(5655), 232-235.

Augustinova, M., & Ferrand, L. (2014). Automaticity of word reading: Evidence from the semantic Stroop paradigm. *Current Directions in Psychological Science, 23*(5), 343-348.

Barabasz, A. F., & Barabasz, M. (2013). Hypnosis for PTSD: Evidence based placebo-controlled trials. *Journal of Trauma and Treatment, S4*.

Bargh, J. A. (1989). Conditional automaticity: Varieties of automatic influence in social perception and cognition. In J. A. Bargh & J. S. Uleman (Eds.), *Unintended thought* (pp. 3-51). New York, NY: Guildford Press

Bargh, J. A. (1992). The ecology of automaticity: Toward establishing the conditions needed to produce automatic processing effects. *American Journal of Psychology, 105*(2), 181-199.

Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, efficiency, intention, and control in social cognition. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (pp. 1-40). Hillsdale, NJ: Guilford Press

Barnier, A. J. (2002). Posthypnotic amnesia for autobiographical episodes: A laboratory model of functional amnesia? *Psychological Science, 13*(3), 232-237.

Beauchamp, M. S., Nath, A. R., & Pasalar, S. (2010). fMRI-guided transcranial magnetic stimulation reveals that the superior temporal sulcus is a cortical locus of the McGurk effect. *Journal of Neuroscience, 30*(7), 2414-2417.

Beck, A. T., Emery, G., & Greenberg, R. L. (2005). *Anxiety disorder and phobias: A cognitive perspective*. New York, NY: Basic Books.

Beck, J. G., Gudmundsdottir, B., Palyo, S. A., Miller, L. M., & Grant, D. M. (2006). Rebound effects following deliberate thought suppression: Does PTSD make a difference? *Behavior Therapy, 37*(2), 170-180.

Bekci, B., & Karakas, S. (2009). Perceptual conflict and response competition: Event-related potentials of the Stroop Effect. *Turkish Journal of Psychiatry, 20*(2), 127-137.

Bell, V., Oakley, D. A., Halligan, P. W., & Deeley, Q. (2011). Dissociation in hysteria and hypnosis: Evidence from cognitive neuroscience. *Journal of Neurology, Neurosurgery, and Psychiatry, 82*(3), 332-339.

Berkovich-Ohana, A., Glicksohn, J., & Goldstein, A. (2012). Mindfulness-induced changes in gamma band activity - Implications for the default mode network, self-reference and attention. *Clinical Neurophysiology, 123*(4), 700-710.

Besner, D. (2001). The myth of ballistic processing: Evidence from Stroop's paradigm. *Psychonomic Bulletin and Review, 8*(2), 324-330.

Blakemore, S. J., Oakley, D. A., & Frith, C. D. (2003). Delusions of alien control in the normal brain. *Neuropsychologia, 41*(8), 1058-1067.

Botvinick, M., Nystrom, L. E., Fissell, K., Carter, C. S., & Cohen, J. D. (1999). Conflict monitoring versus selection-for-action in anterior cingulate cortex. *Nature, 402*(6758), 179-181.

Brewer, J. A., Worhunsky, P. D., Gray, J. R., Tang, Y. Y., Weber, J., & Kober, H. (2011). Meditation experience is associated with differences in default mode network activity and connectivity. *Proceedings of the National Academy of Sciences of the United States of America, 108*(50), 20254-20259.

Brewin, C. R., Gregory, J. D., Lipton, M., & Burgess, N. (2010). Intrusive images in psychological disorders: Characteristics, neural mechanisms, and treatment implications. *Psychological Review, 117*(1), 210-232. doi: 10.1037/a0018113

Bryant, R. A., & Mallard, D. (2005). Reality monitoring in hypnosis: A real-simulating analysis. *International Journal of Clinical and Experimental Hypnosis, 53*(1), 13-25. doi: 10.1080/00207140490914216

Buckner, R. L., Andrews-Hanna, J. R., & Schacter, D. L. (2008). The brain's default network: Anatomy, function, and relevance to disease. *Annals of the New York Academy of Sciences, 1124*, 1-38.

Campbell, N. K., Blinderman, I. M., Lifshitz, M., & Raz, A. (2012). Converging evidence for de-automatization as a function of suggestion. *Consciousness and Cognition, 21*(3), 1579-1581.

Campbell, N. K., & Raz, A. (2012). Subsidiary analysis of different Stroop-embedded negative priming trials. *Consciousness and Cognition, 21*(3), 1586-1590.

Cardeña, E. (2014). Hypnos and psyche: How hypnosis has contributed to the study of conciousness. *Psychology of Consciousness: Theory, Research, and Practice, 1*(2), 123.

Champigny, C. M., & Raz, A. (2014). *Transcultural factors in hypnotizability scales: Limits and prospects.* (Unpublished Master's dissertation), McGill University, Montreal, Canada.

Choy, Y., Fyer, A. J., & Lipsitz, J. D. (2007). Treatment of specific phobia in adults. *Clinical Psychology Review, 27*(3), 266-286.

Cohen, M. D., & Bacdayan, P. (1994). Organizational routines are stored as procedural memory: Evidence from a laboratory study. *Organization Science, 5*(4), 554-568.

Crawford, H. J., & Barabasz, A. F. (1993). Phobias and intense fears: Facilitating their treatment with hypnosis. In J. W. Rhue, S. J. Lynn & I. Kirsch (Eds.), *Handbook of clinical hypnosis*. Washington, DC: American Psychological Association

D'Angelo, M. C., Milliken, B., Jimenez, L., & Lupianez, J. (2013). Implementing flexibility in automaticity: Evidence from context-specific implicit sequence learning. *Consciousness and Cognition, 22*(1), 64-81.

De Jong, R., Liang, C. C., & Lauber, E. (1994). Conditional and unconditional automaticity: A dual-process model of effects of spatial stimulus-response correspondence. *Journal of Experimental Psychology-Human Perception and Performance, 20*(4), 731-750.

Deeley, Q., Oakley, D. A., Toone, B., Giampietro, V., Brammer, M. J., Williams, S. C. R., & Halligan, P. W. (2012). Modulating the default mode network using hypnosis. *International Journal of Clinical and Experimental Hypnosis, 60*(2), 206-228.

Deikman, A. (1966). Deautomatization and the mystic experience. *Psychiatry, 29*(4), 325-338.

Del Casale, A., Ferracuti, S., Rapinesi, C., Serata, D., Sani, G., Savoja, V., . . . Girardi, P. (2012). Neurocognition under hypnosis: Findings from recent functional neuroimaging studies. *International Journal of Clinical and Experimental Hypnosis, 60*(3), 286-317.

Dennett, D. C. (1984). *Elbow room: The varieties of free will worth wanting*. Cambridge, MA: MIT Press.

Derbyshire, S. W., Whalley, M. G., & Oakley, D. A. (2009). Fibromyalgia pain and its modulation by hypnotic and non-hypnotic suggestion:Aan fMRI analysis. *European Journal of Pain, 13*(5), 542-550.

Derbyshire, S. W., Whalley, M. G., Stenger, V. A., & Oakley, D. A. (2004). Cerebral activation during hypnotically induced and imagined pain. *Neuroimage, 23*(1), 392-401.

Dery, C., Campbell, N. K., Lifshitz, M., & Raz, A. (2014). Suggestion overrides automatic audiovisual integration. *Consciousness and Cognition, 24*, 33-37.

Dixon, N. F. (1971). *Subliminal perception: The nature of a controversy*. London: McGraw-Hill.

Doehrman, S., Landau, R., & O'Connell, D. (1978). The Stroop phenomenon: Perceptual conflict or response competition? *Perceptual and Motor Skills, 47*(3 Pt 2), 1127-1131.

Dowsett, S. M., & Livesey, D. J. (2000). The development of inhibitory control: Effects of "executive skills" training. *Developmental Psychology, 36*(2), 161-174.

Elliot, A. J., Maier, M. A., Moller, A. C., Friedman, R., & Meinhardt, J. (2007). Color and psychological functioning: The effect of red on performance attainment. *Journal of Experimental Psychology-General, 136*(1), 154-168.

Elliot, A. J., Shell, M. M., Henry, K. B., & Maier, M. A. (2005). Achievement goals, performance contingencies, and performance attainment: An experimental test. *Journal of Educational Psychology, 97*(4), 630-640.

Eriksen, B. A., & Eriksen, C. W. (1974). Effects of noise letters upon identification of a target letter in a nonsearch task. *Perception and Psychophysics, 16*(1), 143-149.

Evans, J. S. B. T. (2009). How many dual-process theories do we need? One, two, or many? In J. S. B. T. Evans & K. Frankish (Eds.), *In two minds: Dual processes and beyond* (pp. 33-54). New York, NY: Oxford University Press

Evans, J. S. B. T., & Frankish, K. (Eds.). (2009). *In two minds: Dual processes and beyond*. New York, NY: Oxford University Press.

Evans, J. S. B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science, 8*(3), 223-241.

Fan, J., Xu, P. F., Van Dam, N. T., Eilam-Stock, T., Gu, X. S., Luo, Y. J., & Hof, P. R. (2012). Spontaneous brain activity relates to autonomic arousal. *Journal of Neuroscience, 32*(33), 11176-11186.

Fields, H. L., & Price, D. D. (1999). Towards a neurobiology of placebo analgesia. In A. Harrington (Ed.), *The placebo effect: An interdisciplinary exploration* (pp. 93-116). Cambridge, MA: Harvard University Press

Ganor-Stern, D., Tzelgov, J., & Meiran, N. (2013). How are automatic processes elicited by intended actions? *Frontiers in Psychology, 4*.
Ghazanfar, A. A., & Logothetis, N. K. (2003). Neuroperception: Facial expressions linked to monkey calls. *Nature, 423*(6943), 937-938.
Goldfarb, L., Aisenberg, D., & Henik, A. (2011). Think the thought, walk the walk: Social priming reduces the Stroop effect. *Cognition, 118*(2), 193-200.
Gotlib, I. H., & Hamilton, J. P. (2008). Neuroimaging and depression: Current status and unresolved issues. *Current Directions in Psychological Science, 17*(2), 159-163.
Grumm, M., Erbe, K., von Collani, G., & Nestler, S. (2008). Automatic processing of pain: The change of implicit pain associations after psychotherapy. *Behaviour Research and Therapy, 46*(6), 701-714.
Guerrieri, R., Nederkoorn, C., & Jansen, A. (2012). Disinhibition is easier learned than inhibition. The effects of (dis)inhibition training on food intake. *Appetite, 59*(1), 96-99.
Haidt, J. (2007). The new synthesis in moral psychology. *Science, 316*(5827), 998-1002.
Halligan, P. W., Athwal, B. S., Oakley, D. A., & Frackowiak, R. S. (2000). Imaging hypnotic paralysis: Implications for conversion hysteria. *Lancet, 355*(9208), 986-987.
Halligan, P. W., & Oakley, D. A. (2014). Hypnosis and beyond: Exploring the broader domain of suggestion. *Psychology of Consciousness: Theory, Research, and Practice, 1*(2), 105-122.
Harvey, M. A., & Sipprelle, C. N. (1978). Color-blindness, perceptual interference, and hypnosis. *American Journal of Clinical Hypnosis, 20*(3), 189-193.
Hasenkamp, W., & Barsalou, L. W. (2012). Effects of meditation experience on functional connectivity of distributed brain networks. *Frontiers in Human Neuroscience, 6*, 38.
Hasenkamp, W., Wilson-Mendenhall, C. D., Duncan, E., & Barsalou, L. W. (2012). Mind wandering and attention during focused meditation: A fine-grained temporal analysis of fluctuating cognitive states. *Neuroimage, 59*(1), 750-760.
Hasher, L., & Zacks, R. T. (1979). Automatic and effortful processes in memory. *Journal of Experimental Psychology-General, 108*(3), 356-388.
Hassin, R. R., Bargh, J. A., & Zimerman, S. (2009). Automatic and flexible: The case of non-conscious goal pursuit. *Social Cognition, 27*(1), 20-36.
Heap, M., Brown, R. J., & Oakley, D. A. (2004). Introduction. In M. Heap, R. J. Brown & D. A. Oakley (Eds.), *The highly hypnotizable person: Theoretical, experimental, and clinical issues* (pp. 1-4). New York, NY: Brunner-Routledge
Hikosaka, O., & Isoda, M. (2010). Switching from automatic to controlled behavior: Cortico-basal ganglia mechanisms. *Trends in Cognitive Sciences, 14*(4), 154-161.
Hoeft, F., Gabrieli, J. D., Whitfield-Gabrieli, S., Haas, B. W., Bammer, R., Menon, V., & Spiegel, D. (2012). Functional brain basis of hypnotizability. *Archives of General Psychiatry, 69*(10), 1064-1072.
Hofbauer, R. K., Rainville, P., Duncan, G. H., & Bushnell, M. C. (2001). Cortical representation of the sensory dimension of pain. *Journal of Neurophysiology, 86*(1), 402-411.
Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems perspective. *Perspectives on Psychological Science, 4*(2), 162-176.
Hofmann, W., Schmeichel, B. J., & Baddeley, A. D. (2012). Executive functions and self-regulation. *Trends in Cognitive Sciences, 16*(3), 174-180.
Hommel, B. (2011). The Simon effect as tool and heuristic. *Acta Psychol (Amst), 136*(2), 189-202.

Houben, K., & Jansen, A. (2011). Training inhibitory control: A recipe for resisting sweet temptations. *Appetite, 56*(2), 345-349

Houben, K., Wiers, R. W., & Jansen, A. (2011). Getting a grip on drinking behavior: Training working memory to reduce alcohol abuse. *Psychological Science, 22*(7), 968-975.

Huber, A., Lui, F., Duzzi, D., Pagnoni, G., & Porro, C. A. (2014). Structural and functional cerebral correlates of hypnotic suggestibility. *PLoS One, 9*(3), e93187.

Iani, C., Ricci, F., Baroni, G., & Rubichi, S. (2009). Attention control and susceptibility to hypnosis. *Consciousness and Cognition, 18*(4), 856-863.

Iani, C., Ricci, F., Gherri, E., & Rubichi, S. (2006). Hypnotic suggestion modulates cognitive conflict: The case of the flanker compatibility effect. *Psychological Science, 17*(8), 721-727.

Ingram, R. E. (1984). Toward an information-processing analysis of depression. *Cognitive Therapy and Research, 8*(5), 443-477.

Ingram, R. E. (1989). Unique and shared cognitive-factors in social anxiety and depression: Automatic thinking and self-appraisal. *Journal of Social and Clinical Psychology, 8*(2), 198-208.

Isoda, M., & Hikosaka, O. (2011). Cortico-basal ganglia mechanisms for overcoming innate, habitual and motivational behaviors. *European Journal of Neuroscience, 33*(11), 2058-2069.

Jain, S., Shapiro, S. L., Swanick, S., Roesch, S. C., Mills, P. J., Bell, I., & Schwartz, G. E. (2007). A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. *Annals of Behavioral Medicine, 33*(1), 11-21.

Jamieson, G. A., & Woody, E. Z. (2007). Dissociated control as a paradigm for cognitive neuroscience research and theorizing in hypnosis. In G. A. Jamieson (Ed.), *Hypnosis and conscious states: The cognitive neuroscience perspective* (pp. 111-132). New York, NY: Oxford University Press

Jensen, M. P., & Patterson, D. R. (2006). Hypnotic treatment of chronic pain. *Journal of Behavioral Medicine, 29*(1), 95-124. doi:

Jensen, M. P., & Patterson, D. R. (2014). Hypnotic approaches for chronic pain management: Clinical implications of recent research findings. *American Psychologist, 69*(2), 167-177.

Joormann, J., & Gotlib, I. H. (2008). Updating the contents of working memory in depression: Interference from irrelevant negative material. *Journal of Abnormal Psychology, 117*(1), 182-192.

Kahneman, D. (1973). *Attention and effort*. Englewood Cliffs, NJ: Prentice-Hall.

Kahneman, D. (2011). *Thinking, fast and slow*. New York, NY: Farrar, Straus and Giroux.

Kahneman, D., & Chajczyk, D. (1983). Tests of the automaticity of reading: Dilution of Stroop effects by color-irrelevant stimuli. *Journal of Experimental Psychology-Human Perception and Performance, 9*(4), 497-509.

Kallio, S., & Revonsuo, A. (2003). Hypnotic phenomena and altered states of consciousness: A multilevel framework of description and explanation. *Contemporary Hypnosis, 20*(3), 111-164.

Kaptchuk, T. J. (2002). The placebo effect in alternative medicine: Can the performance of a healing ritual have clinical significance? *Annals of Internal Medicine, 136*(11), 817-825.

Kerns, J. G., Cohen, J. D., MacDonald, A. W., 3rd, Cho, R. Y., Stenger, V. A., & Carter, C. S. (2004). Anterior cingulate conflict monitoring and adjustments in control. *Science, 303*(5660), 1023-1026

Kihlstrom, J. F. (1994). One hundred years of hysteria. In S. J. Lynn & J. W. Rhue (Eds.), *Dissociation: Clinical and theoretical perspectives* (pp. 365-394). New York, NY: Guilford Press

Kihlstrom, J. F. (1997). Hypnosis, memory and amnesia. *Philosophical transactions of the Royal Society of London. Series B, Biological Sciences, 352*(1362), 1727-1732

Kihlstrom, J. F. (2013). Neuro-hypnotism: Prospects for hypnosis and neuroscience. *Cortex, 49*(2), 365-374.

Kihlstrom, J. F. (2014). Hypnosis and cognition. *Psychology of Consciousness: Theory, Research, and Practice, 1*(2), 139-152.

Kirsch, I., & Lynn, S. J. (1995). The altered state of hypnosis: Changes in the theoretical landscape. *American Psychologist, 50*(10), 846-858.

Kirsch, I., Montgomery, G., & Sapirstein, G. (1995). Hypnosis as an adjunct to cognitive-behavioral psychotherapy: A meta-analysis. *Journal of Consulting and Clinical Psychology, 63*(2), 214-220.

Kosslyn, S. M., Thompson, W. L., Costantini-Ferrando, M. F., Alpert, N. M., & Spiegel, D. (2000). Hypnotic visual illusion alters color processing in the brain. *American Journal of Psychiatry, 157*(8), 1279-1284.

Kraft, D. (2013). The place of hypnosis in psychiatry part 5: Treatment of specific phobias--animals and situational subtypes. *Australian Journal of Clinical and Experimental Hypnosis, 40*(2), 88-113.

Kubler, A., Dixon, V., & Garavan, H. (2006). Automaticity and reestablishment of executive control: An fMRI study. *Journal of Cognitive Neuroscience, 18*(8), 1331-1342.

Kushnerenko, E., Teinonen, T., Volein, A., & Csibra, G. (2008). Electrophysiological evidence of illusory audiovisual speech percept in human infants. *Proceedings of the National Academy of Sciences of the United States of America, 105*(32), 11442-11445.

Landry, M., Appourchaux, K., & Raz, A. (2014). Elucidating unconscious processing with instrumental hypnosis. *Frontiers in Psychology, 5*, 785.

Landry, M., & Raz, A. (2015). Hypnosis and imaging of the living human brain. *American Journal of Clinical Hypnosis, 57*(1-29).

Laurence, J. R., Beaulieu-Prévost, D., & Du Chéné, T. (2008). Measuring and understanding individual differences in hypnotizability. In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of hypnosis: Theory, research and practice*. New York, NY: Oxford University Press

Lazar, S. W., Bush, G., Gollub, R. L., Fricchione, G. L., Khalsa, G., & Benson, H. (2000). Functional brain mapping of the relaxation response and meditation. *Neuroreport, 11*(7), 1581-1585.

Legrain, V., Damme, S. V., Eccleston, C., Davis, K. D., Seminowicz, D. A., & Crombez, G. (2009). A neurocognitive model of attention to pain: Behavioral and neuroimaging evidence. *Pain, 144*(3), 230-232.

Leibowitz, H. W., & Owens, D. A. (1978). New evidence for the intermediate position of relaxed accommodation. *Documenta Ophthalmologica, 46*(1), 133-147.

Levy, B. J., & Anderson, M. C. (2002). Inhibitory processes and the control of memory retrieval. *Trends in Cognitive Sciences, 6*(7), 299-305.
Levy, B. J., & Anderson, M. C. (2008). Individual differences in the suppression of unwanted memories: The executive deficit hypothesis. *Acta Psychologica, 127*(3), 623-635.
Lifshitz, M., Aubert Bonn, N., Fischer, A., Kashem, I. F., & Raz, A. (2013). Using suggestion to modulate automatic processes: From Stroop to McGurk and beyond. *Cortex, 49*(2), 463-473.
Lipari, S., Baglio, F., Griffanti, L., Mendozzi, L., Garegnani, M., Motta, A., . . . Pugnetti, L. (2012). Altered and asymmetric default mode network activity in a "hypnotic virtuoso": An fMRI and EEG study. *Consciousness and Cognition, 21*(1), 393-400.
Logan, G. D. (1985). Skill and automaticity: Relations, implications, and future directions. *Canadian Journal of Psychology, 39*(2), 367-386.
Logan, G. D. (1988). Toward an instance theory of automatization. *Psychological Review, 95*(4), 492-527.
Lorenz, K. (1970). *Studies in animal and human behavior* (Vol. I & II). Cambridge, MA: Harvard University Press.
Lutz, A., Slagter, H. A., Dunne, J. D., & Davidson, R. J. (2008). Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences, 12*(4), 163-169.
Lynn, S. J., Barnes, S., Deming, A., & Accardi, M. (2010). Hypnosis, rumination, and depression: Catalyzing attention and mindfulness-based treatments. *International Journal of Clinical and Experimental Hypnosis, 58*(2), 202-221.
Lynn, S. J., Rhue, J. W., & Weekes, J. R. (1990). Hypnotic involuntariness: A social cognitive analysis. *Psychological Review, 97*(2), 169-184.
Macleod, C. M. (1992). The Stroop task: The gold standard of attentional measures. *Journal of Experimental Psychology-General, 121*(1), 12-14.
Macleod, C. M. (1998). Training on integrated versus separated Stroop tasks: The progression of interference and facilitation. *Memory & Cognition, 26*(2), 201-211.
Mallard, D., & Bryant, R. A. (2006). Hypnotic conflict: A brief report. *International Journal of Clinical and Experimental Hypnosis, 54*(3), 292-302.
Mason, M. F., Norton, M. I., Van Horn, J. D., Wegner, D. M., Grafton, S. T., & Macrae, C. N. (2007). Wandering minds: The default network and stimulus-independent thought. *Science, 315*(5810), 393-395.
Mazzoni, G., Laurence, J. R., & Heap, M. (2014). Hypnosis and memory: Two hundred years of adventures and still going! *Psychology of Consciousness: Theory, Research, and Practice, 1*(2), 153-167.
Mazzoni, G., Rotriquenz, E., Carvalho, C., Vannucci, M., Roberts, K., & Kirsch, I. (2009). Suggested visual hallucinations in and out of hypnosis. *Consciousness and Cognition, 18*(2), 494-499.
McGeown, W. J., Mazzoni, G., Venneri, A., & Kirsch, I. (2009). Hypnotic induction decreases anterior default mode activity. *Consciousness and Cognition, 18*(4), 848-855.
McGeown, W. J., Venneri, A., Kirsch, I., Nocetti, L., Roberts, K., Foan, L., & Mazzoni, G. (2012). Suggested visual hallucination without hypnosis enhances activity in visual areas of the brain. *Consciousness and Cognition, 21*(1), 100-116.
McGurk, H., & MacDonald, J. (1976). Hearing lips and seeing voices. *Nature, 264*(5588), 746-748.

McVay, J. C., & Kane, M. J. (2010). Does mind wandering reflect executive function or executive failure? Comment on Smallwood and Schooler (2006) and Watkins (2008). *Psychological Bulletin, 136*(2), 188-197.
Michael, R. B., Garry, M., & Kirsch, I. (2012). Suggestion, cognition, and behavior. *Current Directions in Psychological Science, 21*(3), 151-156.
Mineka, S., & Öhman, A. (2002). Phobias and preparedness: The selective, automatic, and encapsulated nature of fear. *Biological Psychiatry, 52*(10), 927-937.
Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "Frontal Lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*(1), 49-100.
Moerman, D. E., & Jonas, W. B. (2002). Deconstructing the placebo effect and finding the meaning response. *Annals of Internal Medicine, 136*(6), 471-476.
Mooneyham, B. W., & Schooler, J. W. (2013). The costs and benefits of mind-wandering: A review. *Canadian Journal of Experimental Psychology, 67*(1), 11-18.
Moore, M., & Tasso, A. T. (2008). Clinical hypnosis: The empirical evidence. In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of hypnosis: Theory, research, and practice*. Oxford: Oxford University Press
Moors, A., & De Houwer, J. (2006). Automaticity: A theoretical and conceptual analysis. *Psychological Bulletin, 132*(2), 297-326.
Mrazek, M. D., Smallwood, J., & Schooler, J. W. (2012). Mindfulness and mind-wandering: Finding convergence through opposing constructs. *Emotion, 12*(3), 442-448
Nash, M. R., & Barnier, A. J. (2008). *The Oxford handbook of hypnosis: Theory, research, and practice*. Oxford: Oxford University Press.
Nee, D. E., Brown, J. W., Askren, M. K., Berman, M. G., Demiralp, E., Krawitz, A., & Jonides, J. (2013). A meta-analysis of executive components of working memory. *Cerebral Cortex, 23*(2), 264-282.
Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology, 100*(4), 569-582.
Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*(3), 504-511.
Nolen-Hoeksema, S., Morrow, J., & Fredrickson, B. L. (1993). Response styles and the duration of episodes of depressed mood. *Journal of Abnormal Psychology, 102*(1), 20-28.
Oakley, D. A. (2008). Hypnosis, trance and suggestion: Evidence from neuroimaging. In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of hypnosis: Theory, research, and practice* (pp. 365-392). Oxford: Oxford University Press
Oakley, D. A., & Halligan, P. W. (2009). Hypnotic suggestion and cognitive neuroscience. *Trends in Cognitive Sciences, 13*(6), 264-270.
Oakley, D. A., & Halligan, P. W. (2011). Using hypnosis to gain insights into healthy and pathological cognitive functioning. *Consciousness and Cognition, 20*(2), 328-331.
Oakley, D. A., & Halligan, P. W. (2013). Hypnotic suggestion: Opportunities for cognitive neuroscience. *Nature Reviews Neuroscience, 14*(8), 565-576.
Öhman, A., & Soares, J. J. (1993). On the automatic nature of phobic fear: Conditioned electrodermal responses to masked fear-relevant stimuli. *Journal of Abnormal Psychology, 102*(1), 121-132.
Paelecke-Habermann, Y., Pohl, J., & Leplow, B. (2005). Attention and executive functions in remitted major depression patients. *Journal of Affective Disorders, 89*(1-3), 125-135

Parris, B. A., & Dienes, Z. (2013). Hypnotic suggestibility predicts the magnitude of the imaginative word blindness suggestion effect in a non-hypnotic context. *Consciousness and Cognition, 22*(3), 868-874.
Patterson, D. R., & Jensen, M. P. (2003). Hypnosis and clinical pain. *Psychological Bulletin, 129*(4), 495-521.
Petrides, M. (2005). Lateral prefrontal cortex: Architectonic and functional organization. *Philosophical Transactions of the Royal Society B-Biological Sciences, 360*(1456), 781-795.
Petty, R. E., Fazio, R. H., & Briñol, P. (2012). *Attitudes: Insights from the new implicit measures*. New York, NY: Psychology Press.
Piccione, C., Hilgard, E. R., & Zimbardo, P. G. (1989). On the degree of stability of measured hypnotizability over a 25-year period. *Journal of Personality and Social Psychology, 56*(2), 289-295.
Plassmann, H., O'Doherty, J., Shiv, B., & Rangel, A. (2008). Marketing actions can modulate neural representations of experienced pleasantness. *Proceedings of the National Academy of Sciences of the United States of America, 105*(3), 1050-1054.
Ploghaus, A., Becerra, L., Borras, C., & Borsook, D. (2003). Neural circuitry underlying pain modulation: Expectation, hypnosis, placebo. *Trends in Cognitive Sciences, 7*(5), 197-200.
Polito, V., Barnier, A., Woody, E., & Connors, M. H. (2014). Measuring agency change across the domain of hypnosis. *Psychology of Consciousness: Theory, Research, and Practice, 1*(1), 3-19.
Posner, M. I., & Fan, J. (2008). Attention as an organ system. In J. R. Pomerantz (Ed.), *Topics in integrative neuroscience: From cells to cognition* (pp. 31-61). New York: Cambridge University Press
Posner, M. I., & Snyder, C. R. (1975a). Attention and cognitive control. In R. L. Solso (Ed.), *Information processing and cognition: The Loyola symposium* (pp. 55-85). Hillsdale, NJ: Erlbaum
Posner, M. I., & Snyder, C. R. (1975b). Facilitation and inhibition in the processing of signals. In P. M. A. Rabbitt & S. Dornic (Eds.), *Attention and performance V* (pp. 669-681): Academic Press
Raij, T. T., Numminen, J., Narvanen, S., Hiltunen, J., & Hari, R. (2005). Brain correlates of subjective reality of physically and psychologically induced pain. *Proceedings of the National Academy of Sciences of the United States of America, 102*(6), 2147-2151.
Raij, T. T., Numminen, J., Narvanen, S., Hiltunen, J., & Hari, R. (2009). Strength of prefrontal activation predicts intensity of suggestion-induced pain. *Human Brain Mapping, 30*(9), 2890-2897.
Ray, W. J., & Tucker, D. M. (2003). Evolutionary approaches to understanding the hypnotic experience. *International Journal of Clinical and Experimental Hypnosis, 51*(3), 256-281.
Raz, A. (2011). Hypnosis: A twilight zone of the top-down variety. *Trends in Cognitive Sciences, 15*(12), 555-557.
Raz, A., & Campbell, N. K. J. (2011). Can suggestion obviate reading? Supplementing primary Stroop evidence with exploratory negative priming analyses. *Consciousness and Cognition, 20*(2), 312-320.

Raz, A., Fan, J., & Posner, M. I. (2005). Hypnotic suggestion reduces conflict in the human brain. *Proceedings of the National Academy of Sciences of the United States of America, 102*(28), 9978-9983. doi: 10.1073/Pnas.0503064102

Raz, A., Keller, S., Norman, K., & Senechal, D. (2007). Elucidating Tourette's Syndrome: Perspectives from hypnosis, attention and self-regulation. *American Journal of Clinical Hypnosis, 49*(4), 289-309.

Raz, A., Kirsch, I., Pollard, J., & Nitkin-Kaner, Y. (2006). Suggestion reduces the Stroop effect. *Psychological Science, 17*(2), 91-95.

Raz, A., Landzberg, K. S., Schweizer, H. R., Zephrani, Z. R., Shapiro, T., Fan, J., & Posner, M. I. (2003). Posthypnotic suggestion and the modulation of Stroop interference under cycloplegia. *Consciousness and Cognition, 12*(3), 332-346.

Raz, A., Shapiro, T., Fan, J., & Posner, M. I. (2002). Hypnotic suggestion and the modulation of Stroop interference. *Archives of General Psychiatry, 59*(12), 1155-1161.

Roder, C. H., Michal, M., Overbeck, G., van de Ven, V. G., & Linden, D. E. (2007). Pain response in depersonalization: A functional imaging study using hypnosis in healthy subjects. *Psychotherapy and Psychosomatics, 76*(2), 115-121.

Rolls, E. T., & Grabenhorst, F. (2008). The orbitofrontal cortex and beyond: From affect to decision-making. *Progress in Neurobiology, 86*(3), 216-244.

Rueda, M. R., Checa, P., & Combita, L. M. (2012). Enhanced efficiency of the executive attention network after training in preschool children: Immediate changes and effects after two months (vol 2, pg s192, 2012). *Developmental Cognitive Neuroscience, 2*(2), 291-291.

Schneider, W., & Chein, J. M. (2003). Controlled & automatic processing: Behavior, theory, and biological mechanisms. *Cognitive Science, 27*(3), 525-559.

Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological Review, 84*(1), 1-66.

Sheehan, P. W., Donovan, P., & MacLeod, C. M. (1988). Strategy manipulation and the Stroop effect in hypnosis. *Journal of Abnormal Psychology, 97*(4), 455-460.

Shenhav, A., Botvinick, M. M., & Cohen, J. D. (2013). The expected value of control: An integrative theory of anterior cingulate cortex function. *Neuron, 79*(2), 217-240.

Shipherd, J. C., & Beck, J. G. (2005). The role of thought suppression in posttraumatic stress disorder. *Behavior Therapy, 36*(3), 277-287.

Simmons, A., Strigo, I., Matthews, S. C., Paulus, M. P., & Stein, M. B. (2006). Anticipation of aversive visual stimuli is associated with increased insula activation in anxiety-prone subjects. *Biological Psychiatry, 60*(4), 402-409.

Simon, J. R. (1969). Reactions toward the source of stimulation. *Journal of Experimental Psychology, 81*(1), 174-176.

Smallwood, J., & Schooler, J. W. (2006). The restless mind. *Psychological Bulletin, 132*(6), 946-958.

Solomon, S. S., & King, J. G. (1995). Influence of color on fire vehicle accidents. *Journal of Safety Research, 26*(1), 41-48.

Spiegel, D. (2013). Tranceformations: Hypnosis in brain and body. *Depression and Anxiety, 30*(4), 342-352.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*(6), 643-662.

Stuss, D. T., & Alexander, M. P. (2000). Executive functions and the frontal lobes: A conceptual view. *Psychological Research, 63*(3-4), 289-298.
Summerfield, Q., & McGrath, M. (1984). Detection and resolution of audio-visual incompatibility in the perception of vowels. *The Quarterly Journal of Experimental Psychology, 36*(1), 51-74.
Szechtman, H., Woody, E., Bowers, K. S., & Nahmias, C. (1998). Where the imaginal appears real: A positron emission tomography study of auditory hallucinations. *Proceedings of the National Academy of Sciences of the United States of America, 95*(4), 1956-1960.
Tanaka, A., & Tokuno, Y. (2011). The effect of the color red on avoidance motivation. *Social Behavior and Personality, 39*(2), 287-288.
Tang, Y. Y., Lu, Q., Fan, M., Yang, Y., & Posner, M. I. (2012). Mechanisms of white matter changes induced by meditation. *Proceedings of the National Academy of Sciences of the United States of America, 109*(26), 10570-10574.
Tang, Y. Y., Lu, Q., Geng, X., Stein, E. A., Yang, Y., & Posner, M. I. (2010). Short-term meditation induces white matter changes in the anterior cingulate. *Proceedings of the National Academy of Sciences of the United States of America, 107*(35), 15649-15652.
Tang, Y. Y., Ma, Y. H., Fan, Y. X., Feng, H. B., Wang, J. H., Feng, S. G., . . . Fan, M. (2009). Central and autonomic nervous system interaction is altered by short-term meditation. *Proceedings of the National Academy of Sciences of the United States of America, 106*(22), 8865-8870.
Tang, Y. Y., & Posner, M. I. (2009). Attention training and attention state training. *Trends in Cognitive Sciences, 13*(5), 222-227.
Tang, Y. Y., Posner, M. I., & Rothbart, M. K. (2014). Meditation improves self-regulation over the life span. *Annals of the New York Academy of Sciences, 1307*, 104-111.
Taylor, V. A., Daneault, V., Grant, J., Scavone, G., Breton, E., Roffe-Vidal, S., . . . Beauregard, M. (2012). Impact of meditation training on the default mode network during a restful state. *Social Cognitive and Affective Neuroscience, 8*(1), 4-14.
Teachman, B. A., Joormann, J., Steinman, S. A., & Gotlib, I. H. (2012). Automaticity in anxiety disorders and major depressive disorder. *Clinical Psychology Review, 32*(6), 575-603.
Teper, R., & Inzlicht, M. (2013). Meditation, mindfulness and executive control: The importance of emotional acceptance and brain-based performance monitoring. *Social Cognitive and Affective Neuroscience, 8*(1), 85-92.
Terhune, D. B., Cardeña, E., & Lindgren, M. (2011a). Dissociated control as a signature of typological variability in high hypnotic suggestibility. *Consciousness and Cognition, 20*(3), 727-736.
Terhune, D. B., Cardeña, E., & Lindgren, M. (2011b). Dissociative tendencies and individual differences in high hypnotic suggestibility. *Cognitive Neuropsychiatry, 16*(2), 113-135.
Todorov, A., Pakrashi, M., & Oosterhof, N. N. (2009). Evaluating faces on trustworthiness after minimal time exposure. *Social Cognition, 27*(6), 813-833.
Traquair, H. M. (1949). *An introduction to clinical perimetry* (6th ed.). St. Louis: The C.V. Mosby Company.
Wagstaff, G. F. (2004). High hypnotizability in a sociocognitive framework. In M. Heap, R. J. Brown & D. A. Oakley (Eds.), *The highly hypnotizable person: Theoretical, experimental, and clinical issues* (pp. 85-114). New York, NY: Brunner-Routledge
Wagstaff, G. F. (2014). On the centrality of the concept of an altered state to definitions of hypnosis. *Journal of Mind-Body Regulation, 2*(2), 90-108.

Wallis, J. D. (2007). Orbitofrontal cortex and its contribution to decision-making. *Annual Review of Neuroscience, 30*, 31-56.

Wenzlaff, R. M., & Wegner, D. M. (2000). Thought suppression. *Annual Review of Psychology, 51*, 59-91.

Whitfield-Gabrieli, S., Moran, J. M., Nieto-Castanon, A., Triantafyllou, C., Saxe, R., & Gabrieli, J. D. E. (2011). Associations and dissociations between default and self-reference networks in the human brain. *Neuroimage, 55*(1), 225-232.

Wiech, K., Ploner, M., & Tracey, I. (2008). Neurocognitive aspects of pain perception. *Trends in Cognitive Sciences, 12*(8), 306-313.

Wilkinson, M. R., & Ball, L. J. (2010). *Dual processes in mental state understanding: Is theorising synonymous with intuitive thinking and is simulation synonymous with reflective thinking?* Paper presented at the 35th Annual Meeting of the Cognitive Science Society, Humboldt University.

Wolitzky-Taylor, K. B., Horowitz, J. D., Powers, M. B., & Telch, M. J. (2008). Psychological approaches in the treatment of specific phobias: A meta-analysis. *Clinical Psychology Review, 28*(6), 1021-1037.

Woody, E. Z., & Barnier, A. J. (2012). Hypnosis scales for the twenty-first century: What do we need and how should we use them? In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of hypnosis: Theory, research, and practice* (pp. 255-282). Oxford: Oxford University Press

Woody, E. Z., & Farvolden, P. (1998). Dissociation in hypnosis and frontal executive function. *American Journal of Clinical Hypnosis, 40*(3), 206-216.

Woody, E. Z., & Sadler, P. (2008). Dissociation theories of hypnosis. In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of hypnosis: Theory, research, and practice* (Vol. 81-110). Oxford: Oxford University Press

Yapko, M. D. (1992). *Hypnosis and the treatment of depressions: Strategies for change*. New York: Brunnel/Mazel.

Connecting Text: Manuscript 1 to Manuscript 2

The concept of automaticity pervades nearly all psychological domains. Thirty years ago, researchers began hypothesizing that basic social-perceptual processes, such as impression formation and stereotyping, involve efficient and unintentional components (Bargh, 1989). Today, cognitive psychologists consider automaticity a crucial staple in explaining and predicting most psychological phenomena (Bargh, Schwader, Hailey, Dyer, & Boothby, 2012). In the next phase of research, we must take advantage of top-down strategies to investigate the malleability of automatic processes in healthy and pathological functioning.

In Manuscript 1, we recalled how early theorists proposed that controlled processes became automatic through extensive practice, starting out as conscious and effortful and becoming efficient and involuntary (Schneider & Shiffrin, 1977). However, we now recognize that skill acquisition does not constitute the only mechanism of automatization (Bargh et al., 2012). People acquire and embody beliefs and expectations that are capable of exerting a non-conscious influence on higher-order mental processes. These innate cognitions that we possess about ourselves and the world around us substantially influence how we react to individuals, objects, and events.

As discussed in Manuscript 1, regaining control over maladaptive and automatic cognitions represents a particularly important implication for the field of health psychology. Manuscript 2 applies this notion to patients with chronic spontaneous urticaria, a dermatological condition with an unknown aetiology. We posit that psychosocial factors, such as personality traits, emotional stress, and coping style, can adversely impact symptomatology and quality of life. In the subsequent manuscript, we investigate whether overcoming maladaptive and reflexive thought processes through cognitive restructuring and hypnosis benefits this clinical population.

References

Bargh, J. A. (1989). Conditional automaticity: Varieties of automatic influence in social perception and cognition. In J. A. Bargh & J. S. Uleman (Eds.), *Unintended thought* (pp. 3-51). New York, NY: Guildford Press

Bargh, J. A., Schwader, K. L., Hailey, S. E., Dyer, R. L., & Boothby, E. J. (2012). Automaticity in social-cognitive processes. *Trends in Cognitive Sciences, 16*(12), 593-605.

Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological Review, 84*(1), 1-66.

Manuscript 2

Using psychosocial factors to mediate chronic hives:

A preliminary report

Rebecca Oksenhendler[a], Moshe Ben-Shoshan[b], & Amir Raz[a,c]

[a] Department of Psychiatry, Faculty of Medicine, McGill University, Montreal, Canada

[b] Department of Paediatrics, McGill University Health Center, Montreal, Canada

[c] Departments of Psychology, Neurology & Neurosurgery at McGill University and the Lady Davis Institute at the SMDB Jewish General Hospital, Montreal, Canada

Abstract

Psychosocial factors may play a critical role in the manifestation of chronic spontaneous urticaria (CSU)—a skin disorder characterized by the spontaneous occurrence of wheals lasting for more than six weeks. Treatment remains unsuccessful or partially successful due to our limited understanding of the biological mechanisms underlying this condition. The disfigurement and common discomfort, when they occur, entail marked psychological burden, including stress and anxiety. Hypnosis and cognitive behavioural therapy (CBT) hold considerable promise for controlling aversive physical and psychological symptoms, with some evidence suggesting that hypnosis and relaxation techniques alleviate urticarial wheals. However, randomized controlled trials that directly compare cognitive intervention to mainstream medicine are needed to establish such claims. In this study, we complement standard-of-care antihistamine treatment with a psychological approach to aid in the relief of individuals diagnosed with CSU. For ten weeks, participants in the treatment group received CBT and hypnosis, while participants in the control group received empathic listening and progressive muscle relaxation. Results indicated that the signs and symptoms, as measured by a daily symptoms diary, did not improve during the study. However, both group demonstrated a significant improvement in quality of life. Quality of life serves as an important measure when assessing CSU in individuals. It is possible that a long-term follow-up may reveal differences in quality of life impairment as participants in the treatment group implement the CBT and self-hypnosis strategies learned over the course of the sessions. Altogether, future research with larger samples must replicate these findings in order to better understand how psychosocial factors mediate CSU.

Introduction

Chronic spontaneous urticaria (CSU), a skin disorder characterized by the occurrence of daily wheals lasting for at least six weeks, sometimes with angioedema, remains a major problem in terms of aetiology, investigation, and management (Ortonne, 2011; Zuberbier et al., 2009). Recent findings suggest that psychosocial factors may play a critical role in the manifestation of CSU (Ben-Shoshan, Clarke, & Raz, 2012). The disfigurement and discomfort of wheals, when present, can lead to marked psychological burden with major detrimental effects on quality of life. Moreover, CSU can adversely affect performance at work, school, and in private life. In an attempt to relieve their symptoms, individuals with CSU often request multiple appointments with different allergists and visit the hospital more often than other allergy patients. Unfortunately, physicians offer limited management by way of symptomatology and have little to offer by way of treatment. The present study complements standard-of-care treatment with an adjunctive psychological approach to promote symptom relief and enhance quality of life for CSU patients.

Prevalence and disease burden

CSU, also known as chronic hives, is a common and debilitating allergic condition that affects 0.5-1% of the population (Zuberbier et al., 2009). Although all age groups can develop CSU, the peak incidence occurs between 20 to 40 years of age (Maurer et al., 2011). In 30-55% of cases, CSU will resolve naturally within five years but can persist for ten years or more (Kozel & Sabroe, 2004).

Although many physicians may consider the non-life-threatening symptoms of CSU as relatively mild, they can pose a long-term hardship for patients and their families. Moreover, the idiopathic aetiology of the condition presents an ongoing challenge for the treating clinician. Due

to the unclear pathogenesis of and tenuously effective treatment for CSU, individuals will often seek multiple consultations with different allergists, dermatologists, and other clinicians (Ben-Shoshan et al., 2012). This trend introduces a prolonged financial and resource burden to the healthcare system, while considerably decreasing the quality of life for CSU patients (Ferrer, 2009).

In general, patients with unexplained physical symptoms tend to have a higher burden of disease and use a considerable amount of healthcare resources (Zonneveld, Sprangers, Kooiman, van't Spijker, & Busschbach, 2013). Though urticaria constitutes the fourth most common allergic condition, urticaria patients visit the emergency department more than patients suffering from more common allergic diseases (54.5% vs. 24.6%; $p < 0.001$; Ferrer, 2009). In Canada, the impact of increased rates of urticaria cases and number of hospital visits is particularly pervasive compared to other developed countries because the 153 allergists available nationwide are the ones who almost exclusively see and manage these patients. Responding to a Canada-wide survey, allergists and dermatologists reported an incidence per month of 13 and 4 patients, respectively, and a prevalence of 199 and 44 patients, respectively (Sharma, Miller, & Murray, 2000).

Ferrer (2009) report that urticaria has the strongest impact on school performance and causes the highest number of absences from work, compared to other allergic diseases. The percentage of urticaria patients with work absences is significantly higher compared to other allergic conditions (7.7% vs. 5.1%; $p = 0.017$), with an average of 15.52±22.56 missed days. Approximately 56% of working patients miss at least one day of work due to their hives. In addition, 7.4% of adults and children with urticaria miss school with an average of 7.5±18.5 missed days, and 3.3% of children with urticaria also cause their parents to miss work.

Correspondingly, individuals with CSU have significantly lower school performance compared to other allergies diseases ($p = 0.029$). Furthermore, patients suffering from CSU score in the lowest 25th percentile on physical impact and below the 20th percentile on psychological impact relative to the general population.

When taking direct and indirect healthcare-related costs into account, CSU patients consume an annual mean of $2047±1483 USD (Delong, Culler, Saini, Beck, & Chen, 2008). Because this condition is primarily an outpatient disease, medication costs represent 62.5% (i.e., $1280) of the total annual cost, while indirect costs, such as work absences and earnings lost due to travel to outpatient visits, constitute 15.7% ($322) of total costs. Consequently, low-income patients face the highest risk for suboptimal treatment and increased burden due to poor disease management (Zonneveld et al., 2013).

Diagnosis, pathogenesis, and treatment

In addition to its substantial impact on quality of life, performance, and medical costs, CSU poses a challenge in its diagnosis. CSU essentially follows a diagnosis of exclusion when physicians cannot determine any contributing factors as the cause of the cutaneous reaction. Many theories exist to explain the pathogenesis, but an expert consensus has not yet been reached (Saini, 2014).

Clinicians and researchers generally classify urticaria by duration, frequency, and underlying aetiology (Saini, 2014). Spontaneous urticaria is the most common form of urticaria, with up to one in four people presenting with short-lived wheals in their lifetime (Maurer et al., 2011). Symptoms occurring “out of the blue” comprise the key characteristic. Whereas acute spontaneous urticaria lasts for only a few days or weeks, the symptoms will last longer in 10% of patients and will thus be classified as CSU. Individuals diagnosed with CSU fall into at least two

subgroups: those who are truly idiopathic and those with autoimmune chronic urticaria (45% vs. 55%; Kaplan & Greaves, 2009). However, the allergy community generally does not distinguish between these categories because the practical management essentially follows the same strategy (Zuberbier et al., 2009).

One prominent theory proposes that mast cell degranulation and histamine release contribute to the pathogenesis of CSU (Sabroe et al., 1999). Autoimmune chronic urticaria may be caused by circulating immunoglobulin G autoantibodies against immunoglubin E (IgE) or high-affinity IgE receptors, which directly activate mast cells and basophils (Saini, 2014). In an urticarial lesion biopsy, researchers found degranulation of skin mast cells, as well as lymphocytes, eosinophils, neutrophils, and basophils (Saini, 2014). Upon activation, both mast cells and basophils release histamine and other inflammatory mediators, which are capable of causing local vasodilation, itch, and swelling of the skin. Indeed, studies have observed elevated skin histamine in urticarial tissue samples (Claveau, Lavoie, Brunet, Bedard, & Hebert, 1993; Kaplan, Horakova, & Katz, 1978). However, reports have found no mast cell increase in lesion or non-lesion biopsies compared to the skin of healthy controls (Smith, Kepley, Schwartz, & Lee, 1995). Therefore, these augmented histamine levels may reflect an increase in histamine content per mast cell, enhanced mast cell activation, or basophil recruitment, rather than an increased number of mast cells. Accordingly, desloratidine, a third generation H_1-antihistimaine that inhibits human skin mast cell activation and histamine release, serves as first line treatment for CSU (Weller & Maurer, 2009). The pathogenesis of CSU in patients without autoantibodies remains unclear, although studies have found mast cell specific factors in a proportion of these individuals (Sabroe et al., 1999).

With an unknown pathogenesis, causal or curative treatment for CSU is difficult. Second generation non-sedating H_1-antihistamines are the mainstay of symptomatic therapy, but relatively few patients experience effective symptom relief from treatment with recommended doses (Ortonne, 2012; Zuberbier et al., 2009). Although some studies indicate that up-dosing increases the efficiency of these drugs while retaining their favourable safety profiles, recommendations for the use of higher doses is not yet evidence-based (Ortonne, 2011). In addition, clinicians often incorporate sedating antihistamines into the treatment regimen for patients who have difficulty falling and staying asleep due to itching sensations (Yosipovitch, Ansari, Goon, Chan, & Goh, 2002). When antihistamine treatment proves inadequate, physicians may add H_2 blockers, leukotriene receptor antagonists, doxepin (a tricyclic antidepressant with antihistaminergic properties), oral corticosteroids for brief use, or omalizumab to the regimen (Maurer et al., 2013; Schaefer, 2011).

Psychodermatology: A biopsychosocial perspective to CSU

Mental and skin health are intimately related throughout the lifetime, beginning at foetal development as they mature together as part of the ectoderm (Picardi & Abeni, 2001). The skin and central nervous system share many hormones, neurotransmitters, and receptors, which has a profound impact on skin biology (Arck, Slominski, Theoharides, Peters, & Paus, 2006). In addition to serving as the largest sensory organ and providing protection from the external environment, skin plays a key role in socialization processes, responding to emotional stimuli and influencing body image and self-esteem (Picardi & Pasquini, 2007; Rasoulian, Ebrahimi, Zare, & Taherifar, 2010).

Researchers have long observed and described the relationship between skin diseases and emotional distress (Picardi & Abeni, 2001). In the case of CSU, studies have attempted to

identify psychosocial factors that may contribute to its manifestation. Therefore, it may be more useful to model CSU as a psychodermatological disorder with a multifactorial aetiology. In contrast to a traditional biomedical model, this holistic framework critically recognizes the importance of understanding the impact of CSU on quality of life. Notably, quality of life reflects how an individual perceives and reacts to his or her health status and to other non-medical aspects of life, encompassing physical and emotional well-being and satisfaction with social functioning (O'Donnell, Lawlor, Simpson, Morgan, & Greaves, 1997). Indeed, patients generally self-describe their disease not only in terms of symptoms but how it affects their daily functioning, thoughts, feelings, and behaviours (Surdea-Blaga, Baban, & Dumitrascu, 2012). In the case of CSU, patients mainly emphasize how symptoms, the unpredictable nature of the attacks, and the imposed social restrictions adversely limit their activities and psychosocial well-being (O'Donnell et al., 1997). These variables represent important factors that have been under-recognized in previous models of CSU.

Psychosocial factors under the skin. Almost 60 years ago, Rees (1957) uncovered a relationship between stressful life events and the onset of symptoms in 51% of CSU participants, compared to 8% of controls. Since then, numerous studies have replicated this result with varying prevalence rates (e.g., Chung, Symons, Gilliam, & Kaminski, 2010; Engin, Uguz, Yilmaz, Ozdemir, & Mevlitoglu, 2008; Malhotra & Mehta, 2008; Ozkan et al., 2007). For example, one study found that 90% of CSU participants experienced almost three times the number of stressful life situations compared to patients with fungal infections (Fava, Perini, Santonastaso, & Vellerfornasa, 1980). The stressful life events that preceded the onset of the hives ranged from change in school, residence, or type of work, to promotion, marriage, and

birth of a child (Teshima et al., 1982). However, life events in and of themselves are not sufficient to precipitate CSU.

Although stressful life events are associated with the emergence of CSU, stress perception and coping mechanisms are the strongest predictors of psychological well-being and disease activity (Herguner et al., 2011; Weldon, 2014). Indeed, emotional distress can occur regardless of the occurrence of stressful events (Palsson & Drossman, 2005). Various coping strategies can either catalyze or curtail emotional distress based on how they appraise their situation. For example, emotion-focused coping, which includes venting emotions and mental disengagement, represents a maladaptive strategy that facilitates emotional distress (Chung et al., 2010). Problem-based coping, on the other hand, that aims to manage or alter the source of stress can lead to better outcomes.

Personality traits may also mediate the relation between stress and health outcomes. When Uguz, Engin, and Yimaz (2008) recruited 89 CSU patients from a dermatology outpatient clinic, they diagnosed 44 of these participants with at least one Axis I diagnosis and 40 with at least one Axis II diagnosis according to the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition Revised*. Interestingly, obsessive-compulsive disorder (OCD) and obsessive-compulsive personality disorder comprised the primary diagnoses for Axis I and II disorders, respectively. Although no study has yet investigated any relationship between individuals with CSU and personality traits, in general, people diagnosed with these two disorders tend to score higher on the *Revised Neuroticism-Extraversion-Openness Personality Inventory* Neuroticism scale, compared to normative data (Trull, 1992; Wu, Clark, & Watson, 2006). Defined as the tendency to experience negative emotions, neuroticism may adversely influence coping strategies by trying to escape the problem, blaming oneself, and catastrophizing

(Drossman et al., 2000). This plausible prevalence of neuroticism within the CSU population may further contribute to increased distress through two paths. First, people who score higher on neuroticism may experience a greater number of stressful events because they may not be as capable of anticipating or preventing them (Bolger & Schilling, 1991). Second, neuroticism might increase reactivity to stressful events because they cannot cope effectively under stress. This pattern may in part explain the disproportionate rate of stressful life events and levels of perceived stress in CSU patients relative to the general population.

Patients with CSU suffer from psychiatric comorbidity more than the general population and patients with psoriasis or atopic dermatitis (Chung et al., 2010), with prevalence rates ranging from 35 to 65% (Ozkan et al., 2007; Picardi, Abeni, Melchi, Puddu, & Pasquini, 2000; Uguz et al., 2008). Studies have reported anxiety, depression, and somatoform disorders as the most common mental illnesses in individuals with CSU (Pasaoglu, Bavbek, Tugcu, Abadoglu, & Misirligil, 2006; Sheehan-Dare, Henderson, & Cotterill, 1990). Psychiatric comorbidity in the CSU population appears to exert a detrimental impact on quality of life (Staubach et al., 2011). For example, anxiety symptoms may potentiate worse coping, acceptance, and living with CSU (Barbosa, Freitas, & Barbosa, 2011). Although investigators have yet to formulate such a study, it is conceivable that CSU patients diagnosed with depression might engage in more catastrophic thinking and therefore experience more intense symptoms and greater activity limitations (Lackner, Quigley, & Blanchard, 2004). Given that approximately half of CSU patients suffer from at least one psychiatric disorder, interventions focusing on mental health may improve quality of life (Mlynek, Maurer, & Zalewska, 2008).

It is also plausible that psychiatric symptoms may appear in reaction to disfigurement, discomfort, or perceived social stigma. For example, the occurrence of physical symptoms may

lead to a heightened state of emotional tension, thus enhancing anxiety symptoms and feelings of distress due to the unpredictable nature of the symptomatology and its lack of improvement (Barbosa et al., 2011). Furthermore, CSU patients often experience itching at night, which may prevent them from falling and staying asleep. This disruption in their sleep cycle can cause psychiatric symptoms—including irritability, depression, anxiety, and insomnia—to develop (Weldon, 2006; Yang, Sun, Wu, & Wang, 2005). In addition, the presence of wheals can cause an alteration in body image, especially when they appear on visible body parts (Barbosa et al., 2011).

Connecting psychosocial factors to potential physiological mechanisms. Through the bidirectional "brain-skin connection," perceived stress can disrupt the dynamic equilibrium between the nervous, endocrine, and immune systems (Arck & Paus, 2006; Arck et al., 2006). Stress commonly precedes the onset and exacerbation of several dermatological conditions, including CSU. Psychological stress activates the hypothalamic-pituitary-adrenal (HPA) axis, with subsequent upregulation of key stress hormones, including corticotropin-releasing hormone (CRH), adrenocorticotropic hormone (ACTH), cortisol, and prolactin (Arck et al., 2006).

CSU patients exhibit elevated skin levels of the CRH receptor-1 (CRH-1) compared to normal foreskin, breast skin, and cultured human keratinocytes (Papadopoulou, Kalogeromitros, Staurianeas, Tiblalexi, & Theoharides, 2005). Located perivascularly close to sympathetic and sensory nerve endings, human mast cells express CRH-1, thus acting as a target for a number of stress hormones. In addition, mast cells generate CRH to further activate the HPA axis (Arck et al., 2006; Theoharides et al., 1998). Therefore, CSU patients may be especially susceptible to psychological stress.

In sum, CSU represents more than just a cosmetic nuisance and exemplifies the multifactorial aspects of a psychodermatological disorder. A complete understanding of this condition incorporates the interaction between the multitude of biological, psychological, and social factors (Keegan, 1976). Failure to ameliorate psychosocial aspects of CSU may amplify disease severity, undermine treatment efforts, decrease quality of life, and contribute to increased healthcare use in ways comparable to patients suffering from ischemic heart disease (Berrino et al., 2006; O'Donnell et al., 1997; Zachariae, Zachariae, Ibsen, Mortensen, & Wulf, 2004).

Cognitive behavioural therapy and hypnosis as an adjunctive treatment to CSU

Despite over half a century of research investigating the role of mind-body factors in CSU, there has been no systematic trial comparing a suitable psychological intervention with traditional biomedical therapies (Broom, 2010). Given the cyclic influence of cognitive factors and coping strategies on CSU, cognitive behavioural therapy (CBT) that facilitates cognitive restructuring may potentially ameliorate quality of life and curtail CSU symptomology.

Hypnosis may further control CSU-related symptomatology. The hypnotic experience comprises changes in perception and attention, as well as emotional and cognitive alterations (Raz, 2011). Accordingly, individuals under hypnosis report an increase in absorption, focused attention, and reduction in mind-wandering (Oakley & Halligan, 2009). Within the clinic, researchers have capitalized on hypnosis to modify health-risk behaviours such as smoking and over-eating (Elkins & Perfect, 2008), provide pain relief (Patterson, 2010), and treat anxiety and depression (Bryant, 2008; Yapko, 2008). One theory posits that experiencing relief from specific side effects with hypnotic suggestions may modify expectations of those side effects, which in turn may directly reduce the experience of those side effects (Kirsch, 1990). Studies have strongly supported the efficacy of hypnosis in alleviating pain and dermatological conditions,

and more recent findings document the effects of hypnosis in the context of serious dermatological side effects such as skin toxicity in cancer (Benham & Younger, 2008; Patterson, 2010; Schnur et al., 2009).

Evidence suggests that a combination of hypnosis and CBT might be even more helpful compared to each technique on its own. A meta-analysis demonstrated that the average patient receiving CBT with hypnosis benefited more than 75% of clients receiving CBT alone (Kirsch, Montgomery, & Sapirstein, 1995). More recently, however, researchers did not find an additive benefit of using hypnosis as an adjunct to CBT for the treatment of acute-stress disorder (Bryant, Moulds, Guthrie, & Nixon, 2005). In this study, they randomly assigned 87 participants to receive either CBT, CBT with hypnosis, or supportive counselling. Results showed that at the post-treatment assessment and six-month follow-up, participants in both the CBT and CBT-hypnosis group were less likely to meet criteria for post-traumatic stress disorder, compared to the counselling group. The authors suggested that these findings might have occurred as a result of their research design, whereby hypnosis was limited to imaginal exposure that typically reduces re-experiencing symptoms rather than a broader range of symptoms. Future investigations must use hypnosis in a manner that is clearly additive, and not merely repetitive (Moore & Tasso, 2008). Overall, a combined CBT and hypnosis intervention holds considerable promise for controlling aversive physical and psychological symptoms associated with CSU and will likely improve quality of life.

CBT and psychosocial effect. The CBT approach offers a generic framework for understanding a wide range of disorders and problems while also providing effective treatment for a diverse set of populations. CBT aims to improve well-being by identifying the thinking and

belief system associated with psychological disturbances, and critically revising them to be more consistent with desired outcomes and positive life goals (Jackson, Nissenson, & Cloitre, 2009). Although the focus and methods of treatment depend on the complaint or illness, all CBT techniques stem from the same fundamental principle that cognitions play a central role in the development and maintenance of emotional and behavioural responses to life events (González-Prendes & Resko, 2012).

Three key assumptions underscore cognitive-behavioural models of treatment (Dobson & Dozois, 2001). First, individuals always have access to the content of their cognitive processes. Although at times specific thoughts or beliefs may not be present in their immediate awareness, with training and practice individuals can become aware of them. Second, our thinking mediates the way in which we respond to environmental cues. Our emotional and behavioural reactions are not caused by life events; rather, the way in which we interpret our reality is critical to how we react to that reality. Third, we can target, modify, and change these cognitions. Consequently, when someone modifies these cognitions in a rational, realistic, and balanced manner, they will relieve their symptoms and improve their adaptability and functionality.

Studies have investigated the utility of CBT for a range of chronic diseases, with varying results. This approach has proven most successful for rheumatic diseases and oncology, with subsequent improvement in psychosocial variables and clinical indices of disease activity (Sensky, Timberlake, Ryan, & Allard, 2003; Tatrow & Montgomery, 2006). In psoriasis, there is some evidence that suggests that cognitive-behavioural approaches can result in the reduction of psychological distress and in the clinical severity of the condition (Fortune et al., 2002).

CBT is uniquely suited to address the emotional, social, functional, physical, and body image issues associated with CSU. According to a cognitive-behavioural model, psychological,

social, and physiological factors maintain CSU symptoms and distress. Believing that there must be an organic explanation for the pain leads to further medical consultations, increased attention and hypervigilence of bodily sensations, and amplified anxiety, which may in turn lead to a heightened sensitivity to itchiness (Toner et al., 1998). Accordingly, this model highlights that the manner in which a person approaches his or her condition can amplify symptoms and interfere with coping and quality of life. Therefore, effective CBT for CSU patients requires more than teaching them to relax or manage their levels of stress; it must help individuals to examine their subjective appraisal of the current situations and reinterpret events.

Hypnosis and skin symptoms. In the realm of dermatology, hypnosis may help reduce skin pain and itchiness, ameliorate psychosomatic aspects of skin diseases, and accelerate the resolution of certain skin diseases through the mind-body connection (Shenefelt, 2000). This technique serves as an especially useful tool for a range of dermatological conditions with psychosocial components. However, we have yet to understand the mechanisms by which hypnosis produces improvement in symptoms and diseases of the skin (Shenefelt, 2003). For example, hypnosis may help regulate blood flow and other autonomic functions not usually under conscious control, although it seems that it may be more effective in changing the subjective experience rather than the peripheral physiology (Benham & Younger, 2008).

One can find a number of reviews supporting the potential for hypnosis to treat dermatological disorders (Shenefelt, 2000, 2002, 2003, 2008). The literature investigating the effectiveness of hypnosis typically consists of one or a few uncontrolled cases for specific dermatological conditions, such as eczema and pruritus (Shenefelt, 2003). For example, numerous case reports intimate that hypnotherapy can improve atopic dermatitis, a relapsing itchy skin disorder, in both children and adults (Twerski & Naar, 1974). After administering a

direct suggestion for non-scratching behaviour as well as for skin comfort and coolness, patients with treatment-resistant atopic dermatitis experienced a significant reduction in itchiness, scratching, sleep disturbances, and tension (Stewart & Thomas, 1995). For psoriasis, physicians and researchers concur that stress can trigger its onset, exacerbation, and maintenance (Kantor, 1990). Studies have found hypnotic suggestions to positively affect psoriasis, especially if a significant emotional factor has triggered the symptoms (Shenefelt, 2002). In a small randomized controlled trial, investigators only observed a significant improvement in psoriasis symptoms in the highly hypnotizable participants (Tausk & Whitmore, 1999). Despite the promise of the place of hypnosis in the field of psychodermatology, researchers and clinicians still lack sufficient information to confidently assert that these findings are due exclusively to hypnosis (Benham & Younger, 2008). Without further empirical research, we cannot yet separate clinical anecdote from controlled experimentation.

Evidence supporting the effectiveness of hypnosis in reducing CSU symptoms is modest at best. In 1963, Japanese researchers administered suggestions for symptom removal to 27 CSU patients under hypnosis, resulting in recovery of nearly the entire group (Kaneko & Takaishi, 1963). In addition, a 1987 study provided hypnosis with relaxation therapy to 15 adults with CSU (Shertzer & Lookingbill, 1987). Fourteen months after completion, six patients were free of hives and seven patients reported improvement, with 80% reporting decreased medication use. However, the design did not include a control group and therefore the true effect of the intervention could not be determined. Despite the lack of research on the effectiveness of hypnosis for management of CSU, the use of hypnosis for other clinical conditions suggests that it may provide beneficial effects for CSU patients.

Understanding the psychosocial components of this idiopathic condition will allow us to

develop adjunctive interventions to accompany the inadequate drug therapy, thus alleviating an overburdened health system and enhancing the quality of life of patients. In the present study, we examined the impact of a combined CBT and hypnosis intervention on CSU patients based on objective (e.g., number and size of lesions) and subjective (e.g., quality of life ratings, itching, and burning) measures. To control for interventionist attention, time, and patient outcome expectancy, the control group received empathic listening and progressive muscle relaxation (PMR). We hypothesized that psychological and clinical outcomes will improve in both the treatment and control condition, although participants in the treatment group will experience a greater improvement in these measures.

Methods

Participants

Participants consisted of 11 individuals (4 males and 7 females; ages 14-45 years) diagnosed with CSU by their treating allergist. We defined CSU as the recurrence of itchy wheals with or without angioedema present for most days of the week lasting for at least six weeks. We recruited participants as young as 14 years old because age-related heterogeneity in adolescents is not a significant factor in this particular allergic condition (Zuberbier et al., 2009). Since we are interested in understanding the psychopathology underlying idiopathic CSU, we excluded patients with known triggers for their hives, such as pressure, temperature, sweating, sunlight, food reaction, drug allergy, or parasitoses. Furthermore, individuals suffering from a comorbid major psychiatric diagnosis or significant cognitive impairment were also ineligible for study participation. Participants could not take oral or parenteral corticosteroids, methotrexate, cyclosporine, or other immunosuppressant medications four weeks before screening until the end

of the study. For the duration of study, participants were asked to only take 5 mg of desloratidine, a second-generation standard-of-care antihistamine, once daily.

Study procedure

Two weeks before the psychological intervention began, participants met with the treating allergist. At the appointment, the allergist assessed symptom severity and the surface area of the hives by completing the Treatment Effectiveness Scale (TES) and the 10-cm Visual Analogue Scale (VAS), respectively. Participants completed the Chronic Urticaria Quality of Life Questionnaire (CU-Q_2oL), which measures the relative burden of CSU and its effect on subjective well-being (Baiardini et al., 2005; See Appendix B and C). Participants also filled out a medical history form. In addition, participants monitored their signs and symptoms with the well-established Urticaria Activity Score (UAS) for twelve weeks (Mlynek, Zalewska-Janowska, et al., 2008; See Appendix B). Data taken during the pre-assessment stage allowed us to generate a baseline UAS and quality of life rating, which is an important adjuvant of assessment for any management strategy of CSU patients.

Participants attended ten weekly sessions that each lasted 30 minutes at the Institute of Community and Family Psychiatry at the Jewish General Hospital. We randomly assigned participants to the treatment or control group. Participants in the treatment group received 15 minutes of CBT and 15 minutes of hypnosis per session. We based this segment of the protocol on the successful intervention for the treatment of skin toxicity in oncological contexts (Schnur et al., 2009). In the attention control group, participants received empathic listening for 15 minutes and then practiced PMR for the last 15 minutes. Dr. Mark Jensen kindly shared the PMR scripts used in his study that compared self-hypnosis to PMR in reducing pain intensity in multiple sclerosis patients (Jensen et al., 2009).

After ten sessions, participants returned to their allergist, who was blind to group assignment. The allergist rated their CSU once more with TES and VAS and participants completed the CU-Q_2oL.

Treatment group

CBT. In this study, we practiced *Rational Emotive Behavioural Therapy* (REBT), a specific type of CBT. Like all CBT approaches, REBT is based on the tenet that irrational beliefs lead to clinical consequences, rather than the events themselves. However, in contrast to other forms of CBT, REBT emphasizes the importance of being respectful of patients' concerns and helping them to find a way to live with those concerns.

The CBT portion occurred during the first half of the session. In a private room, interventionists met with participants to educate them on: first, how to identify negative, unhelpful beliefs and the emotional, behavioural, and physical consequences of those beliefs; second, how to dispute those unhelpful beliefs and to replace them with more helpful alternatives (Ellis, 1994); and third, behavioural strategies to help manage symptoms of CSU.

Every week, participants brought with them a thought record worksheet completed as homework. During the session, the interventionist discussed their response to the homework. On these worksheets, they had to: identity an activating event (e.g., itching sensation); identify negative or unhelpful beliefs (e.g., "I can't stand this feeling"); identify the emotional, behavioural, and physical consequences of those beliefs (e.g., "I feel anxious and skipped work today); dispute those negative, unhelpful beliefs (e.g., "Is having this belief helping me?"); and replace those negative unhelpful beliefs with more effective and helpful ones (e.g., "I wish I didn't have to live with this symptom for now, but I can stand it.").

Hypnosis. Participants received a hypnosis session after the CBT segment. To allay any potential concerns about hypnosis, we addressed any questions at the time of consent and commencement of the initial hypnosis intervention session. Participants were instructed to relax their bodies and minds during the induction procedure, and suggestions were made throughout the session for participants to feel more deeply relaxed and hypnotized. Hypnosis began with relaxing imagery followed by suggestions for reduced distress and negative skin symptoms (e.g., pain, itching, and burning sensations), as well as positive suggestions for incompatible responses (e.g., health, well-being). Moreover, we incorporated suggestions for healing, coolness, and comfort to all affected areas rather than naming a specific location. The standardized hypnotic induction included: relaxation instructions that guided participants to experience mental and physical relaxation, suggestions to find a safe and comforting place, and instructions on how to access and remove oneself from this relaxed feeling. At the end, participants learned how to perform self-hypnosis and were informed that they could practice it as often as they liked.

Attention control group

Emphatic listening. Participants in the attention control group met with the interventionist for the same amount of time as the treatment group on a weekly basis. Participants directed the flow of the conversation while the interventionist offered reflective and empathic comments, asked objective-oriented questions, and encouraged more description and detail according to standardized procedures (Lang, Laser, Lutgendorf, Logan, & Spiegel, 1996). The interventionist did not lead the patient in imagery, relaxation, or evaluation of thought processes.

PMR. The PMR intervention provided by Jensen et al. (2009) involved the progressive tightening and relaxing of different muscle groups throughout the body, with ongoing

suggestions for an increased sense of relaxation and comfort. We encouraged participants in the control condition to practice PMR on their own everyday.

Statistical analysis

We used SPSS© statistical software to analyze our data. We excluded two participants from our analysis because they left the study after one session. One had a scheduling conflict and the other realized that she was in the control condition.

To analyze changes between pre-assessment (i.e., weeks 1 and 2) and post-assessment (i.e., week 12) for each group, paired t-tests evaluated improvement in UAS, quality of life and its subcategories, TES, and VAS measures. To examine group differences in change over the 12-week period, independent t-tests compared percent change in UAS, quality of life and its subcategories, TES, and VAS measures between the treatment and control condition.

Results

Results indicated that UAS measures did not significantly improve in the treatment ($t(4)=1.729$, $p=0.159$) or control group ($t(3)=1.369$, $p=0.270$). Accordingly, we also found no significant difference in change of UAS measures between the two groups. Participants in the treatment group demonstrated a significant within-group increase in quality of life ($t(4)=6.237$, $p=0.003$) with a large effect size ($d=2.437$). Participants in the control group also exhibited a significant within-group improvement in quality of life ($t(3)=4.003$, $p=0.028$) with a large effect size as well ($d=2.003$). However, participants in the treatment condition did not show an appreciable increase in quality of life when compared to those in the control condition. In the treatment condition, questionnaire responses indicated a significant improvement in symptoms ($t(4) = 5.250$, $p=0.006$), activities ($t(4)=3.944$, $p =0.017$), and social functioning ($t(4)=9.129$,

p=0.001). Control group participants demonstrated a significant increase only in social interactions (t(3)=3.783, p=0.032); See Figure 1).

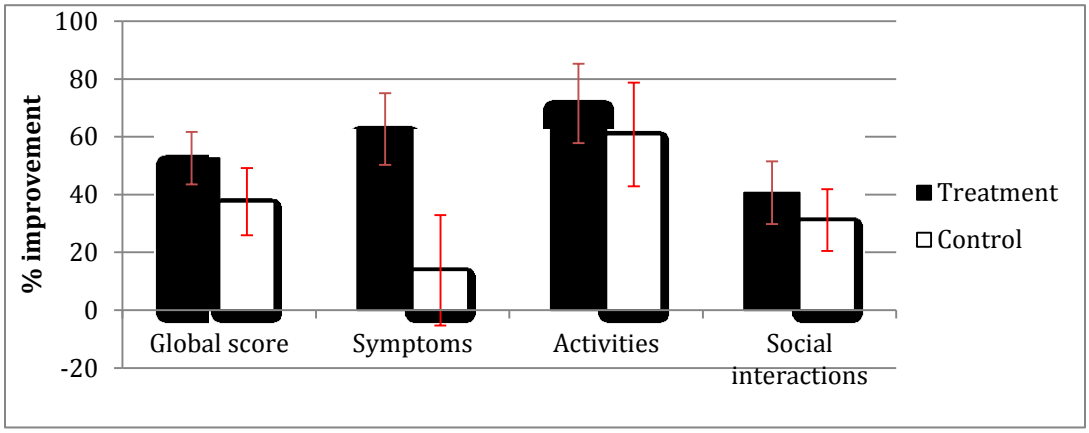

Figure 1. Percent improvement in quality of life for the treatment and control group in global score, symptoms, activities, and social functioning. Standard error bars are shown.

Allergist-administered measures of symptom severity showed no improvement using the 10-cm VAS measure for participants in the treatment group following intervention (t(4)=1.383 ,p=0.239). However, results from the TES, another clinician-rated tool, showed a significant improvement in CSU signs for this group at the same time-point (t(4)=, p=0.041). The control group did not improve in signs or symptoms according to these two measures (t(3)=0.695, p=0.537 and t(3)=1.260, p=0.297, respectively; See Figures 2 and 3). However, the observed improvement in the treatment group was not significantly different than that of the control group. Finally, there was no significant correlation between change in disease activity and quality of life ratings (r=-0.198, p=0.610).

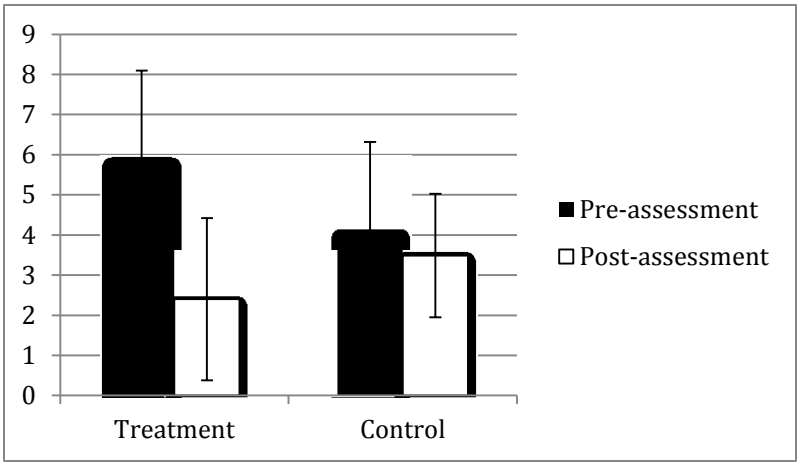

Figure 2. Comparison of 10-cm VAS scores for both groups between pre- and post-assessment. Please note that a score of 0 means no hives cover the body, while a score 10 means hives cover the entire body.

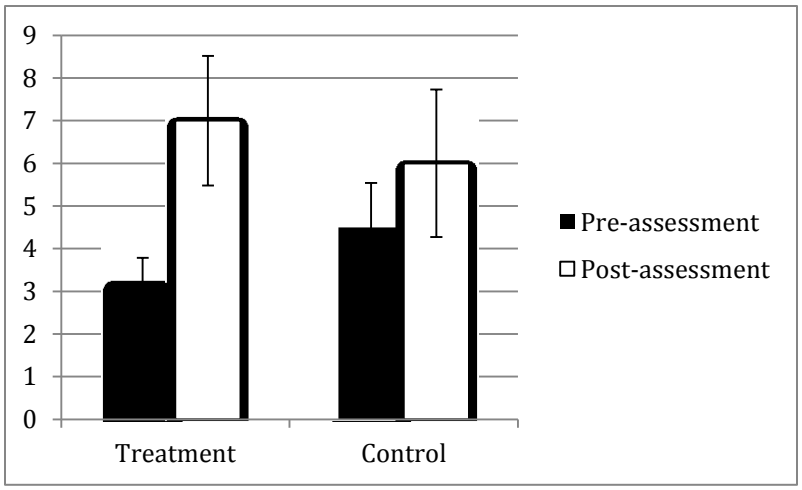

Figure 3. Comparison of TES for both groups between pre- and post-assessment. Please note that a score of 0 means very severe symptoms, while 10 means asymptomatic.

Discussion

In this small pilot study, participants in both conditions experienced similar levels of improvement in overall quality of life with no accompanying changes in disease activity. For both groups, we did not find a significant difference in the UAS when we compared scores from Week 1 and 2 (i.e., our baseline measure) to Week 12. Comparison of the TES and VAS between pre- and post-assessment revealed that signs, but not symptoms, significantly improved for

participants in the treatment group. We did not find an improvement in signs or symptoms for the control group.

We initially hypothesized that both groups would show an improvement in signs and symptoms with a greater improvement in the treatment condition. However, we did not see this amelioration in either group according to the UAS. Conversely, analysis of the TES and VAS indicated that allergists observed a significant difference in signs for the treatment group but not the condition group. Considering that participants completed the UAS every day during the study and allergists filled out the TES and VAS only twice, the UAS may represent a more reliable measure of disease activity. Moreover, these results may be due to our participant profile: the average baseline UAS was 5.6, suggesting that participants had mild symptoms to begin with. Therefore, it is possible that our participants experienced a lull in symptoms at the outset of the study. A ceiling effect may be contributing to the insignificant symptom relief provided by our psychological intervention. In general, the unpredictable variation in disease activity makes the efficacy of treatments difficult to assess (Kozel & Sabroe, 2004).

Although we did not observe a significant improvement in symptomatology for either hypnosis or PMR, this finding is in line with the proposition that hypnosis and relaxation produce a similar physiological state (Benham & Younger, 2008). However, the literature supports the position that hypnosis does indeed offer considerable symptom relief compared to PMR (Jensen, 2011; Jensen et al., 2009). Despite the fact that both techniques instruct individuals to focus their attention and provide suggestions for relaxation, the hypnosis script involves additional components, such as context-building metaphors, guided imagery of a "special place," self-hypnosis, and symptom relief. Therefore, PMR provides a suitable control to the hypnosis session.

Viewing CSU through a biopsychosocial lens, counting the number of hives and rating itchiness cannot fully determine the success of a given treatment (Maurer et al., 2011). In addition to these types of measurements, impairment in quality of life comprises an exceptionally important outcome parameter when taking a holistic approach to CSU. Considering that CSU has a severe impact on quality of life compared to other skin diseases, helping participants to better cope with their condition was a key goal in our study (Lewis & Finlay, 2004). We predicted that the intervention in both conditions would enhance quality of life but that participants receiving CBT and hypnosis would benefit significantly more than those receiving empathic listening and PMR. However, the small sample size may have precluded achieving a significant difference in improvement between the two groups. Accordingly, we observed a larger effect size for the treatment condition relative to the control condition. Given the difference in magnitudes of the effect size, it is likely that future studies with a larger sample will demonstrate that CBT and hypnosis do significantly improve quality of life compared to empathic listening and PMR.

Over a longer period of time, differences in quality of life may emerge between the two groups. In some cases, people can take longer to accept the rationale underlying CBT and thus may be less willing to apply what they learned during their sessions. For example, when researchers compared CBT to treatment offered by a family physician for depressed participants, they found that while some participants responded quickly to treatment, others improved more slowly (Fennell & Teasdale, 1987). Therefore, our short-term intervention may not have provided an adequate timeframe to observe the superior effects of CBT over empathic listening.

The lack of a clear difference between outcomes in the treatment and control conditions may also be due in part to the design of the control intervention. Although it is not based on a theoretical rationale, our control condition shares many common factors with CBT, such as a

therapeutic relationship, support, empathic responding, and the expectation that the treatment will be effective (Kirsch, 2005; Wampold, Minami, Tierney, Baskin, & Bhati, 2005). Yet it would be naïve to conclude that all psychotherapy serves as a simple, undifferentiated placebo effect (Kirsch, 1990). Systematic reviews of CBT for medically ambiguous conditions, such as irritable bowel syndrome, chronic fatigue syndrome, and fibromyalgia, conclude that there is a modest, yet clinically significant, effect size of CBT on symptom management (Deary, Chalder, & Sharpe, 2007).

Interestingly, we found no correlation between changes in disease severity and in improvement quality of life. These results support the cognitive-behavioural notion that symptoms alone do not predict quality of life; rather, the manner in which a person adjusts to life with a chronic condition strongly impacts this dimension. While some studies propose that disease severity does in fact drive quality of life impairments (Mlynek, Zalewska-Janowska, et al., 2008), other investigations report that coping styles also predict well-being and functioning (Chung et al., 2010). Moreover, additional findings have not detected a relationship between the disease course and reductions in quality of life in CSU patients with psychiatric comorbidity (Staubach et al., 2006). Overall, psychosocial factors constitute a critical element in how individuals live with CSU.

It is difficult to evaluate our results in the context of other findings because, to the best of our knowledge, similar studies have not completely controlled for the placebo effect present in CBT and hypnosis. For example, Antoni et al. (2006) randomized 199 women recently treated for non-metastatic breast cancer to receive either a two-hour weekly cognitive-behavioural stress management (CBSM) intervention with relaxation training for ten weeks or a 5-6 hour educational version of this intervention. At the 12-month follow-up, participants in the CBSM

group showed increased emotional well-being, positive lifestyle change, and positive affect, relative to the control group. In contrast to our protocol, the authors did not control for attention time, with less than one third of the contact hours than the CBSM group. In another study, researchers provided a combination of CBT and hypnosis or standard care to women undergoing breast cancer radiotherapy (Schnur et al., 2009). Results indicated that the treatment approach increased levels of positive affect and decreased levels of negative affect. However, the standard care control group had no interventionist; their involvement consisted solely of regularly completing questionnaire packets. Therefore, the protocol failed to control for attention, time, and response expectancies.

Readers should consider these findings as preliminary results due to a number of limitations. First, the small number of participants limits the power to detect significant treatment effects as well as the reliability of the results. Large-scale studies are needed to determine whether CBT and hypnosis provide beneficial effects beyond the placebo effect for CSU patients. Second, the patients who agreed to participate represent a sub-group of this clinical population. According to our protocol, participants were allowed to take 5 mg of desloratidine on a daily basis. However, many CSU patients require considerably higher doses of antihistamines along with a range of drugs, such as tricyclic antidepressants or corticosteroids. Because participants with severe symptomatology were unwilling to limit themselves to a low dose of antihistamine, our participants had mild to moderate signs and symptoms before the study began.

Third, we excluded participants presenting with psychiatric comorbidity. We fulfilled this criterion by examining their drug regimen, as well as verifying their medical history with their treating allergist. Because we did not use any questionnaires that specifically assess mental illness, it is possible that we treated participants with an undiagnosed mental illness. Moreover,

excluding participants with a mental illness holds implications for the ecological validity of our study because other investigations have detected high prevalence rates of depression and anxiety within the CSU population (Engin et al., 2008; Hashiro & Okumura, 1994; Sheehan-Dare et al., 1990).

Fourth, we encouraged participants to practice self-hypnosis or PMR outside of the sessions yet we did not take into account the number of hours they spent engaged in these activities. This variable might confound our results, whereby differences in practice time might lead to different subjective and objective outcomes. Moreover, the treatment group might have had more doubts about their ability to successfully engage in self-hypnosis than the control group with PMR. Consequently, participants in the treatment condition might dedicate less time to their technique compared to participants in the control condition.

Conclusion and Future Directions

Like many other chronic skin disorders, the treatment of CSU primarily aims to improve quality of life. Regardless of group assignment, participants experienced a better quality of life at the conclusion of the study. In this sense, our intervention was able to fulfill this unmet clinical need by focusing on the disease experience rather than just physical health. Of course, this line of research requires studies with larger samples for sufficient power to draw conclusions about the efficacy of psychological intervention for CSU. Importantly, these studies would benefit from a wait-list group to control for the natural progress of the disease. Furthermore, in order to elucidate the role of the brain-skin connection in CSU, future investigators can examine whether a change in immunological function correlates with an improvement in emotional distress, symptoms, and quality of life.

Although years away, it is important to consider how we may apply our results to CSU

management strategies. If subsequent research demonstrates that quality of life in CSU patients improves with the treatment or control condition, then allergists might want to dedicate more time to simply listening to and empathizing with their patients. This technique alone may reduce the number of times they see each CSU patient and might diminish unnecessary testing to determine an organic cause to their condition. However, if the evidence suggests that a combination of CBT and hypnosis provides unique benefits, translating future findings to the clinic may be beneficial for patients, physicians, and the healthcare system, yet challenging at the same time. In Canada, the provincial healthcare system covers the cost of psychologists if they are employed by a hospital, correctional facility, community clinic, social agency, or school (Canadian Psychological Association, 2015). In addition, there is a shortage of healthcare professionals trained in CBT and hypnosis. Therefore, training new personnel for the purpose of treating individuals with a non-life-threatening disorder may prove a daunting task. Yet, in contrast to the largely ineffective pharmacotherapy currently available, this minimal-risk intervention may eventually become a viable option that offers relief to many a CSU patient alongside considerable savings to society.

References

Antoni, M. H., Lechner, S. C., Kazi, A., Wimberly, S. R., Sifre, T., Urcuyo, K. R., . . . Carver, C. S. (2006). How stress management improves quality of life after treatment for breast cancer. *Journal of Consulting and Clinical Psychology, 74*(6), 1143-1152.

Arck, P. C., & Paus, R. (2006). From the brain-skin connection: The neuroendocrine-immune misalliance of stress and itch. *Neuroimmunomodulation, 13*(5-6), 347-356.

Arck, P. C., Slominski, A., Theoharides, T. C., Peters, E. M. J., & Paus, R. (2006). Neuroimmunology of stress: Skin takes center stage. *Journal of Investigative Dermatology, 126*(8), 1697-1704.

Baiardini, I., Pasquali, M., Braido, F., Fumagalli, F., Guerra, L., Compalati, E., . . . Canonica, G. W. (2005). A new tool to evaluate the impact of chronic urticaria on quality of life: Chronic urticaria quality of life questionnaire (CU-Q2oL). *Allergy, 60*(8), 1073-1078.

Barbosa, F., Freitas, J., & Barbosa, A. (2011). Chronic idiopathic urticaria and anxiety symptoms. *Journal of Health Psychology, 16*(7), 1038-1047.

Ben-Shoshan, M., Clarke, A., & Raz, A. (2012). Psychosocial factors and the pathogenesis of chronic hives: A survey of Canadian physicians. *Allergy & Therapy, 3*(1).

Benham, G., & Younger, J. (2008). Hypnosis and mind-body interactions. In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of hypnosis: Theory, research, and practice* (pp. 393-435). Oxford: Oxford University Press

Berrino, A. M., Voltolini, S., Fiaschi, D., Pellegrini, S., Bignardi, D., Minale, P., . . . Maura, E. (2006). Chronic urticaria: Importance of a medical-psychological approach. *European Annals of Allergy and Clinical Immunology, 38*(5), 149-152.

Bolger, N., & Schilling, E. A. (1991). Personality and the problems of everyday life: The role of neuroticism in exposure and reactivity to daily stressors. *Journal of Personality, 59*(3), 355-386.

Broom, B. C. (2010). A reappraisal of the role of 'mind body' factors in chronic urticaria. *Postgraduate Medical Journal, 86*, 365-370. doi: 10.1136/pgmj.2009.096446

Bryant, R. A. (2008). Hypnosis and anxiety: Early interventions. In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of hypnosis: Theory, research, and practice* (pp. 536-547). Oxford: Oxford University Press

Bryant, R. A., Moulds, M. L., Guthrie, R. M., & Nixon, R. D. (2005). The additive benefit of hypnosis and cognitive-behavioral therapy in treating acute stress disorder. *Journal of Consulting and Clinical Psychology, 73*(2), 334-340.

Canadian Psychological Association. (2015). What to expect from a psychologist. from http://www.cpa.ca/public/decidingtoseeapsychologist/psychologistwhattoexpect/

Chung, M. C., Symons, C., Gilliam, J., & Kaminski, E. R. (2010). Stress, psychiatric co-morbidity and coping in patients with chronic idiopathic urticaria. *Psychology & Health, 25*(4), 477-490.

Claveau, J., Lavoie, A., Brunet, C., Bedard, P. M., & Hebert, J. (1993). Chronic idiopathic urticaria: Possible contribution of histamine-releasing factor to pathogenesis. *Journal of Allergy and Clinical Immunology, 92*(1), 132-137.

Deary, V., Chalder, T., & Sharpe, M. (2007). The cognitive behavioural model of medically unexplained symptoms: A theoretical and empirical review. *Clinical Psychology Review, 27*(7), 781-797.

Delong, L. K., Culler, S. D., Saini, S. S., Beck, L. A., & Chen, S. C. (2008). Annual direct and indirect health care costs of chronic idiopathic urticaria: A cost analysis of 50 nonimmunosuppressed patients. *Archives of Dermatology, 144*(1), 35-39.

Dobson, K., & Dozois, D. (2001). Historal and philosophical basis of cognitive-behavior therapy. In K. Dobson (Ed.), *Handbook of cognitive-behavioral therapies* (pp. 3-39). New York: Guildford

Drossman, D. A., Leserman, J., Li, Z. M., Keefe, F., Hu, Y. J. B., & Toomey, T. C. (2000). Effects of coping on health outcome among women with gastrointestinal disorders. *Psychosomatic Medicine, 62*(3), 309-317.

Ellis, A. (1994). *Reason and emotion in psychotherapy* (Rev. and updated. ed.). Secaucus, NJ: Carol Pub. Group.

Elkins, G., & Perfect, M. (2008). Hypnosis for health-compromising behaviors. In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of hypnosis: Theory, research, and practice* (pp. 569-592). Oxford: Oxford University Press

Engin, B., Uguz, F., Yilmaz, E., Ozdemir, M., & Mevlitoglu, I. (2008). The levels of depression, anxiety and quality of life in patients with chronic idiopathic urticaria. *Journal of the European Academy of Dermatology and Venereology, 22*(1), 36-40.

Fava, G. A., Perini, G. I., Santonastaso, P., & Vellerfornasa, C. (1980). Life events and psychological distress in dermatologic disorders: Psoriasis, chronic urticaria and fungal-infections. *British Journal of Medical Psychology, 53*(Sep), 277-282.

Fennell, M. J. V., & Teasdale, J. D. (1987). Cognitive therapy for depression: Individual differences and the process of change. *Cognitive Therapy and Research, 11*(2), 253-271.

Ferrer, M. (2009). Epidemiology, healthcare, resources, use and clinical features of different types of urticaria. Alergologica 2005. *Journal of Investigational Allergology and Clinical Immunology, 19*, 21-26.

Fortune, D. G., Richards, H. L., Kirby, B., Bowcock, S., Main, C. J., Griffiths, C. E. M. (2002). A cognitive-behavioural symptom management programme as an adjunct in psoriasis therapy. *British Journal of Dermatology*, *146*(3), 458-465

González-Prendes, A. A., & Resko, S. M. (2012). Cognitive-behavioral therapy. In S. Ringel & J. Brandell (Eds.), *Trauma: Contemporary directions in theory, practice, and research*: Sage Publications, Inc.

Hashiro, M., & Okumura, M. (1994). Anxiety, depression, psychosomatic symptoms and autonomic nervous function in patients with chronic urticaria. *Journal of Dermatological Science, 8*(2), 129-135.

Herguner, S., Kilic, G., Karakoc, S., Tamay, Z., Tuzun, U., & Guler, N. (2011). Levels of depression, anxiety and behavioural problems and frequency of psychiatric disorders in children with chronic idiopathic urticaria. *British Journal of Dermatology, 164*(6), 1383-1386.

Jackson, C., Nissenson, K., & Cloitre, M. (2009). Cognitive-behavioral therapy. In C. A. Courtois & J. D. Ford (Eds.), *Treating complex traumatic stress disorders: An evidence-based guide*. New York: Guildford

Jensen, M. P. (2011). Psychosocial approaches to pain management: An organizational framework. *Pain, 152*(4), 717-725.

Jensen, M. P., Barber, J., Romano, J. M., Molton, I. R., Raichle, K. A., Osborne, T. L., . . . Patterson, D. R. (2009). A comparison of self-hypnosis versus progressive muscle

relaxation in patients with multiple sclerosis and chronic pain. *International Journal of Clinical and Experimental Hypnosis, 57*(2), 198-221.
Kaneko, Z., & Takaishi, N. (1963). Psychosomatic studies in chronic urticaria. *Folia Psychiatrica et Neurologica Japonica, 17*(1).
Kantor, S. D. (1990). Stress and Psoriasis. *Cutis, 46*(4), 321-322.
Kaplan, A. P., & Greaves, M. (2009). Pathogenesis of chronic urticaria. *Clinical and Experimental Allergy, 39*(6), 777-787.
Kaplan, A. P., Horakova, Z., & Katz, S. I. (1978). Assessment of tissue fluid histamine levels in patients with urticaria. *Journal of Allergy and Clinical Immunology, 61*(6), 350-354.
Keegan, D. L. (1976). Chronic urticaria: Clinical psychophysiological and therapeutic aspects. *Psychosomatics, 17*(3), 160-163.
Kirsch, I. (1990). *Changing expectations: A key to effective psychotherapy*. Pacific Grove, CA: Brooks/Cole.

Kirsch, I. (2005). Placebo psychotherapy: Synonym or oxymoron? *Journal of Clinical Psychology, 61*(7), 791-803.
Kirsch, I., Montgomery, G., & Sapirstein, G. (1995). Hypnosis as an adjunct to cognitive-behavioral psychotherapy: A meta-analysis. *Journal of Consulting and Clinical Psychology, 63*(2), 214-220.
Kozel, M. M. A., & Sabroe, R. A. (2004). Chronic urticaria: Aetiology, management and current and future treatment options. *Drugs, 64*(22), 2515-2536.
Lackner, J. M., Quigley, B. M., & Blanchard, E. B. (2004). Depression and abdominal pain in IBS patients: The mediating role of catastrophizing. *Psychosomatic Medicine, 66*(3), 435-441.
Lang, E. V., Laser, E., Lutgendorf, S. K., Logan, H. L., & Spiegel, D. (1996). *Empathic attention and self-hypnotic relaxation for interventional radiological procedures: A treatment manual*.
Lewis, V., & Finlay, A. Y. (2004). 10 years experience of the Dermatology Life Quality Index (DLQI). *Journal of Investigative Dermatology Symposium Proceedings, 9*(2), 169-180.
Malhotra, S. K., & Mehta, V. (2008). Role of stressful life events in induction or exacerbation of psoriasis and chronic urticaria. *Indian Journal of Dermatology Venereology & Leprology, 74*(6), 594-599.
Maurer, M., Rosen, K., Hsieh, H. J., Saini, S., Grattan, C., Gimenez-Arnau, A., . . . Casale, T. (2013). Omalizumab for the Treatment of Chronic Idiopathic or Spontaneous Urticaria. *New England Journal of Medicine, 368*(10), 924-935.
Maurer, M., Weller, K., Bindslev-Jensen, C., Gimenez-Arnau, A., Bousquet, P. J., Bousquet, J., . . . Zuberbier, T. (2011). Unmet clinical needs in chronic spontaneous urticaria. A GA(2)LEN task force report. *Allergy, 66*(3), 317-330.
Mlynek, A., Maurer, M., & Zalewska, A. (2008). Update on chronic urticaria: Focusing on mechanisms. *Current Opinion in Allergy and Clinical Immunology, 8*(5), 433-437.
Mlynek, A., Zalewska-Janowska, A., Martus, P., Staubach, P., Zuberbier, T., & Maurer, M. (2008). How to assess disease activity in patients with chronic urticaria? *Allergy, 63*(6), 777-780.
Moore, M., & Tasso, A. F. (2008). Clinical hypnosis: The empiral evidence. In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of clinical hypnosis: Theory, research, and practice* (pp. 697-726). Oxford: Oxford University Press

O'Donnell, B. F., Lawlor, F., Simpson, J., Morgan, M., & Greaves, M. W. (1997). The impact of chronic urticaria on the quality of life. *British Journal of Dermatology, 136*(2), 197-201.
Oakley, D. A., & Halligan, P. W. (2009). Hypnotic suggestion and cognitive neuroscience. *Trends in Cognitive Sciences, 13*(6), 264-270.
Ortonne, J. P. (2011). Chronic urticaria: A comparison of management guidelines. *Expert Opinion on Pharmacotherapy, 12*(17), 2683-2693.
Ortonne, J. P. (2012). Urticaria and its subtypes: The role of second-generation antihistamines. *European Journal of Internal Medicine, 23*(1), 26-30.
Ozkan, M., Oflaz, S. B., Kocaman, N., Ozseker, F., Gelincik, A., Buyukozturk, S., . . . Colakoglu, B. (2007). Psychiatric morbidity and quality of life in patients with chronic idiopathic urticaria. *Annals of Allergy Asthma & Immunology, 99*(1), 29-33.
Palsson, A. S., & Drossman, D. A. (2005). Psychiatric and psychological dysfunction in irritable bowel syndrome and the role of psychological treatments. *Gastroenterology Clinics of North America, 34*(2), 281-+.
Papadopoulou, N., Kalogeromitros, D., Staurianeas, N. G., Tiblalexi, D., & Theoharides, T. C. (2005). Corticotropin-releasing hormone receptor-1 and histidine decarboxylase expression in chronic urticaria. *Journal of Investigative Dermatology, 125*(5), 952-955.
Pasaoglu, G., Bavbek, S., Tugcu, H., Abadoglu, O., & Misirligil, Z. (2006). Psychological status of patients with chronic urticaria. *Journal of Dermatology, 33*(11), 765-771.
Patterson, D. R. (2010). *Clinical hypnosis for pain control*. Washington, DC: American Psychological Association.
Picardi, A., & Abeni, D. (2001). Stressful life events and skin diseases: Disentangling evidence from myth. *Psychotherapy and Psychosomatics, 70*(3), 118-136.
Picardi, A., Abeni, D., Melchi, C. F., Puddu, P., & Pasquini, P. (2000). Psychiatric morbidity in dermatological outpatients: An issue to be recognized. *British Journal of Dermatology, 143*(5), 983-991.
Picardi, A., & Pasquini, P. (2007). Toward a biopsychosocial approach to skin diseases. In P. Porcelli & N. Sonino (Eds.), *Psychological factors affecting medical conditions: A new classification for DSM-V* (Vol. 28, pp. 109-126). Switzerland: Karger
Rasoulian, M., Ebrahimi, A. A., Zare, M., & Taherifar, Z. (2010). Psychiatric morbidity in dermatological conditions. *International Journal of Psychiatry in Clinical Practice, 14*(1), 18-22.
Raz, A. (2011). Hypnosis: A twilight zone of the top-down variety. *Trends in Cognitive Sciences, 15*(12), 555-557.
Rees, L. (1957). An aetiological study of chronic urticaria and angioneurotic oedema. *Journal of Psychosomatic Research, 2*(3), 172-189.
Sabroe, R. A., Poon, E., Orchard, G. E., Lane, D., Francis, D. M., Barr, R. M., . . . Greaves, M. W. (1999). Cutaneous inflammatory cell infiltrate in chronic idiopathic urticaria: Comparison of patients with and without anti-Fc epsilon RI or anti-IgE autoantibodies. *Journal of Allergy and Clinical Immunology, 103*(3), 484-493.
Saini, S. S. (2014). Chronic spontaneous urticaria: Etiology and pathogenesis. *Immunology and Allergy Clinics of North America, 34*(1), 33-52.
Schaefer, P. (2011). Urticaria: Evaluation and treatment. *American Family Physician, 83*(9), 1078-1084.
Schnur, J. B., David, D., Kangas, M., Green, S., Bovbjerg, D. H., & Montgomery, G. H. (2009). A randomized trial of a cognitive-behavioral therapy and hypnosis intervention on

positive and negative affect during breast cancer radiotherapy. *Journal of Clinical Psychology, 65*(4), 443-455.
Sharma, J. K., Miller, R., & Murray, S. (2000). Chronic urticaria: A Canadian perspective on patterns and practical management strategies. *Journal of Cutaneous Medicine and Surgery, 4*(2), 89-93.
Sharpe, L., Sensky, T., Timberlake, N., Ryan, B., & Allard, S. (2003). Long-term efficacy of a cognitive behavioural treatment from a randomized controlled trial for patients recently diagnosed with rheumatoid arthritis. *Rheumatology*, *42*(3), 435-441.
Sheehan-Dare, R. A., Henderson, M. J., & Cotterill, J. A. (1990). Anxiety and depression in patients with chronic urticaria and generalized pruritus. *British Journal of Dermatology, 123*(6), 769-774.
Shenefelt, P. D. (2000). Hypnosis in dermatology. *Archives of Dermatology, 136*(3), 393-399.
Shenefelt, P. D. (2002). Complementary psychotherapy in dermatology: Hypnosis and biofeedback. *Clinics in Dermatology, 20*(5), 595-601.
Shenefelt, P. D. (2003). Biofeedback, cognitive-behavioral methods, and hypnosis in dermatology: is it all in your mind? *Dermatologic Therapy, 16*(2), 114-122.
Shenefelt, P. D. (2008). Relaxation, meditation, and hypnosis for skin disorders and procedures. In B. N. DeLuca (Ed.), *Mind-body and relaxation research focus* (pp. 45-63): Nova Science Publishers Inc.
Shertzer, C. L., & Lookingbill, D. P. (1987). Effects of relaxation therapy and hypnotizability in chronic urticaria. *Archives of Dermatology, 123*(7), 913-916.
Smith, C. H., Kepley, C., Schwartz, L. B., & Lee, T. H. (1995). Mast-cell number and phenotype in chronic idiopathic urticaria. *Journal of Allergy and Clinical Immunology, 96*(3), 360-364.
Staubach, P., Dechene, M., Metz, M., Magerl, M., Siebenhaar, F., Weller, K., . . . Maurer, M. (2011). High prevalence of mental disorders and emotional distress in patients with chronic spontaneous urticaria. *Acta Dermato-Venereologica, 91*(5), 557-561.
Staubach, P., Eckhardt-Henn, A., Dechene, M., Vonend, A., Metz, M., Magerl, M., . . . Maurer, M. (2006). Quality of life in patients with chronic urticaria is differentially impaired and determined by psychiatric comorbidity. *British Journal of Dermatology, 154*(2), 294-298.
Stewart, A. C., & Thomas, S. E. (1995). Hypnotherapy as a treatment for atopic dermatitis in adults and children. *British Journal of Dermatology, 132*(5), 778-783.
Surdea-Blaga, T., Baban, A., & Dumitrascu, D. L. (2012). Psychosocial determinants of irritable bowel syndrome. *World Journal of Gastroenterology, 18*(7), 616-626.
Tatrow, K., & Montgomery, G. H. (2006). Cognitive behavioral therapy techniques for distress and pain in breast cancer patients: A meta-analysis. *Journal of Behavioral Medicine*, *29*(1), 17-27.
Tausk, F., & Whitmore, S. E. (1999). A pilot study of hypnosis in the treatment of patients with psoriasis. *Psychotherapy and Psychosomatics, 68*(4), 221-225.
Teshima, H., Kubo, C., Kihara, H., Imada, Y., Nagata, S., Ago, Y., & Ikemi, Y. (1982). Psychosomatic aspects of skin diseases from the standpoint of immunology. *Psychotherapy and Psychosomatics, 37*(3), 165-175.
Theoharides, T. C., Singh, L. K., Boucher, W., Pang, X. Z., Letourneau, R., Webster, E., & Chrousos, G. (1998). Corticotropin-releasing hormone induces skin mast cell degranulation and increased vascular permeability, a possible explanation for its proinflammatory effects. *Endocrinology, 139*(1), 403-413.

Toner, B. B., Segal, Z. V., Emmott, S., Myran, D., Ali, A., DiGasbarro, I., & Stuckless, N. (1998). Cognitive-behavioral group therapy for patients with irritable bowel syndrome. *International Journal of Group Psychotherapy, 48*(2), 215-243.

Trull, T. J. (1992). DSM-III-R personality disorders and the five-factor model of personality: an empirical comparison. *Journal of Abnormal Psychology, 101*(3), 553-560.

Twerski, A. J., & Naar, R. (1974). Hypnotherapy in a case of refractory dermatitis. *American Journal of Clinical Hypnosis, 16*(3), 202-205.

Uguz, F., Engin, B., & Yimaz, E. (2008). Axis I and Axis II diagnoses in patients with chronic idiopathic urticaria. *Journal of Psychosomatic Research, 64*(2), 225-229.

Wampold, B. E., Minami, T., Tierney, S. C., Baskin, T. W., & Bhati, K. S. (2005). The placebo is powerful: Estimating placebo effects in medicine and psychotherapy from randomized clinical trials. *Journal of Clinical Psychology, 61*(7), 835-854.

Weldon, D. R. (2006). Quality of life in patients with urticaria. *Allergy and Asthma Proceedings, 27*(2), 96-99.

Weldon, D. R. (2014). Quality of life in patients with urticaria and angioedema: Assessing burden of disease. *Allergy and Asthma Proceedings, 35*(1), 4-9.

Weller, K., & Maurer, M. (2009). Desloratadine inhibits human skin mast cell activation and histamine release. *Journal of Investigative Dermatology, 129*(11), 2723-2726.

Wu, K. D., Clark, L. A., & Watson, D. (2006). Relations between obsessive-compulsive disorder and personality: Beyond Axis I-Axis II comorbidity. *Journal of Anxiety Disorders, 20*(6), 695-717.

Yang, H. Y., Sun, C. C., Wu, Y. C., & Wang, J. D. (2005). Stress, insomnia, and chronic idiopathic urticaria - A case-control study. *Journal of the Formosan Medical Association, 104*(4), 254-263.

Yapko, M. D. (2008). Hypnotic approaches to treating depression. In M. R. Nash & A. J. Barnier (Eds.), *The Oxford handbook of hypnosis: Theory, research, and practice* (pp. 550-567). Oxford: Oxford University Press

Yosipovitch, G., Ansari, N., Goon, A., Chan, Y. H., & Goh, C. L. (2002). Clinical characteristics of pruritus in chronic idiopathic urticaria. *British Journal of Dermatology, 147*(1), 32-36.

Zachariae, R., Zachariae, C., Ibsen, H. H. W., Mortensen, J. T., & Wulf, H. C. (2004). Psychological symptoms and quality of life of dermatology outpatients and hospitalized dermatology patients. *Acta Dermato-Venereologica, 84*(3), 205-212.

Zonneveld, L. N. L., Sprangers, M. A. G., Kooiman, C. G., van't Spijker, A., & Busschbach, J. J. V. (2013). Patients with unexplained physical symptoms have poorer quality of life and higher costs than other patient groups: a cross-sectional study on burden. *BMC Health Services Research, 13*.

Zuberbier, T., Asero, R., Bindslev-Jensen, C., Canonica, G. W., Church, M. K., Gimenez-Arnau, A., . . . Maurer, M. (2009). EAACI/GA2LEN/EDF/WAO guideline: Definition, classification and diagnosis of urticaria. *Allergy, 64*(10), 1417-1426.

General discussion

The mechanisms subserving the development of automaticity, as well as the suppression of unwanted automatic cognitions and behaviours, provide insight into healthy and pathological functioning. Strengthening the executive network represents once such mechanism of unringing the bell. In particular, lasting modifications of the executive system substantially consolidate the influence of self-regulation mechanisms over automatic processes (Kubler, Dixon, & Garavan, 2006). This ability appears especially important when certain automatic responses are no longer adaptive and may even prove dangerous.

Hypnosis, meditation, and psychotherapy aid individuals in tapping into their ability to alter automatic thoughts, feelings, and behaviours—in other words, to self-regulate. For many of these practices, people must actively engage their mental faculties to change a myriad of deeply entrenched impressions, judgements, goals, and actions that fall outside their attention or awareness. Achieving this level of control critically influences how our bodies function and heal.

Spanning the biopsychosocial domain, chronic spontaneous urticaria (CSU) places a number of demands on its patients, such as managing symptoms, negotiating close relationships affected by activity limitations, suppressing ruminative thoughts about one's predicament, and regulating common comorbid moods like depression and anxiety (Nes, Roach, & Segerstrom, 2009). In CSU, as well as for other chronic disorders, the capacity to adjust and lead a positive quality of life partly hinges on strong self-regulation abilities, which in turn rely on executive functioning (Nes et al., 2009).

When we perceive the mind and body as a single entity, we can control for much of the disease experience that we once considered beyond our grasp—or automatic (Langer, 2009). We applied this principle to CSU. By providing cognitive behavioural therapy with a cognitive

restructuring component and hypnosis, we sought to ameliorate symptomatology as well as the psychological perception regarding the disease. At the end of the study, participants in the treatment group experienced significant improvements in quality of life. Although they did not exhibit a reduction in symptoms, to a large extent most patients suffering from a chronic illness mainly care about how well they can function and how they feel on a day-to-day basis (Gralnek, Hays, Kilbourne, Naliboff, & Mayer, 2000). In the future, large-scale studies must focus on how this intervention achieves these outcomes and whether these improvements are long-lasting for CSU patients. Overall, by harnessing the power of our mind to think adaptively, we become involved in the health process rather than just the outcome (Langer, 2009).

References

Gralnek, I. M., Hays, R. D., Kilbourne, A., Naliboff, B., & Mayer, E. A. (2000). The impact of irritable bowel syndrome on health-related quality of life. *Gastroenterology, 119*(3), 654-660.

Kubler, A., Dixon, V., & Garavan, H. (2006). Automaticity and reestablishment of executive control: An fMRI study. *Journal of Cognitive Neuroscience, 18*(8), 1331-1342.

Langer, E. J. (2009). *Counterclockwise: Mindful health and the power of possiblity*. New York: Ballantine Books.

Nes, L. S., Roach, A. R., & Segerstrom, S. C. (2009). Executive functions, self-regulation, and chronic pain: A review. *Annals of Behavioral Medicine, 37*(2), 173-183.

Appendix A

Methods

Materials

We used two classes of words in our classic Stroop paradigm: colour words (RED, BLUE, GREEN and YELLOW) and neutral words (LOT, SHIP, KNIFE and FLOWER) matched on both length and lexical frequency. Participants sat at a viewing distance of approximately 67cm in front of a colour computer monitor. Stimuli consisted of a single word written in one of the four ink colours, which appeared on the center of the monitor where a black fixation-cross was visible. All characters were in upper-case font against a white background, and the stimuli subtended visual angles of 0.5º vertically and 1.3º to 1.9º horizontally depending on the word length. We used the three primary colours – red (λ=650 nm), blue (λ=475 nm), and green (λ=510 nm) – as well as (sodium) yellow (λ=586 nm).

For the Stroop task, three experimental conditions were applied: a congruent condition, in which each colour word was presented in its own colour; a neutral condition, in which each neutral word was presented in any of the four colours; and an incongruent condition, in which each colour word was presented in any of the three colours other than the one to which it referred (e.g., the word "RED" presented in green). During each trial, participants were asked to indicate the ink colour in which a word was presented in by pressing one of 4 keys on a keyboard. The colour-labeled response keys were "V", "B", "N" and "M" for colours red, blue, green and yellow, respectively. Two fingers of each hand were used to press the response keys (i.e., left middle finger for "V", right index finger for "N", etc.). Speed and accuracy were emphasized equally.

To measure the quantifiable rating of participants' response to suggestions under standard conditions, we screened volunteers for hypnotic suggestibility using both the Harvard Group Scale of Hypnotic Susceptibility Form A (HGSHS-A) (Shor & Orne, 1962) and the Stanford Hypnotic Susceptibility Scale, Form C (SHSS-C) sans the ammonia challenge for anosmia (Weitzenhoffer & Hilgard, 1962). Having screened about 500 individuals on these two scales, we identified 49 participants scoring in the highly suggestible range (10-11 of a possible 11 on the SHSS-C; top 5% of HGSHS-A), and 34 participants scoring in the less-suggestible range (0-1 of a possible 11 on the SHSS-C; bottom 5% of HGSHS-A). We then invited these individuals for further participation, comprising a total of 83 participants, all of whom were proficient readers of English with normal or corrected-to-normal vision (average age = 23.4 years; 39 females).

Design and Procedure

We instructed participants to focus their eyes on a fixation cross in the center of the monitor. A stimulus would follow, replacing the crosshair. The stimulus remained on the screen for a maximum of two seconds or until the participant responded. Following a response, veridical visual feedback appeared (i.e., the words "CORRECT" or "INCORRECT" flashed in black ink), and the fixation cross was redisplayed at the center for a variable duration contingent upon the participant's RT. At this point, a new stimulus appeared on the screen, again replacing the fixation cross and beginning the next trial. The interstimulus interval was four seconds.

The experimenter informed all participants that suggestions may be administered at certain points during the experiment. The following posthypnotic suggestion was verbally presented to both HSIs and LSIs:

Very soon you will be playing the computer game. When I clap my hands, meaningless symbols will appear in the middle of the screen. They will feel like characters of a foreign language that you do not know, and you will not attempt to attribute any meaning to them. This gibberish will be printed in one of four ink colours: red, blue, green, or yellow. Although you will attend to the symbols' ink colour only, you will look straight at the scrambled signs and crisply see all of them. Your job is to quickly and accurately depress the key that corresponds to the ink colour shown. You will find that you can play this game easily and effortlessly. When I clap my hands twice, you will regain your reading abilities.

Seventy-three of the 83 participants performed the Stroop task twice, once with and once without suggestion, resting for 15 minutes between sessions. Order was counterbalanced so that every even participant would first do the Stroop task without suggestion and every odd participant would first do it with suggestion. In addition, for 10 HSIs, five participants performed the Stroop task without suggestion only, and five participants performed the task with suggestion only.

Thirty-two practice trials preceded the first experimental session for each participant. This training session confirmed that participants were able to understand the task, proficiently map the four display colours to the appropriate response keys, and respond quickly and accurately. Following this brief training session, participants took a short break and then completed 144 experimental trials, presented in random order. The trials were equally divided among the neutral, congruent, and incongruent conditions. For participants in the suggestion-first condition, these trials were preceded by the hand clap, which was the signal to activate the suggestion. At the end of this first set of trials, participants in the suggestion-first condition

heard a double hand clap, which was the signal for canceling the suggestion. Following a 15-minute rest period, participants completed another set of 144 experimental trials, again in random order. For participants in the suggestion-second condition a single hand clap preceded this second set of trials, and a double hand clap followed it.

Statistical Analysis

We present both RT and Accuracy analyses. While RT is a continuous variable with normal distribution, accuracy is a heavily skewed binary variable. We performed statistical procedures using PROC MIXED with the General Linear Model (GLM) in SAS v.9.2 (SAS Institute Inc., Cary NC). Because accuracy is not normally distributed, we analyzed accuracy data using both GLM (following the RT analysis) and a generalized estimation equation (PROC GENMOD in SAS). Although the latter (i.e., odds ratio) is a more sensitive measure, results from these two analyses were largely comparable.

To develop a solid descriptive understanding of our datasets prior to conducting a confirmatory statistical analysis and post-hoc investigations of significant results, we explored the data including by computing descriptive statistics such as variances, plotting the data in box-plots, histograms, and scatter-plots. For continuous response, we used the GLM, including between-subjects factors, within-subjects factors, and their interactions to calculate parameter estimates, 95% confidence intervals, and test-related hypotheses.

Appendix B

Score	Wheals (welts or raised lesions)	Itchiness
0	None	None
1	Les than 20 wheals/day	Present but not annoying
2	20-50 wheals/day	Annoying but does not interfere with normal daily activities or sleep
3	More than 50 wheals/day or large areas where wheals merge.	Severe itchiness, interfering with normal daily activities or sleep.

UAS Follow-up table :

Figure 1. UAS.

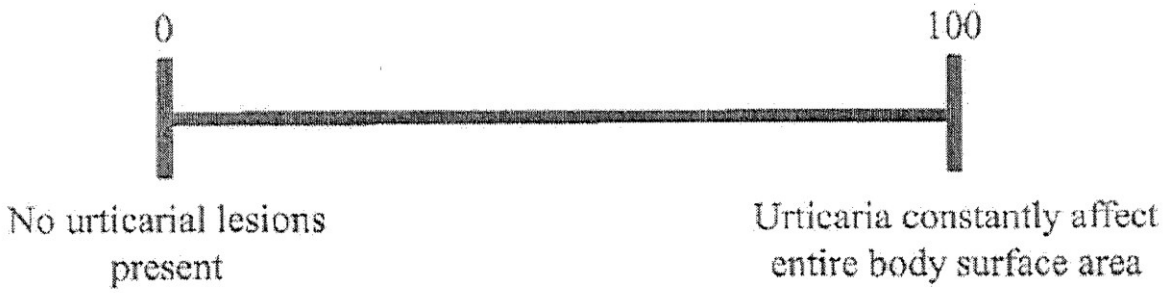

Figure 2. VAS.

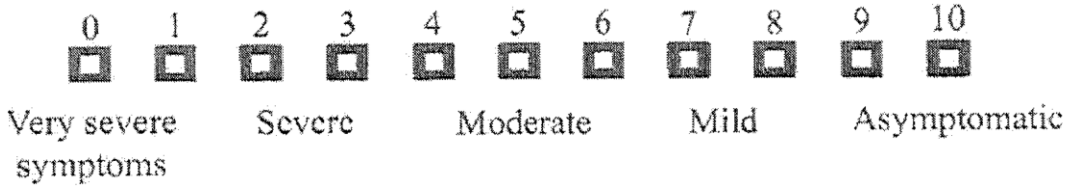

Figure 3. TES.

Appendix C

Chronic Urticaria Quality of Life Questionnaire
(CU-Q_2oL)

In the past two weeks, to what extent have you been bothered by the following symptoms?

1 Itching
o Not at all o A little o Somewhat o A lot o Very much

2 Bumps (welts)
o Not at all o A little o Somewhat o A lot o Very much

3 Puffy eyes
o Not at all o A little o Somewhat o A lot o Very much

4 Swollen lips
o Not at all o A little o Somewhat o A lot o Very much

In the past two weeks, to what extent has urticaria (hives) limited you in the following aspects of daily life?

5 Work
o Not at all o A little o Somewhat o A lot o Very much

6 Physical activity
o Not at all o A little o Somewhat o A lot o Very much

7 Sleep
o Not at all o A little o Somewhat o A lot o Very much

8 Free time
o Not at all o A little o Somewhat o A lot o Very much

9 Social relationships
o Not at all o A little o Somewhat o A lot o Very much

10 Eating
o Not at all o A little o Somewhat o A lot o Very much

The following questions are intended to further investigate difficulties and problems that may be hives-related (referring to the past two weeks).

11 Do you have difficulty falling asleep?
o Not at all o A little o Somewhat o A lot o Very much

12 Do you wake up during the night?

o Not at all o A little o Somewhat o A lot o Very much
s

13 In the daytime, are you tired for lack of proper rest at night?

o Not at all o A little o Somewhat o A lot o Very much

14 Do you have difficulty concentrating?

o Not at all o A little o Somewhat o A lot o Very much

15 Do you feel nervous?

o Not at all o A little o Somewhat o A lot o Very much

16 Do you feel that you are in a bad mood?

o Not at all o A little o Somewhat o A lot o Very much

17 Do you have to limit your food choices?

o Not at all o A little o Somewhat o A lot o Very much

18 Are you embarrassed by signs of hives appearing on your body?

o Not at all o A little o Somewhat o A lot o Very much

19 Are you embarrassed to go out to public places?

o Not at all o A little o Somewhat o A lot o Very much

20 Is it a problem for you to use cosmetics (e.g.: perfumes, creams, bubble bath, makeup)?

o Not at all o A little o Somewhat o A lot o Very much

21 Are you limited in your choice of clothing?

o Not at all o A little o Somewhat o A lot o Very much

22 Are hives causing you to limit your participation in sports?

o Not at all o A little o Somewhat o A lot o Very much

23 Are you bothered by the side effects of medications used to treat hives?

o Not at all o A little o Somewhat o A lot o Very much