Psychopathology Review
PR Volume 4 (2017), Issue 3, 377-399
ISSN 2051-8315 / DOI:10.5127/pr.044714

Could a Unified Theory of Cognition and Emotion Further The Transdiagnostic Perspective? A Critical Analysis Using Interacting Cognitive Subsystems as a Case Example

Felicity A Cowdrey[a,d], Claire Lomax[b], James D Gregory[a], Philip J Barnard[c]

[a] *Clinical Psychology Unit and Research Centre, University of Bath, Bath, UK.*

[b] *Clinical Psychology, School of Psychology, Newcastle University, Newcastle upon Tyne, UK*

[c] *Visiting scientist, MRC Cognition and Brain Sciences Unit, Cambridge, UK.*

[d] *Cotswold House Specialist Eating Disorders Unit, Savernake Hospital, Marlborough, UK*

Abstract

There is evidence that common processes underlie psychological disorders transdiagnostically. A challenge for the transdiagnostic movement is accounting for such processes theoretically. Theories of psychological disorders are traditionally restricted in scope, often explaining specific aspects of a disorder. The alternative to such '*micro-theories'* is developing frameworks which explain general human cognition, so called '*macro-theories*', and applying these systematically to clinical phenomena. Interacting Cognitive Subsystems (ICS) [Teasdale, J.D., & Barnard, P.J. (1993). *Affect, cognition and change: Re-modelling depressive thought,* Lawrence Erlbaum Associates, Hove] is a macro-theory which aims to explain aspects of information processing. The aim of this review is to examine whether ICS provides a useful platform for understanding common processes which maintain psychological disorders. The core principles of ICS are explained and theoretical papers adopting ICS to explain a particular psychological disorder or symptom are considered. Dysfunctional schematic mental models, reciprocal interactions between emotional and intellectual beliefs, as well as attention and memory processes, are identified as being important to the maintenance of psychological disorders. Concrete examples of how such variables can be translated into novel therapeutic strategies are given. The review concludes that unified theories of cognition and emotion have the potential to drive forward developments in transdiagnostic thinking, research and treatment.

Keywords: Transdiagnostic, theory, psychological treatment, cognition, emotion

Abbreviations: ICS Interacting Cognitive Subsystems; CBT cognitive behavioural therapy

Correspondence to: Dr. Felicity Ann Cowdrey, Clinical Psychologist, Cotswold House Specialist Eating Disorder Unit, London Road, Marlborough, UK, SN83HL. Email: felicity.cowdrey@nhs.net

Received 22-Jun-2014; received in revised form 08-May-2015; accepted 17-May-2015

Table of Contents

Introduction

Effective psychological therapies are largely the product of clinical theory. There are a multitude of special purpose clinical theories, so called ‘micro-theories’, which have resulted in psychological interventions for specific diagnoses or symptoms. For example, the cognitive theory of depression proposed by Beck and colleagues underpins cognitive therapy for depression (Beck, 1967), for which there is an impressive evidence-base (Butler, Chapman, Forman, & Beck, 2006). Similarly, the cognitive theory of social anxiety disorder has guided the development of a specific form of cognitive behavioural therapy (CBT) which is now the recommended treatment for this presentation (Clark & Wells, 1995; NICE, 2013). Whilst micro-theories emphasise different psychological processes to a greater or lesser extent, common constructs can be identified across them such as schemata, arousal and attention (Beck & Haigh, 2014). These constructs have been derived from basic scientific theories which detail the fundamental mechanisms of cognition and affect.

Despite some common ground, significant theoretical heterogeneity has emerged within clinical psychology. This is not due to fundamentally different processes underpinning psychological disorders; rather it is a result of theorists highlighting particular constructs over others, using different language to describe seemingly similar processes or in some cases, attributing a different meaning to the same word. For example, the terms ‘meta-cognition’, ‘observing self’ and ‘mindfulness’ have been adopted by different theorists to refer to overlapping processes. Similarly, the meaning of ‘schema’ (or plural ‘schemata’) is different depending on the specific theory being studied. For Beck, schemata are cognitive representations of an individual’s prior experiences (Beck, Rush, Shaw, & Emery, 1979), whilst for other theorists schemata refer to broader and multimodal (sights, sounds, smells) representations of past memories (James, Reichelt, Freeston, & Barton, 2007).

Micro-theories emphasise different constructs, whilst omitting others, depending on the phenomena which they are trying to explain. This is in part understandable; in developing theory for applied clinical settings, there has to be a trade-off in terms of applicability for clinicians versus theoretical completeness. Basic scientific theory, which arguably has the potential to explain psychological phenomena in more detail, can be complex and as identified by Barnard, a very detailed understanding of such theory is not necessary in order to conduct effective therapeutic work with clients (Barnard, 2004).

There are, however, potentially some disadvantages of using micro-theories which focus on specific disorders or symptoms. Psychological disorders are defined by a constellation of symptoms. Therefore, in order to understand and treat a psychological disorder in its entirety, theories need to have the potential to explain the range of signs,

symptoms and processes associated with a particular psychological disorder. As micro-theories have restricted scope, therapists may have to switch between theories and therapies both when working within a disorder or across disorders (for example, in the case of co-morbidity). By relying on micro-theory, therapists may find themselves switching between theories depending on whether they deem that attention, memory or cognition is the crucial factor in maintaining a client's symptoms. This requires clinicians to understand a range of theoretically diverse terms, processes and principles. Perhaps unsurprisingly, it has been identified that clinicians are not always familiar with the theoretical underpinnings of treatments they are administering (Dobson & Beshai, 2013). This is concerning given the view that greater working knowledge of theory will result in better clinical outcome (Herbert, Gaudiano, & Forman, 2013). Further, each time a micro-theory is developed for a specific process or disorder, a new programme of research is required to test the validity of the predictions it makes. Diverging from the law of parsimony, this seems an inefficient way of working, especially if the results do not support the theory in question.

There is also the issue of accounting theoretically for symptom overlap. Individual micro-theories cannot explain commonalities across disorders and nor should they; by definition, micro-theories are disorder-specific, accounting for a specific disorder's aetiology and maintenance. However, this poses a significant challenge for the transdiagnostic movement as proponents of this argue for an 'across-diagnosis' perspective rather than focusing on specific disorders (Mansell, Harvey, Watkins, & Shafran, 2008). Whilst intuitively this makes sense, without a unifying theory, 'pick and mix' models will simply be replaced by 'pick and mix' processes.

One alternative to micro-theories is to use comprehensive 'macro-theories' to bridge the gap between basic scientific theory and micro-theories (Barnard, 2004). Macro-theories aim to not only explain individual mental components, such as memory and attention, but model how these basic components work together (Barnard, May, Duke, & Duce, 2000). Using macro-theory, it may be possible to overcome some of the disadvantages of relying on micro-theories whilst negating the need for clinicians to have an extensive understanding of basic scientific theory. The possible advantages of using macro-theories generally in clinical practice will be considered briefly.

Macro-theories detail the mechanisms which underlie 'normal' cognition and affect and have evolved as a result of empirical research in the general population. This is an advantage as such theories can be used as a platform for understanding how 'normal' mechanisms go wrong in the case of psychological disorders. Such an approach lends itself to more streamlined and less stigmatizing research strategies which seek to test hypotheses about what happens when mechanisms function beyond the limits of the 'normal' range. Further, macro-theory provides a common language which could be used across problems and contexts. In this way, various micro-theories could be subsumed by an overarching macro-theory but importantly, consistent terminology would be used to describe similar concepts. Lastly, macro-theory could model the *interaction* between processes thereby accounting for both symptom overlap and differences.

Given the advantages of macro-theories, it is important to recognise that they do not dominate the theoretical landscape in clinical psychology and consider why this is the case. Compared to micro-theories, which are restricted in nature, understanding macro-theories in the first instance requires significant investment in terms of time. This may be a challenge for busy clinicians whose practice has been successfully informed by micro-theories for many years. Further, macro-theories are not theories in the traditional sense that the field of clinical psychology has tended to employ them; they are based on 'normal' functioning and account for many aspects of human experience. Therefore, macro-theories have low predictive power for explaining a specific clinical phenomenon and it is initially hard to envisage how such theories could be distilled to explain a specific phenomenon. Lastly, as macro-theories define the basic units and mechanics of the human mind, the evidence-base is specified at a different level compared to clinical theories. Whilst macro-theories generally have strong theoretical evidence in supports of their key attributes, there is a relative lack of data examining the mechanisms in clinical subjects. This potentially reduces their applicability to clinical practice.

There are now a number of frequently cited theories which go beyond the definition of a micro-theory, such as Perceptual Control Theory (Powers, 1973; Powers, Clark, & McFarland, 1960); The Perceptual Motor Processing Model of Emotion (Leventhal, 1979), The Schematic Propositional Analogical and Associative Representation Systems Approach (Power & Dalgleish, 1997) and the Generic Cognitive Model (Beck & Haigh, 2014).

For the purpose of this review, Interacting Cognitive Subsystems (ICS) (Teasdale & Barnard, 1993) has been selected as the lens through which the potential use of macro-theory transdiagnostically will be investigated. ICS has been selected for number of reasons. Firstly, as ICS cites as an aim "to be able explain all aspects of information processing" (Teasdale, 1993 p. 344), it is potentially relevant to the theoretical understanding of psychopathology transdiagnostically. Secondly, clinicians only need a broad understanding of ICS as a whole; specific processes or aspects of ICS that pertain to a particular clinical phenomenon can be concentrated on. Thirdly, ICS provides a theoretical rationale for the use of novel interventions, such as mindfulness-based interventions. This is timely given the surge of interest and evidence in support of mindfulness-based interventions for a range of psychological and health problems (for a review see Fjorback, Arendt, Ornbol, Fink, & Walach, 2011). Lastly, ICS is a general framework of how the mind works and therefore a number of the predictions have been systematically tested in the general population (for example, Barnard, Scott, & May, 2001; Ramponi, Barnard, & Nimmo-Smith, 2004; Scott, Barnard, & May, 2001). Papers have addressed how ICS explains a wide range of empirical phenomena in language, understanding, short term and working memory, visual attention, cognition and emotion (for example, May, Dean, & Barnard, 2003; Su, Bowman, & Barnard, 2011). Mechanisms that are hypothesised to go outside the normal limits in clinical conditions have also been tested and modelled computationally. In one key experimental study, healthy participants were induced to ruminate and following this manipulation, the same effects on memory were observed as that seen in a depressed state; that is, lower levels of autobiographical recall and recognition memory (Barnard, Watkins, & Ramponi, 2006; Ramponi et al., 2004).

Overview of ICS

ICS was first described as a macro-theory which has the potential to explain aspects of information processing (Barnard, 1985). Initially, ICS was used to explain performance on short-term memory tasks and was later developed to explain the interaction between cognitive processes and emotional reactions by Barnard and Teasdale (Barnard and Teasdale, 1991). The essence of ICS can be understood by drawing on five key principles which will be briefly outlined. Table 1 provides a glossary of key terms used within ICS.

Firstly, ICS suggests that qualitatively distinct information is encoded as nine different mental codes, each by their respective subsystem: acoustic, visual, body-state, object, morphonolexical (speech forms), propositional, implicational, articulatory and limb. Each of these subsystems process a specific type of mental code (for example, the acoustic subsystem processes acoustic code); conducts a transformation process from one code to another and contains a code-specific memory store or 'image record' (Figure 1). These 'image records' can be drawn upon at times of remembering but also when trying to comprehend a specific situation or predict a future outcome. Multiple records of the same event will therefore be stored but in the different subsystems (for example, an acoustic store and a visual store), which is consistent with how other theories conceptualise the storage of, for example, autobiographical memories (Brewin, Gregory, Lipton, & Burgess, 2010). Information transformation therefore occurs within a specific subsystem and successful information processing involves the exchange of information between subsystems. As a result, the code which is inputted into a system will differ from code which is outputted.

In ICS, information processing occurs through a chain of transformations and the nature of these transformations is based largely on previous experiences. For example, visual information of a person's boss frowning at them will be inputted as visual code that may activate an intrusive image of a past experience of depression (within subsystem transformation producing an 'image record') which then is transformed into an effector code constituting somatic symptoms of the depressive episode, such as a slumped posture. As will be discussed further below, if the constellation of codes is typical of a previous affect-related experience, an emotional response will occur. This transformation process may partially account for the confusion individuals experience in understanding their responses to both internal and external stimuli, that is, the relationship between a boss's frown and slumping into one's seat is not immediately obvious.

Table 1: Summary of Key ICS Terms and Processes

ICS term or process	Description
Cognitive subsystems	The workings of the mind are modelled by interactions between subsystems which are constrained by a number of operating principles.
	Each subsystem deals with a different type of code such as acoustic code or visual code.
	Information processing involves the transformation of patterns of information in one code into patterns of information in another code.
	Totality of these interactions produces a model of the mind as a dynamic and self-organising system.
Propositional meaning	Encoded in propositional subsystem.
	Conceptual, analytical and can be assessed as true or false.
	Not connected to emotion, physical sensation or body-states.
	The kind of meaning of individual words in a sentence or the individual actions that make up a sequence in a practical visuospatial task.
	Carries no affective charge.
Implicational meaning	Represents higher order implicit meanings, or schematic mental models of experience, encoded in the implicational subsystem.
	Generic, holistic meaning which lack explicit detail.
	Similar to the meaning of a whole sentence, rather than the individual words.
	Comprised of multimodal patterns of code (propositions, sensory, and body-state sources).
	The kind of meaning linked to felt senses or intuition.
	Can carry affective charge and it is the only level of representation that can directly produce emotion.
Body-state subsystem	Encodes interoceptive (e.g., heart rate), somatic (e.g., touch) and proprioceptive (e.g., posture) signals, labelling location, intensity and rate of stimulation, as well as taste and smells.
	Different bodily inputs are integrated into a felt sense of the body.
	Subjectively corresponds to bodily sensations, for example, of pressure, pain, positions and experience of parts of the body.
Direct transformation	Occur online, without awareness in real time.
	Ongoing, occurring in the background.
Buffered transformation	Transformation from one code to another code via an image, akin to a short term memory store.
	Allows a large array of information to be transformed in ‘chunks’.
	Buffer can only be held at one subsystem at a time, but can constantly shift.
	Location of buffering determines the focus of attention.
Mode of processing	The focus of the mind’s attention
	Gives rise to mutually exclusive, distinct mindsets.
	A function of where buffered transformation is occurring (and thus where attention is directed).

The *way* in which information is transformed from one type of code into another is also important in ICS. The transformation process can occur in two different modes: direct and buffered. In direct mode, the transformation processes makes use of limited amounts of incoming information and occurs ‘on-line’. In buffered mode, chunks of incoming information are allowed to accumulate before the transformation process occurs. Thus in buffered mode, more information is collated before a response occurs and so the response reflects the wider context than is possible

in direct mode. Only one subsystem can enter buffered processing mode at any one time due to capacity restraints. Therefore, the buffered subsystem becomes the focal point for attention. For example, buffering of the body-state subsystem would result in awareness of bodily sensations.

Two subsystems capture specific and more general meanings: propositional and implicational. The information represented by propositional and implicational code is fundamental to the application of ICS to psychological disorders, particularly as emotion production depends on the implicational subsystem. Therefore, the propositional and implicational subsystems warrant further discussion.

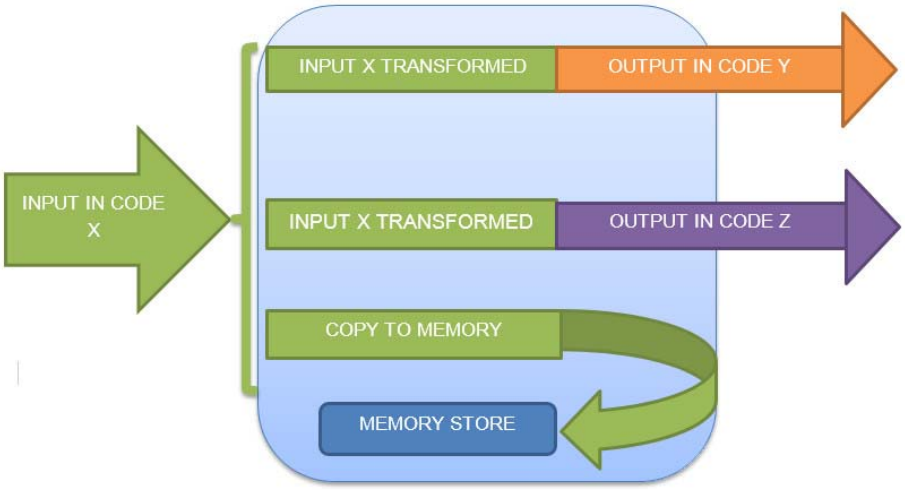

Figure 1a: The basic structure of a subsystem within ICS. ICS defines nine subsystems. One cognitive subsystem is shown. Two processes occur within each subsystem, transformations and copy processes. There is a memory store within each subsystem. Figure 1a is adapted from "Affect, Cognition and Change" by J.D Teasdale and P.J. Barnard, 1993, p.58.

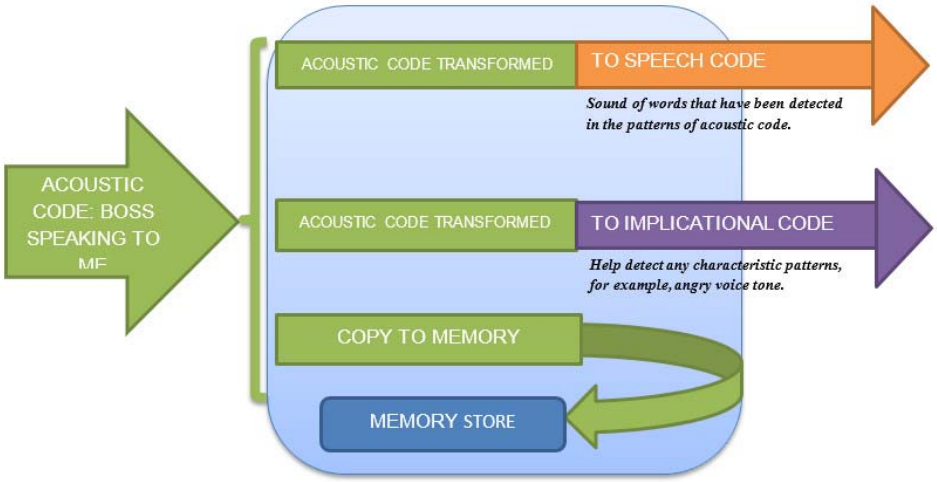

Figure 1b: An example of an acoustic cognitive subsystem at work. This subsystem contains both the acoustic to speech code (morphonolexical) and acoustic to implicational transformations. Acoustic information is received and transformed. It can then be stored as speech code and an integrative schematic code (implicational). In this example, implicational code might represent, for example, the schematic mental model "when my boss talks to me he is angry".

Two levels of meaning and emotion production.

ICS makes an important distinction between propositional and implicational meaning. Propositional code represents specific conceptual meanings that can have a truth value (Teasdale & Barnard, 1993). For example, 'My heart is beating faster' would be considered propositional as the concept is easy to grasp and can be assessed as being true or false. Patterns of implicational code represent a more generic and holistic level of meaning which is harder to express linguistically and experienced more like a felt sense, for example 'self as anxious' or 'self as weak and helpless'. This more abstract level of meaning is derived from specific propositional meanings combined with sensory-derived elements (Teasdale & Barnard, 1993). Within ICS, frequently co-occurring patterns of implicational code are thought of as 'schematic mental models' of experience. Therefore you may have a schematic mental model of 'unacceptable self' which is comprised of propositional code 'I'm boring and useless' and sluggish bodily feedback. The overall meaning captured by schematic mental models is qualitatively different from the sum of its parts. An analogy made by Teasdale and Barnard for understanding this is the difference between individual words of a sentence and the sentence as a whole; the meaning of a whole sentence (implicational meaning) is qualitatively different from the component words (Teasdale & Barnard, 1993).

The exchange of information *between* propositional and implicational subsystems is integral for the formation and maintenance of schematic mental models and functions as a control loop; schematic mental models generate specific propositions and propositions are processed and fed back to the implicational subsystem and used to modify schematic mental models (Teasdale & Barnard, 1993). Teasdale and Barnard have referred to the reciprocal dialogue the propositional and implicational subsystems as the 'central engine of cognition' (Teasdale & Barnard, 1993). As will be demonstrated, central engine 'malfunction' is thought to give rise to a number of processes, such as repetitive negative thinking, that are central to the onset and maintenance of psychological disorders.

The second important point about the implicational and propositional distinction is that emotion can only be generated by the implicational subsystem (Teasdale & Barnard, 1993). For a given emotion, there will be a schematic mental model which has been created based on previous situations which also elicited that emotion. When the implicational subsystem subsequently processes patterns of code which resemble that stored as the emotion-related schematic mental model, the corresponding emotion is produced. Given that schematic mental models are comprised of different types of code (for example, body-state, propositional, acoustic code), when the schematic model is activated, the emotional reaction will be experienced at different levels (for example, physiological, behavioural, affective) (Teasdale & Barnard, 1993). A unique feature of ICS is therefore the possibility for the same information to be represented at different levels. Thus, a person could remember an upsetting event at the propositional level but would not re-experience the emotion unless the information was also represented at the implicational level. Barnard and Teasdale have helpfully referred to the distinction between propositional and implicational meaning as the distinction between "knowing with the head" versus "knowing with the heart" (1991 p. 21); a distinction also often used by therapists and of crucial importance for understanding the application of ICS to a range of emotional difficulties.

Using the components of ICS described above, this review will evaluate whether ICS, as an example of a macro-theory, could contribute to, or even benefit, the theoretical understanding of psychological disorders transdiagnostically. By doing so, this review will highlight novel implications of macro-theory for clinical theory and practice.

Explaining Transdiagnostic Psychological Processes Using ICS

Cognitive Processes

Transdiagnostic cognitive and affective processes are at the heart of psychological disorders. It is therefore essential that clinical theory can accurately account for both the cognitive and affective experiences of clients. This section will consider how ICS explains intellectualised versus emotional beliefs, repetitive negative thinking as well as broader perceptions of the self which result from maladaptive schematic mental models. In particular, this section seeks to explore the extent to which ICS can explain the existence of these processes across psychological disorders. Table 2 provides further clinical examples of how ICS can be used to understand transdiagnostic psychological processes.

Table 2: ICS Constructs and Processes Applied to Clinical Phenomenon

ICS construct or component	Description	Clinical relevance and examples
Schematic mental model	Content of the models are based on previous experiences of co-occurring multimodal inputs. Regenerated on-line. Dormant models can be reactivated by a similar constellation of inputs. Determines content of cognition. Processing results in emotionally charged felt senses of the self.	In depression, there may be a deep-seated sense of the self as worthless and unlovable. This schematic mental model will be derived from repeatedly co-occurring patterns of visual input (mum frowning at me), acoustic input (angry tone of mum's voice), body-state input (slumped posture, lethargy) and propositional information (being told 'I am bad' by my parents).
Interlock	A self-perpetuating processing configuration can occur through ruminative, negative self-focused cognitive processing. Maintenance of the interlock depends on the continuous creation and regeneration of schematic mental models encoding certain themes. Does not allow the creation of modified, potentially more adaptive, affect-related schematic mental models.	Central to the maintenance of psychological disorders which are characterised by repetitive negative thinking and routine-bound or ritualised behaviour. In depression, interactions between the subsystems become dominated by processing information with negative, depressive content; depressogenic schematic mental models generate negative specific meanings (such as attributions for particular failures to personal, global inadequacies, or expectations of future failures and continuing depression); patterns of such meanings, in turn, regenerate depressogenic schematic mental models. The ruminative cycle is then maintained. Reinstatement of interlock can lead to relapse and recurrence. One strategy to prevent establishment of interlock configuration at times of potential relapse is to teach general 'mind management' skills, i.e. to disengage from 'doing mode' or 'mindless emoting mode' into 'mindful experiencing mode'.
Doing mode	Attention held at propositional subsystem. Relatively impersonal detached thoughts *about* the self or emotion and *about* goal-oriented strategies to deal with emotion and emotion-related problems. Focus on past or future rather than immediate, present-moment experience. Functional if used appropriately, for example when planning or problem-solving. Dysfunctional if overused as it suppresses awareness of emotion and body-state.	'Knowing with your head' or 'cold' cognition Depressive interlock is an example of 'doing mode'; here ruminative thinking *about* the self, *about* depression, *about* its causes and consequences dominate awareness. Worry in anxiety disorders may be explained by 'doing mode' processing. The individual thinks repetitively about threat-related information, for example, "they will look and me and think I am stupid", "I might hurt my children." In eating disorders, an individual might think repetitively about their weight and eating habits but remain detached from their bodily and emotional experiences and as a result are able to overcome hunger cues and resist eating.

Mindless emoting mode	Attention held at body-state subsystem. Overwhelming awareness of emotion. Individuals immersed in, and identify with, their emotional reactions, with little self-awareness, internal exploration or reflection.	In mania or hypomania, individuals are immersed in and identify with their affective reactions and so their behaviour becomes driven by affect rather than cognition. When individuals experience panic attacks, they are in 'mindless emoting mode'; overwhelmed by physiological sensations, unable to cooly reflect on their experiences. In anorexia nervosa, people may switch into 'mindless emoting mode' if they notice even subtle changes in sensory or body-state feedback, such as their waist band feeling tighter after eating. Feeling overwhelmed by such experience, they may report feeling fat, disgusting and out of control.
Mindful experiencing mode (Sometimes also referred to as '*being mode*' in the ICS literature).	Attention held at the implicational subsystem. Feelings, sensations and thoughts are directly sensed as aspects of subjective experience rather than just *thinking about* them. Focus is on the present-moment, reflexive awareness with a holistic, multisensory awareness of wider meaning. Similar to state of mind when meditating or reading poetry	In mindfulness–based cognitive therapy, one aim is to help individuals who have a tendency to get caught-up in ruminative cycles to mindfully observe negative thought patterns rather than dwell on them; it aims to move people into mindful experiencing mode. In anorexia nervosa, the body will be experienced as a valued part of the self when people are in this mode. In anxiety disorders, people will notice the physiological sensations and the catastrophic thoughts but not react in the same was as either in 'doing mode' or 'mindless emoting mode'.

Table 2 is adapted with permission from "Schematic models and modes of mind in anorexia nervosa 1: A novel process account. Park, Dunn and Barnard (2011). International Journal of Cognitive Therapy 4 (4), 415-437.

Knowing with the head versus knowing with the heart. Whilst formerly it has not been recognised as a transdiagnostic process, clinically it is often observed that clients can know something intellectually but still hold the opposite belief at an emotional level. As an example, a depressed client may know intellectually that they are not 'a total failure' and may be able to list all their recent academic and social achievements, yet they still experience a 'felt sense' that they have failed in life. Teasdale and Barnard have argued that micro-theories, including Beck's cognitive model, do not accurately represent what is known from cognitive science about the complexity of the human mind, particularly how the same information can be represented at different levels of meaning (Barnard, 2009; Teasdale, 1993, 1999; Teasdale & Barnard, 1993). By acknowledging that the same information can be represented at different levels ICS has the potential to model complex cognitive and emotional experiences.

As discussed previously, ICS recognises this distinction between intellectual (propositional) and emotional (implicational) meaning. Teasdale and Barnard suggest micro-theories of depression can be augmented by considering these different levels of meaning (Barnard, 2009; Teasdale, 1993, 1999; Teasdale & Barnard, 1993). In ICS, depression may be triggered by the processing of depressogenic schematic mental models, which for example encode a globally negative view of the self as a failure (Teasdale, 1993, 1999). Such models generate specific propositional meanings, such as attributing a perceived failure as being the result of global, internal, uncontrollable and stable factors. These in turn lead to the regeneration of depressogenic schematic mental models and the production of corresponding emotions (Teasdale, 1999). Therefore in ICS, the depressed state is maintained by the interaction between intellectual *and* emotional levels of meaning. Attention also has an important role in this which will be discussed further in the section on attentional processes.

Park and colleagues propose that since the same information can be represented at different levels of meaning, ICS can account for paradoxical experiences that clients' with anorexia nervosa experience (Park, Dunn, & Barnard, 2011). For example, individuals with anorexia nervosa often demonstrate a discrepancy between intellectual facts

about the body and their felt sense about the body (for example, “objectively I know I am underweight, but I still feel fat”).

Paradoxical experiences, such as those detailed above, cannot be readily explained by micro-theories, are often experienced as confusing and frustrating for clients and therapists and can often present a barrier to therapy. It is possible that the distinction between intellectual and emotional meaning in ICS explains why purely cognitive work is not sufficient at times to make a significant change to the client’s belief system; working with only one type of input (propositional meaning) may not be sufficient to shift an affect-related schematic mental model. As will be discussed further below, ICS would suggest that varying the codes would have a greater impact, for example using video feedback following a behavioural experiment may be more effective than verbal feedback for creating change in the schematic mental model. Using a common language, ICS therefore has the potential to explain some of the more challenging features of psychological disorders and from this novel treatment predictions can be made.

Schematic Mental Models

In many cognitive theories, schemata are thought to be integral for understanding the onset of psychological disorders. Schemata, in the Beckian sense, are defined as structures which organise an individual’s perception of the world. Negative schemata, which are thought to have a causal role in psychological disorders, develop as a result of the interaction between genetic factors, attentional and memory biases and adverse early life experiences (Beck & Haigh, 2014). They can be reduced to a specific static core belief or proposition and dictate the content of cognition is dictated by activation of a particular schema (Beck et al., 1979; Padesky, 1994). For example, in the context of depression, the negative automatic thought “I can’t cope with even simple tasks” may reflect activation of a ‘not good enough’ schema. In ICS, schemata (or ‘schematic mental models’) are broader, more dynamic and may include sensory as well as verbal information which has been encoded (Barnard, 2009; Teasdale, 1993; Teasdale & Barnard, 1993). Therefore, in ICS specific propositions (such as “I am weak”) form just one part of the broader schematic mental model.

What is not clear from disorder-specific cognitive theories is how seemingly similar schemata and negative automatic thoughts can result in different clinical presentations. This issue is particularly pertinent to the transdiagnostic debate (Mansell et al., 2008) and is something that ICS has the potential to explain. Using ICS, Park and colleagues suggest that the exact configuration of the schematic mental model in place may subtly differ and this may account for the disorder-specific features (Park et al., 2011). For example, there are significant parallels in terms of the content of cognition in anorexia nervosa and depression, yet these disorders present quite differently with the body being used more explicitly in anorexia nervosa to manifest psychological distress (Park et al., 2011). As schematic mental models in ICS are comprised of input from different subsystems, it may therefore be that the schematic mental models in place in anorexia nervosa and depression differ in terms of their contribution from the body-state subsystem. There is indirect evidence in support of this: Cowdrey and Park have demonstrated that rumination in individuals with anorexia nervosa is focused on body and eating-related themes (Cowdrey & Park, 2011).

Similarly, activation of a schematic mental model ‘self as bad’ may result in a delusional belief (“they are out to harm me”), rather than a depressive cognition (“I am useless”), if arousal and agitation from the body-state subsystem contributed to the schematic mental model (Gumley, White, & Power, 1999). Whilst it could be argued that agitation is a symptom of both depression and psychosis, ICS would suggest that it is the relative weight of inputs as well as the specific constellation that determines the exact presentation.

Schematic mental models in ICS have also been used to explain the dynamic nature of cognition within a disorder. For example, two extreme schematic mental models are thought to be central to the maintenance of anorexia nervosa: ‘self in control’ and ‘self out of control’ (Park et al., 2011). The schematic mental model which is in place will dictate the content of cognition at that time point. When ‘self in control’ schematic model is in place, the individual will experience high levels of ruminative thinking about eating, weight and shape and their control (Park et al., 2011). Clinically, this would be characterised by restrictive eating practices and other eating disordered behaviours which foster a sense of control. When ‘self out of control’ is in place, individuals will become preoccupied with thoughts about obtaining food and overwhelming feelings of greed, fatness and disgust (Park et al., 2011). Clinically, ‘self out of control’ would be characterised by subjectively or objectively bulimic phases. Unlike micro-theories, ICS therefore

has the potential to account for shifts in the subjective experience of the self. Whilst the example of eating disorders has been drawn on, the same ICS interactions could explain features of other clinical presentations, such as the marked and rapid shift in the experience of self that characterises bipolar disorder.

Repetitive negative thinking. There is good evidence that repetitive negative thinking is elevated in people experiencing a range of emotional problems and is considered a transdiagnostic process (Ehring & Watkins, 2008). In order to develop effective treatments to target repetitive negative thinking, it would be advantageous to have a single theoretical framework which can be applied across clinical presentations. ICS is one possibility.

As previously discussed, the exchange of information *between* propositional and implicational meaning functions as a control loop (Teasdale, 1993, 1999). Akin to any control system, the central engine of cognition can malfunction (Barnard, 2004). Under some circumstances the control system may become stuck in a negative feedback loop, described as 'interlock'; negative schematic models produce negative propositional outputs that, after further processing, produce inputs to the implicational subsystem that regenerate schematic mental models with the same affective tone (Teasdale & Barnard, 1993). Clinically, this will manifest as rumination or other forms of repetitive negative thinking. At other times, a runaway positive feedback loop may arise which would be characterised by rapid change in the schematic model in place.

In ICS, two interconnected feedback loops are particularly important for depression maintenance. The activity of the two interlinked feedback loops is termed 'depressive interlock' (Teasdale, 1993, 1999) which reflects the self-perpetuating and ruminative nature of information processing in depression (Figure 2). In the first feedback loop, the 'cognitive loop', negative specific meanings (propositional inputs) feed into depressogenic schematic mental models (implicational meaning) which in turn generate further negative specific meanings. The second feedback loop operates via the body-state subsystem. Sensory feedback from the impact of depression on the body (for example, slumped posture, frowning expression) regenerates the depressogenic schematic mental models and contributes to depression maintenance (Teasdale, 1993, 1999). Interestingly, a recent study has demonstrated that gait whilst walking is associated with memory for emotionally significant words (Michalak, Rohde, & Troje, 2015). In this study, undergraduate students adopted either a depressed or happy walking style and it was found that those who adopted the depressed walking style recalled significantly more self-referent negative words (Michalak et al., 2015). Whilst limited by the non-clinical sample, this study provides preliminary support for the ICS hypothesis that bodily feedback contributes to the maintenance of depression.

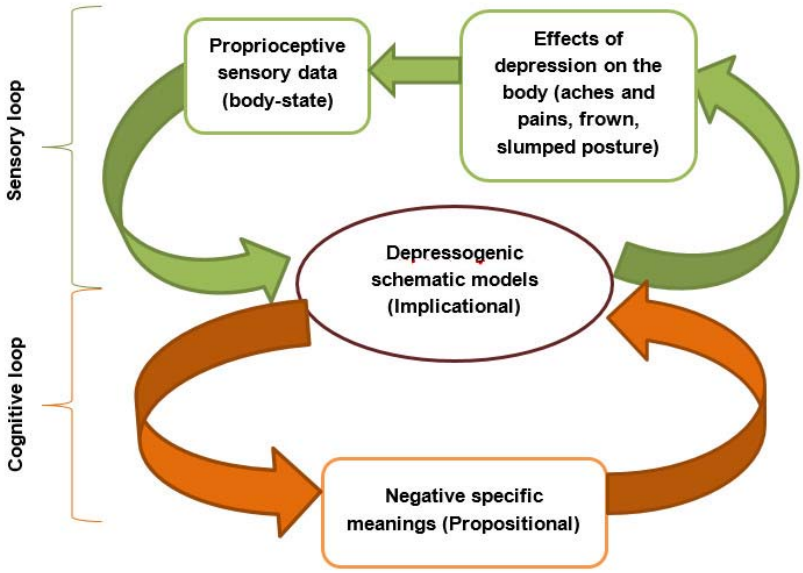

Figure 2. Depressive Interlock. In depressive interlock, depressogenic schematic models are maintained by specific propositional inputs as well as sensory feedback from the body.

The two interconnected feedback loops therefore keep individuals trapped in a ruminative cycle. Depressive interlock is thought to prevent the modification of schematic mental models as information which could potentially contribute

to the formation of non-depressogenic schematic mental models is not processed (Teasdale, 1999). As schematic mental models remain unmodified, the depressed state is maintained. ICS therefore indicates that a critical task in therapy is breaking interlock so that depressogenic schematic mental models can be accessed and updated. The final section of this review will consider strategies to do this.

The reciprocal interactions between the implicational and propositional levels of meaning have also been used to account for ruminative preoccupation on eating, weight and shape in eating disorders (Park et al., 2011) and could plausibly account for other forms of repetitive negative thinking. As an example, rumination in ICS terms reflects buffered propositional processing; such processing brings awareness to streams of ruminative thought which have been generated by the implicational – propositional cycle (Figure 2). Worry, a theoretically similar process to rumination (Borkovec, Alcaine, & Behar, 2004), has yet to be formally conceptualised using ICS. It may be that all that distinguishes worry in generalised anxiety disorder and rumination in depression is the temporal focus with rumination focused on the past and worry on the future. If the same processes were found to account for repetitive negative thinking transdiagnostically, the same treatment predictions could be made.

It is important to note that in ICS, attentional processes have a huge influence on ruminative states. How attentional processes interact with interlock to bring awareness to streams of rumination and other forms of repetitive negative thinking will be considered in the section on attentional processes.

Memory Processes

As described previously, memory is a key resource in ICS; there are separate memory systems for different types of mental code and procedural memory facilitates transformation processes. Further, schematic mental models are based on individuals' previous experiences of the world and are frequently re-accessed from memory.

This section is not an exhaustive or systematic explanation of all memory components using ICS, rather it serves to illustrate how aspects of ICS can be used to explain some of the memory processes which are known to be important to the onset and maintenance of psychological disorders transdiagnostically.

Encoding and retrieval. According to ICS, memory recollection requires activation of schematic mental models from which specific meanings can be derived (Barnard, 2004; Barnard & Teasdale, 1991; Teasdale & Barnard, 1993). In ICS, differentiation between schematic mental models has an important influence on recollection. Barnard and colleagues suggest that recollection deficits in depression may be due to little differentiation between schematic mental models compared to non-depressed individuals in that they emphasise negative themes about self, others and the world (Barnard, Murphy, Carthery-Goulart, Ramponi, & Clare, 2011). Consistent with cognitive conceptualisations of depression (Beck, 1967; Beck & Haigh, 2014), depressed individuals will have an overgeneralised negative view of the world. Barnard and colleagues propose that the similarity between negatively biased incoming information and depressive schematic mental models will prevent further processing or elaboration (Barnard et al., 2011). The schematic mental models therefore remain unmodified and the specific propositions which are generated and function as cues to previously stored memory are similar. The depressed individual may therefore struggle to recall other, potentially more positive, life events contributing to the maintenance of the depressed state. Whilst over general memory is most commonly associated with depression, there is evidence that this memory phenomenon also contributes to the development and maintenance of post-traumatic stress disorder and bipolar disorder (Dempsey, Gooding, & Jones, 2013; Williams et al., 2007). It is therefore possible that the notion of differentiation between schematic models could be used to explain overgeneralised memory across different diagnoses. Clearly, more research is needed to explore this hypothesis.

Fragmented memories following a traumatic event have also been explained using the concept of schematic mental models. It has been suggested that if only a limited amount of the information from the environment is attended to during a traumatic event, for example the smells and sounds during the event, then the trauma schematic mental model which forms will be based on only fragments of information (Lun, 2008). Consistent with other psychological theories of trauma (for example, Brewin et al., 2010), when the trauma schematic mental model is subsequently activated, the sensory pattern encoded at the time of trauma will be re-experienced but without the necessary propositional information to contextualise the experience (Lun, 2008). This is seen clinically when working with trauma clients; clients are often unable to integrate their experiences even if all the information is available. For

example, a client may be aware of visceral feelings at the time of trauma and know the sequence of events but they remain unable to connect the two experiences together which results in a high level of distress. As with existing treatment approaches, ICS would suggest that a key therapeutic task is helping clients to integrate different aspects of their experience and through doing so enable them to shift from a sense of 'self out of control' to 'self in control'.

May and colleagues have also used ICS to explain the notion of craving in those with substance dependence (May, Andrade, Panabokke, & Kavanagh, 2004). They suggest that external cues associated with a habitually used substance could be represented at any of the nine levels of code (for example, if an individual sees something which is associated with the substance it will be represented at a visual level). The code is then transformed. However, the exact nature of the transformation process is guided by an individual's learning history (procedural memory) which, for an individual with a history of substance-dependence, is stored as substance-related schematic mental models. Therefore, through a series of transformations, the cue which was initially seen visually may cause physiological changes (such as heart rate increasing). If this breaks through into conscious awareness it may be experienced subjectively as craving for the substance. Therefore, it is the initial cue that triggers craving via reactivation and regeneration of schematic mental models associated with substance-use which are stored in memory (May et al., 2004).

Schematic mental models and the interactions with other subsystems are central to the ICS understanding of memory processes. Whilst the extant literature has focused on specific disorders, it is plausible that the same ICS processes could be applied transdiagnostically. For example, craving in binge-eating disorder could be explained in a similar way to the ICS conceptualisation of craving in substance-dependence. Further, it is worth noting the marked similarity in the processes through which schematic mental models become re-activated to give rise to craving and other examples given previously, such as the re-activation of depressogenic schematic mental models. This exemplifies how the same processes within ICS can be used to explain phenomena that characterise different clinical presentations.

Attentional Processes

Attentional processes, such as selective attention and attentional avoidance, have been identified transdiagnostically as contributing to the maintenance of disorder (Mansell et al., 2008). Despite this, micro-theories differ in the extent to which they emphasise attentional processes. For example, the cognitive model of body dysmorphic disorder (Veale et al., 1996) identifies self-focused attention as central to the disorder's maintenance, yet attentional processes are not explicitly mentioned in the cognitive model of bulimia nervosa (Fairburn, 1981). Does this mean that when formulating and treating a client with bulimia nervosa, clinicians do not need to consider attentional processes? As macro-theories aim to provide a comprehensive framework, there is less trade-off between the processes which are made explicit and those that are minimised.

The mode of processing refers to exactly how and where attention is directed within ICS. Different modes of processing are characterized depending on whether buffered processing is occurring predominately on the propositional, implicational or one of the other subsystems (Teasdale, 1993, 1999). As the information processed by the buffered subsystem will then dominate the whole processing configuration, it may give rise to different symptoms. Interlock is a good example of what happens if the propositional subsystem is buffered. In this scenario, awareness will become dominated by intellectualised and detached thoughts about perceived discrepancies and attempts to resolve these. This mode of processing is referred to as 'doing mode' in ICS (Teasdale, 1999). Whilst 'doing mode' can be adaptive - problem-solving being a prime example of this - persistent processing in this mode will result in high levels of repetitive negative thinking which in turn will contribute to the regeneration of dysfunctional schematic mental models (Teasdale, 1993, 1999).

Equally, when neither the propositional nor implicational subsystem is buffered, individuals will be unable to coolly reflect or demonstrate intuitive knowledge about their emotional experience; instead individuals will become overwhelmed and immersed in it. Therefore, when both the propositional and implicational subsystems are in direct as opposed to buffered mode, the individual will enter a 'mindless emoting mode (Teasdale, 1993, 1999). 'Mindless emoting mode' is also experienced as highly aversive as individuals become 'lost' in emotional experience (Teasdale, 1999). It is thought that both anorexia nervosa and depression involve fluctuations between 'doing mode' and

'mindless emoting mode'. For example, 'doing mode' may be perceived as relatively rewarding by those with anorexia nervosa as it prevents the individual from attending to the overwhelming and aversive body-state and emotional information that characterises 'mindless emoting mode'(Park et al., 2011).

Unlike in depression and anorexia nervosa where there is fluctuation between the different modes, for people who persistently feel overwhelmed by emotional experiences and as a result engage in self-destructive or impulsive behaviours, it is plausible that mindless emoting may be their default mode of processing. Manic episodes in bipolar disorder would be one example of this. ICS would hypothesise that in a manic state attention is held at the implicational level where there is a high rate of change in the content of the image and the schematic models represented by it (Barnard, 2004). With less attention being paid to the details and content of specific propositions, people enter a 'runaway' cognitive state in which they are immersed in and identify with their affective reactions with little self-awareness, internal exploration or reflection. This could explain some of the behavioural symptoms of a manic episode, such as individuals engaging excessively in pleasurable activities without ability to reflect on or integrate the potential consequences. These hypotheses about the processes involved in mania have some preliminary supporting evidence. For example, Lomax and colleagues used a task designed to investigate different modes of processing and demonstrated that euthymic individuals with bipolar disorder were more likely than a healthy control group to answer questions that were consistent with an implicational mode of processing (Lomax, Barnard, & Lam, 2009).

'Modes of processing' in ICS therefore have the potential to explain how attentional processes contribute to the maintenance of disorders transdiagnostically. This is in contrast to micro-theories which are variable in the extent to which they consider attentional processes.

Somatic Processes

Information from the body has an integral role in production of emotion in ICS and is identified as an important factor in the maintenance of psychological disorders. Micro-theories differ in the extent to which they consider the role of information from the body. For example, central to the cognitive theory of panic disorders is the catastrophic misinterpretation of bodily sensations (Clark, 1986) but somatic inputs have a more subtle role in the cognitive model of obsessive compulsive disorder (Salkovskis, 1985).

In the ICS conceptualisation of depression, feedback from the body (such as slumped posture and reduced activity) reinforces interlock between specific propositional and implicational meaning (Teasdale, 1993, 1999). In contrast to depression, ICS suggests that in mania the exchanges between the propositional and implicational subsystems enter a 'runaway state' which is reinforced by heightened bodily activation (Barnard, 2004). Awareness of this heightened internal state is used as evidence that one has the energy and confidence to achieve a desired goal and thus may manifest as impulsive behaviour. Similarly, in people with more enduring Axis-II psychopathology, Clark (1999) suggests that the immediate connection between the implicational and body-state subsystems in ICS enables creation of vicious cycles between states of arousal, emotion production and behavioural response. As information about arousal reaches the propositional subsystem indirectly, situations which elicit arousal are not appraised and responded to 'coolly', but rather guided by dysfunctional schematic mental models (Clarke, 1999).

Park and colleagues suggest that in anorexia nervosa, the feedback from the body has a particularly influential role in the disorder's maintenance (Park et al., 2011). According to this account, patterns of body-state feedback make an equal contribution to the regeneration of anorexic schematic mental models as cognitive feedback. Park and colleagues argue that existing cognitive frameworks of anorexia nervosa focus exclusively on the cognitive elements and neglect the important interactions between emotion and body-state feedback in the maintenance of anorexia nervosa (Park et al., 2011; Park, Dunn, & Barnard, 2012).

ICS has not yet been theoretically applied to disorders in which misattribution of somatic sensations are central, such as health anxiety or medically unexplained symptoms. However, as ICS recognises the importance of somatic inputs in generating an emotional response, it seems plausible that ICS could augment the formulation of these disorders. For example, rather than hypervigilance to the body *per se* maintaining health anxiety (Salkovskis & Warwick, 1986), it may be the way in which information about the body is processed. A 'doing mode' of processing, characterised by intense awareness of intellectualised thoughts about internal and external stimuli, may drive rumination and

avoidance. Therefore, shifting into an experiential mode of processing in which anxious thoughts and bodily sensations are experienced as passing events may be beneficial. In support of this, a recent trial has demonstrated that mindfulness-based cognitive therapy augments the treatment of health anxiety compared to when health anxious individuals receive usual treatment alone (McManus, Surawy, Muse, Vazquez-Montes, & Williams, 2012).

ICS, in contrast to a number of micro-theories, recognises the direct contribution that somatic processes have in emotion production which is relevant to a range of clinical presentations. However, subtle differences in the interaction between schematic mental models, propositional meanings and somatic states have may reflect disorder-specific features. Importantly, ICS gives equal weighting to sensory information. This could be particularly helpful for devising novel strategies to augment existing cognitive treatments.

Accounting for Comorbidity

Despite different clinical presentations, the reality is that in clinical practice individuals rarely present with one discrete disorder (Kessler, Chiu, Demler, & Walters, 2005). It is possible that the same processes may contribute to the onset and maintenance of a range of different disorders or that a particular process increases the likelihood of another occurring (Harvey, Watkins, Mansell, & Shafran, 2004). If the transdiagnostic perspective is to progress, it will be important for any theory to be able to account for comorbidity. The extant literature on ICS has tended to explain certain processes in the context of a specific disorder; interlock explains rumination in depression, for example. However, this does not mean that other interactions cannot be occurring simultaneously and therefore give rise to symptoms which would be associated with another comorbid condition. As an example, Barnard suggests that delusional ideation is the result of asynchrony between propositional feedback to the implicational subsystem (Barnard, 2004). Whilst this specific interaction might be the defining feature of a psychotic presentation, it does not exclude other maladaptive patterns occurring simultaneously. Thus, in addition to asynchrony, interlock between the propositional and implicational subsystems could be occurring which would give rise to rumination at the same time as psychotic experiences. Thus an individual may meet diagnostic criteria for depression in addition to a psychotic disorder. Simultaneous interactions could also explain other comorbid presentations.

Processes Involved in Relapse

Having theory which accounts for the processes involved in relapse is critical as it enables the development of techniques for preventing or managing its occurrence. In ICS, reoccurrence of *multimodal patterns* of information associated with an episode of illness is thought to contribute to relapse through reactivation of schematic mental models (Barnard, 2009; Teasdale, 1993, 1999). Importantly, it is the specific constellation of constructs (for example, visual, propositional, body-state elements) which lead to reactivation of the schematic model opposed to the activation of individual constructs. This is different to micro-theories which tend to focus on a relatively narrow set of factors, for example maladaptive cognitive patterns combined with a life stressor resulting in depression relapse (Beck et al., 1979).

In depression, patterns of co-occurring information associated with previous episodes of depression trigger reactivation of depressogenic schematic mental models (Teasdale, 1993, 1999). In anorexia nervosa, whilst the processes involved in relapse are similar to depression, Park and colleagues emphasise the role that previous patterns of body-state inputs have in reactivation of an ‘anorexic schematic mental model’ stored in long term memory (Park et al., 2011). Further, akin to the kindling hypotheses in depression (Segal, Williams, Teasdale, & Gemar, 1996) for which there is substantial supporting evidence (for a review see Monroe & Harkness, 2005), Park and colleagues suggest that a less significant set of circumstances compared to the first episode of anorexia nervosa (for example, unintentional weigh loss following exam stress) could reactivate the anorexia nervosa schematic mental model (Park et al., 2011).

Gumley and colleagues propose that if a configuration of internal and external cues bear strong similarity to a previous episode of psychosis, schematic mental models will be accessed more rapidly than if the cues contain elements which are discrepant to previous episodes (Gumley et al., 1999). Similarly, May and colleagues suggest that if schematic mental models related to a particular substance are reactivated by internal (such as intrusive imagery) or external cues in an individual with a history of substance dependence then the existence of procedural knowledge

would lead to the elaboration of specific propositional meanings about obtaining and using the substance (May et al., 2004). Thus reactivated schematic mental models may trigger craving and ultimately motivate an individual to seek out a substance.

According to ICS, relapse can therefore involve multiple and interacting sources of information. The detailed analysis of how different subsystems interact offered by ICS has implications for formulating and predicting the factors and processes involved in relapse. It could also account for changes in diagnosis over time; a subtle variation in a constellation of constructs would result in activation of a different schematic mental model which in turn would drive a different set of symptoms. For example, a configuration of internal and external cues which previously resulted in social anxiety disorder may subsequently result in depression if the configuration lacked arousal from the body-state subsystem.

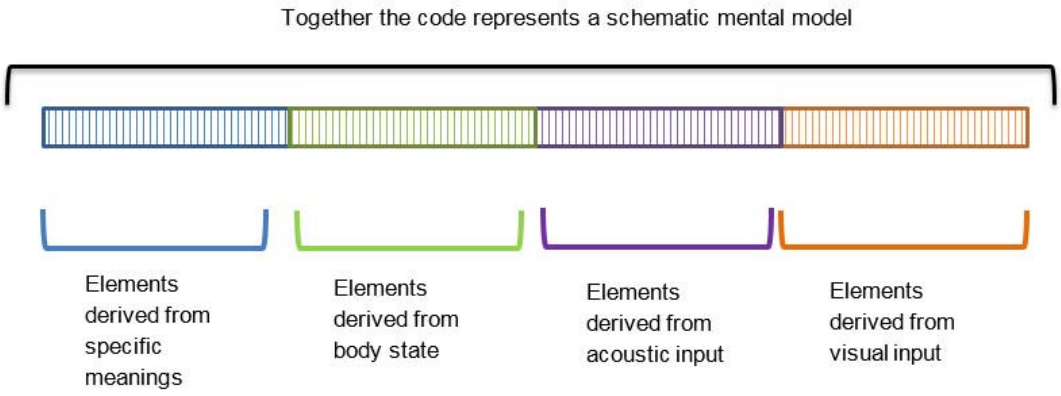

Figure 3a: A representation of a generic implicational schematic mental model. The schematic mental model is made up from specific propositional meanings as well as a range of sensory inputs to give an overall meaning. Figures 3a is adapted from "Emotion and two kinds of meaning: cognitive therapy and applied cognitive science" by J.D Teasdale, 1993, Behaviour, Research and Therapy, p.351

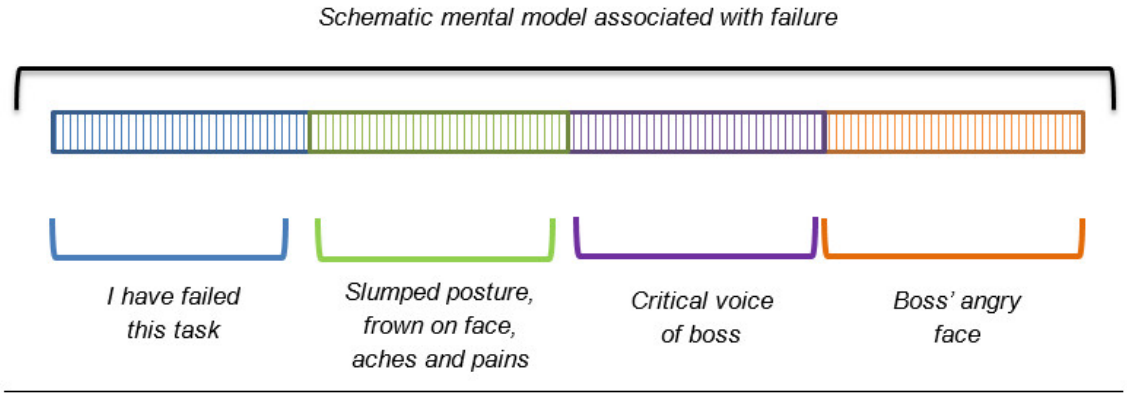

Figure 3b: A representation of a schematic mental model in depression. In depression, an individual may have synthesised the high level meaning of 'self as a failure' based on a range of inputs including sensory (for example, sensory feedback from a slumped posture), acoustic (boss' tone of voice) and propositional meaning (for example, only scoring 40% in the test).

Implications of ICS for Psychological Treatments

According to ICS, it is the occurrence of multimodal patterns of information (for example, visual, propositional, body-state elements) which lead to activation of the maladaptive schematic mental models (or reactivation in the case of relapse) and give rise to symptoms associated with psychological disorder (Barnard, 2009; Teasdale, 1993, 1999).

This is different to micro-theories which tend to focus on a relatively narrow set of factors. Given that ICS provides a broader and more holistic theoretical foundation, it is possible that novel treatments could be derived from it to target the key processes which are known to contribute to the onset and maintenance of psychological disorder.

ICS broadly points to two targets for intervention: developing and encoding adaptive schematic mental models and shifting the mode in which information is processed. The next section will consider how ICS could lead to the development of novel treatments to augment existing approaches.

The Development of Adaptive Schematic Mental Models

In order to avoid interlock, individuals need to develop and encode adaptive schematic mental models (Duff & Kinderman, 2006; Teasdale, 1999). Using depression as an example, Figure 3a demonstrates how schematic mental models are defined by information from a range of sources. Since ICS suggests that it is the total pattern of information that determines the meaning of the schematic mental model and the response generated, Teasdale suggests that changing a small section of the pattern will result in a shift in the overall meaning (Teasdale, 1999). For example, the implicational meaning created following task failure in Figure 3b would be different if the specific propositional meanings were combined with an upright posture and a smile.

Cognitive strategies, such as cognitive restructuring, may be helpful for changing specific propositional meanings which contribute to the schematic mental model. However, as can be seen from Figure 3, there are many different elements which could be targeted that would have the same net effect of altering the overall meaning of the schematic mental model. For example, there is increasing interest in the use of physical and sensory-based interventions, such as dance movement therapy and interoceptive exposure, in reducing psychological distress across a range of psychological disorders and problems (Kiepe, Stöckigt, & Keil, 2012; Park et al., 2012; Wald, Taylor, Chiri, & Sica, 2010). Such approaches, which focus much more on the role of sensory inputs and the body in changing higher level meanings, are in contrast to cognitive models which tend to neglect the role of such inputs. That said, behavioural experiments in CBT may alter the sensory inputs into the schematic mental model. For example, a client with panic disorder who avoids exercise for fear of a heart attack may experiment with running on the spot to test out their catastrophic cognitions. Sensory feedback from the body during the experiment would feed into the schematic mental model alongside propositional input derived from the cognitive work. The integration of the sensory and propositional input may have a net effect of altering the overall meaning of the schematic mental model. Therefore, as well as using the ICS framework to derive novel treatment strategies, it can be used to provide a theoretical justification for components of CBT.

Equally, it is possible that certain interventions which are employed routinely in cognitive therapy may be ineffective, or even unhelpful, because they reactivate and drive maladaptive schematic models. For example, Park and colleagues consider the effect of asking individuals with anorexia nervosa to complete food diaries whilst in a ruminative ‘doing mode’ of processing (Park et al., 2012). They predict that such tasks will generate negative propositional information which will feed back into the implicational subsystem and contribute to the regeneration of maladaptive schematic models. Whilst speculative, it could similarly be argued that the use of thought records in depression could contribute to rumination on negative thoughts about self, world and future if completed whilst in a ‘doing mode’ of mind. ICS therefore provides a framework for understanding why certain therapeutic tasks may be experienced as unhelpful at times by clients.

Innovative interventions which add new elements into the schematic mental model, such as guided imagery (Park et al., 2012) and the use of metaphor (Ylvisaker & Feeney, 1995), could shift meaning and facilitate the formation of positive schematic mental models of self. Such interventions could be paired with strategies which aim to facilitate retrieval of positive material. For example, Dalgleish and colleagues have demonstrated that currently depressed individuals and those in remission can be trained to retrieve positive, self-affirming autobiographical memories using mnemonic techniques (Dalgleish et al., 2013). Therefore, macro-theory could potentially enable clinicians to be creative in their approaches whilst being guided by theory.

Shifting Attention

In ICS, the generation of emotion depends on the implicational subsystem being buffered. Teasdale and others argue that cognitive strategies used in CBT target '*cold*' propositional information and fail to facilitate buffering of the implicational subsystem (Duff & Kinderman, 2006; Park et al., 2012; Teasdale, 1993). Using such strategies, individuals can easily change what they know (propositional meaning) but may not necessarily change how they feel. According to ICS this is problematic as without change at the implicational level, individuals are left vulnerable to relapse (Duff & Kinderman, 2006; Gumley, 2002). Therefore, to augment CBT, ICS suggests that individuals need to develop skills in noticing dysfunctional processing modes and switching to more adaptive processing modes (Teasdale, 1993, 1999) .

Using the ICS framework, it has been suggested that training individuals to notice 'doing' or 'mindless emoting' modes, disengage from them and shift their attentional focus towards 'mindful experiencing' may reduce relapse into disorder (for example, Clarke, 1999; Duff & Kinderman, 2006; Gumley et al., 1999; Lun, 2008; Park et al., 2012; Teasdale, 1999). In 'mindful experiencing mode', aversive information, is purposefully attended to but not challenged or changed directly. Using depression as an example, in 'mindful experiencing mode', depressive thoughts are experienced as passing events in the mind which do not need to be elaborated on (Teasdale, 1999). The task of purposeful attending therefore competes with the interlock process which ICS suggests is integral to the maintenance of a range of psychological disorders and problems.

A number of therapies have been developed which aim to increase awareness of cognitive and affective experiences including mindfulness-based cognitive therapy (Segal, Teasdale, & Williams, 2002), meta-cognitive therapy (Wells & Matthews, 1996), dialectical behaviour therapy (Linehan, 1993) and acceptance and commitment therapy (Hayes, 2004). All of these have an element of mindfulness included. Mindfulness, defined as "paying attention in a particular way: on purpose, in the present moment and non-judgementally" (Kabat-Zinn, 1994 p.4) is developed through meditation practice and teaches mode management skills. According to the ICS analysis, such approaches should be helpful for disorders characterised by maladaptive cognitive processes, such as rumination (Park et al., 2011; Teasdale, 1999). Further, specific forms of CBT have been developed to target the processes underpinning emotional problems opposed to the content of cognition. For example, rumination focused CBT aims to help people shift from unhelpful to more helpful forms of repetitive thinking using imagery, experiential strategies and functional analysis (Watkins et al., 2011). The overall aim of this intervention is to shift individuals out of an abstract-evaluative ('Why') mode and into a concrete-experiential ('How') mode (Watkins & Teasdale, 2004). As with mindfulness-based intervention, rumination focused CBT may compete with the interlock by training individuals to purposefully attend to the mode of processing and alter inputs into the system when an unhelpful processing style is identified.

It is important to note that based on the ICS analysis, some psychological problems may require more focus on the propositional subsystem and less on the emotion-laden implicational subsystem. In the case of mania, where processing is focused on general implicational meanings, strategies which help individuals to detect propositional meanings and reconcile discrepant information may be more effective (Barnard, 2004). Approaches other than mindfulness, such as cognitive remediation training, may therefore be more effective (Lomax et al., 2009).

This section has demonstrated how ICS can be used to generate treatment predictions and strategies across disorders. This represents a different way of working in that clinicians tend to switch between micro-theories depending on the specific clinical presentation. ICS encourages a coherent understanding of an individual's difficulties that accounts for comorbidity, complexity and the role of transdiagnostic mechanisms.

Advantages and Disadvantages of Applying ICS Transdiagnostically

ICS is able to describe and explain disrupted processes that transcend diagnostic boundaries, such as attention, memory and thought processes. Treatments could therefore be developed to target the specific mechanisms or processes regardless of diagnosis. As ICS takes a holistic approach to understanding cognitive and emotional processes, innovative strategies can be developed whilst being theoretically-driven. It may also prove to be useful in explaining, predicting and guiding treatment development, particularly for processes which remain hard to shift using

existing strategies. Another significant advantage of adopting macro-theories such as ICS is that a common language can be used to explain the same psychological processes.

However, there are a number of significant disadvantages which to date have overshadowed the potential advantages of using macro-theories such as ICS to advance the transdiagnostic perspective. One disadvantage is that it is hard to decipher exactly what the consequence will be when part of the system malfunctions. ICS provides the components and apparatus to explain transdiagnostic processes. As has been demonstrated in this review, further work is then required to theorise about what happens when part of the system malfunctions. That said, once core elements of ICS are understood, they can readily be applied to explain different clinical phenomena; employing the ICS conceptualisation of rumination to understand worry demonstrates this possibility.

Future Directions

Before macro-theories such as ICS can be used to guide treatment, more empirical investigations testing out the theoretical predictions in clinical populations are necessary. The research agendas which resulted in the development of mindfulness-based cognitive therapy (MBCT) for relapse in depression (Segal et al., 2002) could be used as a model for this. In line with the research which led to the development of MBCT, the starting point would be investigating the *processes* underpinning symptoms of disorder, rather than just the content of cognition.

Whilst processes are less amenable to empirical investigation than the content of cognition, paradigms have been developed and validated. For example, in Watkins and Teasdale's mode manipulation paradigm, originally developed to examine modes of processing in depression, participants are instructed to read statements that either induce rumination (akin to 'doing mode' in ICS) or experiential focus (akin to 'mindful experiencing mode' in ICS) (Watkins & Teasdale, 2004). These prompts have been shown to reliably induce different modes of processing across a number of disorders (Crane, Barnhofer, Visser, Nightingale, & Williams, 2007; Rawal, Williams, & Park, 2011; Vassilopoulos & Watkins, 2009). Park and colleagues have demonstrated that manipulating the mode of processing, rather than the content of cognition, can have a beneficial effect on eating disorder symptoms (Cowdrey, Stewart, Roberts, & Park, 2013). Using the results of this study, Park and colleagues have examined novel interventions for anorexia nervosa, such as mindful movement classes (Rawal, Park, Enayati, & Williams, 2009). Therefore using ICS, novel treatment strategies could be developed that are truly theory-driven and experimentally informed.

Closing Remarks

The question of whether unified theories of cognition and emotion could further transdiagnostic thinking has been explored using ICS as an example. It is evident that the ICS framework has been used as a tool to explain psychological processes which are central to the onset and maintenance of a wide range of clinical presentations. Despite the complexity of macro-theories, this review has demonstrated the clinical as well as academic utility of a specific macro-theory – ICS. Importantly, ICS provides a common language to express cognitive and emotional processes transdiagnostically. Macro-theories, such as ICS, may therefore have the potential to augment disorder-specific clinical theories, provide theoretical justification for aspects of existing evidence-based psychological treatments and lead to the development of novel hypotheses and treatment strategies which would be applicable across diagnoses.

Whilst the majority of papers included in this review have focused on specific disorders or symptoms, broadly similar elements of ICS have been drawn on. For example, schematic mental models, the distinction between two levels of meaning and interlock processes feature in the majority of papers included in this review. Subtle differences in the interaction between these elements of ICS can explain the specific symptoms which characterise different disorders, such as the central engine entering a 'runaway' state in mania rather than interlock in depression (Barnard, 2004). ICS therefore offers a comprehensive platform for understanding the interaction of cognition and emotion across disorders and reduces the need for multiple micro-theories.

What is clear from this review is there are advantages of using ICS as a tool to delineate transdiagnostic processes, make specific predictions and guide the development of novel interventions. However, in order to further develop these proposals, there needs to be a level of intent, finance and commitment as well as a long term research horizon.

Even if the clinical psychology community were to acknowledge the potential value of ICS or another macro-theory, determining how it could realistically be established and kept on the clinical psychology agenda remains a significant challenge. It may be that in the first instance, the aim should be reducing the gap between micro- and macro-theory. Rather than suggesting that clinicians needed to be *au fait* with the intricacies of ICS, the focus should be on clinicians identifying broad aspects of ICS that are relevant for the clinical domain. As demonstrated in this review, novel hypotheses and formulations can then be derived which are particularly useful for clinical presentations which are poorly understood and hard to treat. Process-focused research strategies would enable predictions to be systematically tested in clinical subjects. An alternative first step for bridging the gap between micro and macro-theory would be using ICS as a vehicle for comparing and contrasting different therapeutic approaches and providing a clear rationale for why a particular treatment works. This is particularly relevant given the increased interest in mindfulness-based approaches and other '*third wave'* therapies across clinical presentations.

A significant limitation of this review is the sole focus on ICS as this is only one example of macro-theory. There are a number of other macro-theories such as Perceptual Control Theory (Powers, 1973; Powers et al., 1960) and The Schematic Propositional Analogical and Associative Representation Systems Approach (Power & Dalgleish, 1997) which could have equally been examined and may provide a better framework than ICS. Caution therefore has to be taken when generalising the results to the broader question of whether unified theories of cognition and emotion could further the transdiagnostic debate. However, this review has highlighted the potential opportunities that frameworks such as ICS can offer in furthering psychological theory, research and treatment transdiagnostically. It is recommended that clinicians and academics consider carefully about how macro-theories can be used to understand different aspects of mental experience in both health and disorder and use them to guide theory, research and practice.

References

Barnard, P., May, J., Duke, D., & Duce, D. (2000). Systems, interactions, and macrotheory. *ACM Trans. Comput.-Hum. Interact., 7*(2), 222-262. https://doi.org/10.1145/353485.353490

Barnard, P. J. (2004). Bridging between basic theory and clinical practice. *Behav Res Ther, 42*(9), 977-1000. https://doi.org/10.1016/j.brat.2004.04.002

Barnard, P. J. (2009). Depression and attention to two kinds of meaning: A cognitive perspective. *Psychoanal Psychother, 23*(3), 248-262. dhttps://doi.org/10.1080/02668730903227123

Barnard, P. J., Murphy, F. C., Carthery-Goulart, M. T., Ramponi, C., & Clare, L. (2011). Exploring the basis and boundary conditions of SenseCam-facilitated recollection. *Memory, 19*(7), 758-767. https://doi.org/10.1080/09658211.2010.533180

Barnard, P. J., Scott, S. K., & May, J. (2001). When the central executive lets us down: Schemas, attention, and load in a generative working memory task. *Memory, 9*(4), 209-221. https://doi.org/10.1080/09658210143000191

Barnard, P. J., & Teasdale, J. D. (1991). Interacting cognitive subsystems: A systemic approach to cognitive affective interaction and change. *Cognition and Emotion, 5*, 1-39. https://doi.org/10.1080/02699939108411021

Barnard, P.J., Watkins, E.R., & Ramponi, C. (2006). Reducing specificity of autobiographical memory in non-clinical participants: the role of rumination and schematic models. *Cognition and Emotion, 20 (3),* 328-350.

Barnard.P.J. (1985). Interacting Cognitive Subsystems. A psycholinguistic approach to short term memory. In Ellis A (Ed.). *Progress in the Psychology of Language, volume 2*. London: Lawrence Erbaum Associates, 197- 258.

Beck, A. T. (1967). *Depression: Clinical, experimental and theoretical aspects*. New York: Harper and Row.

Beck, A. T., & Haigh, E. A. P. (2014). Advances in cognitive theory and therapy: The generic cognitive model. *Annual Review of Clinical Psychology, 10*(1), 1-24. doi: https://doi.org/10.1146/annurev-clinpsy-032813-153734

Beck, A. T., Rush, J., Shaw, B., & Emery, G. (1979). *Cognitive therapy of depression*. New York: Guilford Press.

Borkovec, T. D., Alcaine, O., & Behar, E. (2004). Avoidance theory of worry and generalized anxiety disorder. In R. G. Heimberg, C. L. Turk & D. S. Mennin (Eds.), *Generalized anxiety disorder: Advances in research and practice* (pp. 77-108). New York: Guilford Press.

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

Butler, A. C., Chapman, J. E., Forman, E. M., & Beck, A. T. (2006). The empirical status of cognitive-behavioral therapy: a review of meta-analyses. *Clin Psychol Rev, 26*(1), 17-31. https://doi.org/10.1016/j.cpr.2005.07.003

Clark, D. M. (1986). A cognitive approach to panic. *Behaviour Research and Therapy*, 24(4), 461-470. https://doi.org/10.1016/0005-7967(86)90011-2

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. Heimberg, M. Liebowitz, D. Hope & F. Schneier (Eds.), *Social phobia: Diagnosis, assessment and treatment* (pp. 69-93). New York: Guilford Press.

Clarke, I. (1999). Cognitive therapy and serious mental illness. An interacting cognitive subsystems approach. *Clinical Psychology & Psychotherapy, 6*(5), 375-383. https://doi.org/10.1002/(SICI)1099-0879(199911)6:5<375::AID-CPP216>3.0.CO;2-C

Cowdrey, F. A., & Park, R. J. (2011). Assessing rumination in eating disorders: principal component analysis of a minimally modified ruminative response scale. *Eat Behav, 12*(4), 321-324. https://doi.org/10.1016/j.eatbeh.2011.08.001

Cowdrey, F. A., Stewart, A., Roberts, J., & Park, R. J. (2013). Rumination and modes of processing around meal times in women with anorexia nervosa: qualitative and quantitative results from a pilot study. *Eur Eat Disord Rev, 21*(5), 411-419. https://doi.org/10.1002/erv.2236

Crane, C., Barnhofer, T., Visser, C., Nightingale, H., & Williams, J. M. (2007). The effects of analytical and experiential rumination on autobiographical memory specificity in individuals with a history of major depression. *Behav Res Ther, 45*(12), 3077-3087. https://doi.org/10.1016/j.brat.2007.05.009

Dalgleish, T., Navrady, L., Bird, E., Hill, E., Dunn, B. D., & Golden, A.-M. (2013). Method-of-Loci as a mnemonic device to facilitate access to self-affirming personal memories for individuals with depression. *Clinical Psychological Science*. https://doi.org/10.1177/2167702612468111

Dempsey, R. C., Gooding, P. A., & Jones, S. H. (2013). Assessing the specificity of autobiographical memory in individuals at a trait-based vulnerability to bipolar disorder using a sentence completion task. *Memory, 22*(3), 222-231. https://doi.org/10.1080/09658211.2013.778289

Dobson, K., & Beshai, S. (2013). The theory-practice gap in cognitive behavioral therapy: reflections and a modest proposal to bridge the gap. *Behav Ther, 44*(4), 559-567. https://doi.org/10.1016/j.beth.2013.03.002

Duff, S., & Kinderman, P. (2006). An interacting cognitive subsystems approach to personality disorder. *Clinical Psychology & Psychotherapy, 13*(4), 233-245. https://doi.org/10.1002/cpp.490

Ehring, T., & Watkins, E. R. (2008). Repetitive negative thinking as a transdiagnostic process. *International Journal of Cognitive Therapy, 1*(3), 192-205. https://doi.org/10.1521/ijct.2008.1.3.192

Fairburn, C. (1981). A cognitive behavioural approach to the treatment of bulimia. *Psychol Med, 11*(4), 707-711. https://doi.org/10.1017/S0033291700041209

Fjorback, L. O., Arendt, M., Ornbol, E., Fink, P., & Walach, H. (2011). Mindfulness-based stress reduction and mindfulness-based cognitive therapy: a systematic review of randomized controlled trials. *Acta Psychiatr Scand, 124*(2), 102-119. https://doi.org/10.1111/j.1600-0447.2011.01704.x

Gumley, A., White, C. A., & Power, K. (1999). An interacting cognitive subsystems model of relapse and the course of psychosis [Press release]

Gumley, A. I. (2002). Implicational meaning versus meaning implied by experience: A reply to Clarke (2002) introducing further developments towards an ICS formulation of psychosis [Press release]

Harvey, A., Watkins, E., Mansell, W., & Shafran, R. (2004). *Cognitive behavioural processes across psychological disorders : a transdiagnostic approach to research and treatment* Oxford: OUP. https://doi.org/10.1093/med:psych/9780198528883.001.0001

Hayes, S. C. (2004). Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies. *Behavior Therapy*, 35(4), 639-665. https://doi.org/10.1016/S0005-7894(04)80013-3

Herbert, J. D., Gaudiano, B. A., & Forman, E. M. (2013). The importance of theory in cognitive behavior therapy: a perspective of contextual behavioral science. *Behav Ther, 44*(4), 580-591. https://doi.org/10.1016/j.beth.2013.03.001

James, I. A., Reichelt, F. K., Freeston, M. H., & Barton, S. B. (2007). Schemas as memories: Implications for treatment. *Journal of Cognitive Psychotherapy, 21*(1), 51-57. https://doi.org/10.1891/088983907780493296

Kabat-Zinn, J. (1994). *Wherever you go, there you are: Mindfulness meditation in everyday life*. New York: Hyperion.

Kessler, R. C., Chiu, W. T., Demler, O., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of twelve-month DSM-IV disorders in the National Comorbidity Survey Replication (NCS-R). *Archives of General Psychiatry, 62*(6), 617-627. https://doi.org/10.1001/archpsyc.62.6.617

Kiepe, M.-S., Stöckigt, B., & Keil, T. (2012). Effects of dance therapy and ballroom dances on physical and mental illnesses: A systematic review. *The Arts in Psychotherapy*, 39(5), 404-411. https://doi.org/10.1016/j.aip.2012.06.001

Leventhal, H. (1979). A perceptual-motor processing model of emotion. In P. Pliner, K. Blankstein & I. Spigel (Eds.), *Perception of Emotion in Self and Others* (Vol. 5, pp. 1-46): Springer US. https://doi.org/10.1007/978-1-4684-3548-1_1

Linehan, M. M. (1993). *Skills training manual for treating borderline personality disorder. Diagnosis and treatment of mental disorders.* . New York: Guilford Press.

Lomax, C. L., Barnard, P. J., & Lam, D. (2009). Cognitive processing in bipolar disorder conceptualized using the Interactive Cognitive Subsystems (ICS) model. *Psychol Med, 39*(5), 773-783. https://doi.org/10.1017/S003329170800425X

Lun, L. M. W. (2008). A cognitive model of peritraumatic dissociation. *Psychol Psychother, 81*(Pt 3), 297-307. https://doi.org/10.1348/147608308X304484

Mansell, W., Harvey, A., Watkins, E. R., & Shafran, R. (2008). Cognitive behavioral processes across psychological disorders: A review of the utility and validity of the transdiagnostic approach. *International Journal of Cognitive Therapy, 1*(3), 181-191. https://doi.org/10.1521/ijct.2008.1.3.181

May, J., Andrade, J., Panabokke, N., & Kavanagh, D. (2004). Images of desire: cognitive models of craving. *Memory, 12*(4), 447-461. https://doi.org/10.1080/09658210444000061

May, J., Dean, M., & Barnard, P. (2003). Using film cutting techniques in interface design. *Human Computer Interaction, 18 (4),* 325-372. https://doi.org/10.1207/S15327051HCI1804_1

McManus, F., Surawy, C., Muse, K., Vazquez-Montes, M., & Williams, J. M. (2012). A randomized clinical trial of mindfulness-based cognitive therapy versus unrestricted services for health anxiety (hypochondriasis). *J Consult Clin Psychol, 80*(5), 817-828. https://doi.org/10.1037/a0028782

Michalak, J., Rohde, K., & Troje, N. F. (2015). How we walk affects what we remember: Gait modifications through biofeedback change negative affective memory bias. *Journal of Behavior Therapy and Experimental Psychiatry*, 46(0), 121-125. https://doi.org/10.1016/j.jbtep.2014.09.004

Monroe, S. M., & Harkness, K. L. (2005). Life stress, the "kindling" hypothesis, and the recurrence of depression: considerations from a life stress perspective. *Psychol Rev, 112*(2), 417-445. https://doi.org/10.1037/0033-295X.112.2.417

NICE. (2013). *CG159: Social anxiety disorder: recognition, assessment and treatment*. London: National Institute for Health and Care Excellence.

Padesky, C. A. (1994). Schema change processes in cognitive therapy. *Clinical Psychology and Psychotherapy, 1*(5), 267-278. https://doi.org/10.1002/cpp.5640010502

Park, R. J., Dunn, B. D., & Barnard, P. J. (2011). Schematic models and modes of mind in anorexia nervosa I: A novel process account. *International Journal of Cognitive Therapy, 4*(4), 415-437. https://doi.org/10.1521/ijct.2011.4.4.415

Park, R. J., Dunn, B. D., & Barnard, P. J. (2012). Schematic models and modes of mind in anorexia nervosa II: Implications for treatment and course. *International Journal of Cognitive Therapy, 5*(1), 86-98. https://doi.org/10.1521/ijct.2012.5.1.86

Power, M. J., & Dalgleish, T. (1997). *Cognition and emotion: from order to disorder* Hove: Psychology Press.

Powers, W. T. (1973). *Behaviour: The control of perception*. Chicago, USA: Aldine Publishing Co.

Powers, W. T., Clark, R. K., & McFarland, R. L. (1960). A general feedback theory of human behaviour. Part II. *Perceptual and Motor Skills, 11*, 309-323. https://doi.org/10.2466/pms.1960.11.3.309

Ramponi, C., Barnard, P. J., & Nimmo-Smith, I. (2004). Recollection deficits in dysphoric mood: an effect of schematic models and executive mode? *Memory, 12*(5), 655-670. https://doi.org/10.1080/09658210344000189

Rawal, A., Park, R. J., Enayati, J., & Williams, J. M. G. (2009). A mindful approach to eating disorders. *Healthcare Counselling & Psychotherapy Journal, 9*(4), 16-20.

Rawal, A., Williams, J. M., & Park, R. J. (2011). Effects of analytical and experiential self-focus on stress-induced cognitive reactivity in eating disorder psychopathology. *Behav Res Ther, 49*(10), 635-645. https://doi.org/10.1016/j.brat.2011.06.011

Salkovskis, P. M. (1985). Obsessive–compulsive problems: A cognitive–behavioural analysis. *Behaviour Research and Therapy, 23*, 571-583. https://doi.org/10.1016/0005-7967(85)90105-6

Salkovskis, P. M., & Warwick, H. M. (1986). Morbid preoccupations, health anxiety and reassurance: a cognitive-behavioural approach to hypochondriasis. *Behav Res Ther, 24*(5), 597-602. https://doi.org/10.1016/0005-7967(86)90041-0

Scott, S. K., Barnard, P. J., & May, J. (2001). Specifying executive representations and processes in number generation tasks. *Q J Exp Psychol A, 54*(3), 641-664. https://doi.org/10.1080/713755994

Segal, Z., Teasdale, J., & Williams, M. (2002). *Mindfulness-based cognitive therapy for depression*. New York: Guilford Press.

Segal, Z. V., Williams, J. M., Teasdale, J. D., & Gemar, M. (1996). A cognitive science perspective on kindling and episode sensitization in recurrent affective disorder. *Psychol Med, 26*(2), 371-380. https://doi.org/10.1017/S0033291700034760

Su, L., Bowman, H., & Barnard, P. (2011). Glancing and then looking: on the role of body, affect and meaning in cognitive control. *Frontiers in Psychology (2),* 348. doi:10.3389/fpsyg.2011.00348. https://doi.org/10.3389/fpsyg.2011.00348

Teasdale, J. D. (1993). Emotion and two kinds of meaning: cognitive therapy and applied cognitive science. *Behav Res Ther, 31*(4), 339-354. https://doi.org/10.1016/0005-7967(93)90092-9

Teasdale, J. D. (1999). Emotional processing, three modes of mind and the prevention of relapse in depression. *Behav Res Ther, 37 Suppl 1*, S53-77. https://doi.org/10.1016/S0005-7967(99)00050-9

Teasdale, J. D., & Barnard, P. J. (1993). *Affect, cognition and change: Re-modelling depressive thought.* . Hove: Lawrence Erlbaum Associates.

Vassilopoulos, S. P., & Watkins, E. R. (2009). Adaptive and maladaptive self-focus: a pilot extension study with individuals high and low in fear of negative evaluation. *Behav Ther, 40*(2), 181-189. https://doi.org/10.1016/j.beth.2008.05.003

Veale, D., Gournay, K., Dryden, W., Boocock, A., Shah, F., Willson, R., & Walburn, J. (1996). Body dysmorphic disorder: a cognitive behavioural model and pilot randomised controlled trial. *Behav Res Ther, 34*(9), 717-729. https://doi.org/10.1016/0005-7967(96)00025-3

Wald, J., Taylor, S., Chiri, L. R., & Sica, C. (2010). Posttraumatic stress disorder and chronic pain arising from motor vehicle accidents: efficacy of interoceptive exposure plus trauma-related exposure therapy. *Cogn Behav Ther, 39*(2), 104-113. https://doi.org/10.1080/16506070903183570

Watkins, E., & Teasdale, J. D. (2004). Adaptive and maladaptive self-focus in depression. *J Affect Disord, 82*(1), 1-8. https://doi.org/10.1016/j.jad.2003.10.006

Watkins, E. R., Mullan, E., Wingrove, J., Rimes, K., Steiner, H., Bathurst, N., . . . Scott, J. (2011). Rumination-focused cognitive-behavioural therapy for residual depression: phase II randomised controlled trial. *The British Journal of Psychiatry, 199*(4), 317-322. https://doi.org/10.1192/bjp.bp.110.090282

Wells, A., & Matthews, G. (1996). Modelling cognition in emotional disorder: The S-REF model. *Behaviour Research and Therapy*, 34(11–12), 881-888. https://doi.org/10.1016/S0005-7967(96)00050-2

Williams, J. M. G., Barnhofer, T., Crane, C., Herman, D., Raes, F., Watkins, E., & Dalgleish, T. (2007). Autobiographical memory specificity and emotional disorder. *Psychological Bulletin, 133*(1), 122-148. https://doi.org/10.1037/0033-2909.133.1.122

Ylvisaker, M., & Feeney, T. J. (1995). Traumatic brain injury in adolescence: Assessment and reintegration. *Seminars in Speech and Language, 16*(01), 32-45. https://doi.org/10.1055/s-2008-1064109