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Depression and attention to two kinds of meaning: A cognitive perspective

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The complexity of a mental disorder such as depression is such that a way of interlinking the neural, mental and interpersonal levels is needed. This paper proposes that a theoretical framework which distinguishes, and relates, macro-theory and micro-theory at these levels can serve this purpose. The 'Interacting Cognitive Subsystems' approach to mental architecture is used to show how, via the detailed specification of mental processes and representations, a macro-theory of mental architecture contributes to our understanding of depressed states. In the account advanced by Teasdale and Barnard depressed states are seen as being maintained by an abnormal version of a dynamic dialogue between two qualitatively distinct types of meaning: one is referentially specific, propositional meaning, the other consists of holistic schemata rich in latent content and is called implicational meaning. In depressed states with ruminative and avoidant thought patterns, the mental function of attention is seen as being directed preferentially at propositional meanings. There is a corresponding neglect of attention to implicational meanings. The paper concludes with a brief discussion of how this approach can address transdiagnostic issues and how it may suggest new strategies for therapeutic interventions.

Keywords: depression; meaning; attention; macro-theory; Interacting Cognitive Subsystems

Introduction

As the contributors to this edition have shown, research across disciplines has provided us with a great deal of information about depressed states. The effects of depressive disorder are clearly systemic at multiple levels of analysis relating to brain, mind and interpersonal functioning. However, depressed states of mind are also commonly found in other disorders. There is, therefore, a need to develop a 'transdiagnostic' theory which can give an account of depressive disorders as such, plus an understanding of why symptoms commonly overlap across diagnoses (Mansell, Harvey, Watkins, & Shafran, 2008). Ideally, the same overall theory should also be capable of explaining the features of other major mental disorders.

There is an inevitable tension between wanting 'simple' theories and the complex, system-wide ramifications of depression that require us to take into account many different facets of mental and social life. While the various

theoretical perspectives that seek to account for depression are distinct in one way or another, they are often saying rather similar things while using different frames of reference and vocabularies – in ways that invite both comparison and charged intellectual debates. Their languages also vary in their formality, expressiveness and testability.

This paper offers one 'cognitive' perspective on the complexity of the normal human mind and its application to depression. It is grounded in human information processing theory and therefore is couched in more 'technical' language than most clinicians will be familiar with. It illustrates the potential value of system-level analysis in making possible a macro-theory of mental architecture which might complement other understandings of depression. Without a 'macro-theory' we are left only with micro-theories concerning specific mental capabilities and the hypotheses of limited scope which they are able to generate.

Systems: Macro-theory and micro-theory

Figure 1 illustrates three systems at the different levels of neural, mental and behavioural architecture. Each is represented as a hierarchy where the system overall (A) is first decomposed into basic interacting units (Bs). These are further decomposed into constituents (Cs). The basic units for the neural architecture (left of figure) might represent large-scale interacting neural circuits such as the limbic system and frontal cortex. Each of these can be divided into smaller units such as nuclei and local cortical regions interacting within those circuits. The operations of this system that need to be explained are electro-chemical. In respect of the 'behavioural' architecture (right of the figure) the basic units (Bs) are individual humans and the entities with which they interact in their physical environment
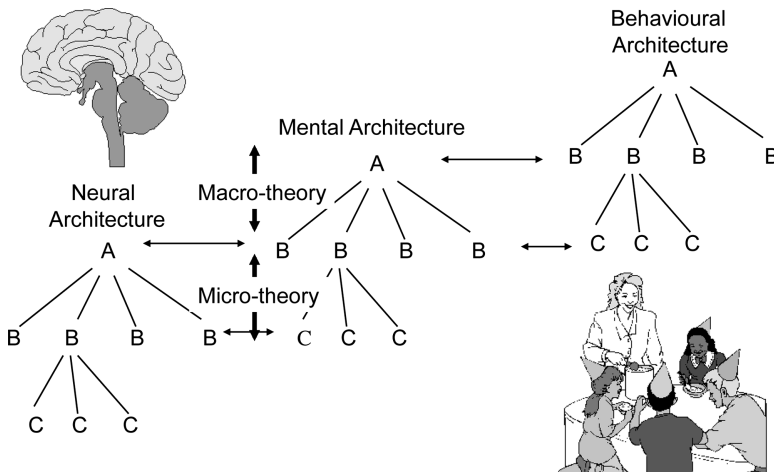

Figure 1. Three system levels: Relating neural architecture, mental architecture and behavioural architecture.

and social worlds. Here the 'system' consists of shifting assemblies of basic 'units' coming together in different and frequently changing contexts (e.g. family home, work, socializing). The behaviour of this system relates to human actions in the world, including vocal and gestural communication. Between neural and behavioural architecture is mental architecture. The behaviour of mental architecture can be thought of in terms of how 'information' is represented, stored and used by mental processes rather than in terms of physical processes in the brain or actions in the world. The basic units in mental architecture are thus subsystems of mind. Their constituents are mental processes.

A full account of complex conditions such as depression would require a complete theory for all of these systems and of how their operation depends one upon another. Figure 1 also indicates what is required for a complete account. We would need theories for the workings of specific mental competencies such as language, thought, memory, attention and emotion. In this scheme, these are called micro-theories. In addition, we require a macro-theory of how these basic components *work together* within the mind as a whole. The same general approach can be applied to the neural and behavioural architectures. The horizontal arrows between the systems indicate in part, for instance, that the behaviour of mental architecture will be constrained by the neural architecture that implements it, and in part will be determined by the owner of that architecture having learnt about the regularities encountered in the behavioural systems within which they have participated.

Knowing that a particular system is composed of hierarchically organized 'units' says little about the way those parts actually behave. Eventually, we need to be able to specify how a system is configured, what the capabilities of the units are, what requirements need to be met for them to use their capability and how the operation of a whole system is dynamically controlled and co-ordinated (Barnard, May, Duke, & Duce, 2000). However, we already know that depression affects cognitive, affective and somatic features of mental life and a macro-theory of mental architecture of this kind offers a viable way of confronting the complexities of this condition, and possibly of others that may be closely allied with it. It also provides a key conceptual bridge between neural and behavioural systems.

'Basic mammal' architecture

To give a clearer idea of an approach which is likely to be unfamiliar to most clinicians, I will describe an architecture of a sort that might be sufficient for a 'basic mammal', such as a rat. This basic mammalian plan will then be developed to characterize what is needed for the human.

Figure 2 shows a plan of mental architecture in much the same format as might be used to specify the architecture of a computer system. There are four subsystems, the postulated 'basic units' (Bs in Figure 1): VISUAL for processing sights, ACOUSTIC for sounds, BODY STATE for bodily information and MULTIMODAL for integrating the products of the three sensory subsystems and
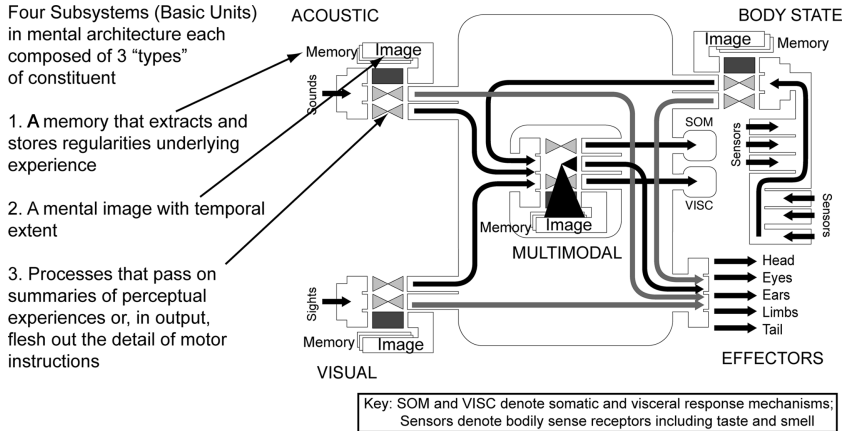
Figure 2. A four-subsystem mental architecture where the constituents of each subsystem defining how its processes can be configured.

handling the regularities occurring in cross-modal experiences. Their 'inputs' from sense receptors and 'outputs' to bodily effectors (head, eyes, limbs, somatic and visceral, etc.) are also shown. The arrows show patterns of information flow.

Each subsystem has three kinds of 'constituents' (Cs in Figure 1), with defined capabilities: a memory, an image and processes. The memory extracts and preserves regularities of experience (what has been found to go with what in each of the four domains). The image holds a trace of recent input. The content of sensory images would be equivalent to what we humans consciously experience as states and dynamics within the current sights and sounds 'out there in the world', as well as to physical feelings in our bodies. The image of the multi-modal subsystem represents an abstract synthesis of underlying commonalities among these inputs (the 'invariants'). It captures holistic feelings which may be marked by positive or negative emotions. In our more advanced architecture, such an image might consist of a sense of unease or of positive anticipation about some forthcoming event. In common with other approaches, emotions are regarded as information (e.g. Schwarz & Clore, 1983) and evolved to guide the adaptive selection of actions (e.g. Tooby & Cosmides, 2000).

Whereas the memory components of the sensory subsystems would support what is often referred to as perceptual learning, the memory system of the multi-modal subsystem would support classical and instrumental conditioning. It would do this via extracting and preserving the co-occurrence of content derived from the sensory subsystems along with positive and negative affective markers. Each subsystem also contains processes to create images that we can be aware of (indexed by horizontal dark grey rectangles) or to transform information for onward transmission to another subsystem or an effector (the lighter grey dumb-bell shapes). Taken together, the components and flow patterns specify how this

'basic mammal' mind could be configured. It also provides a framework in which we can add more detail, or micro-theory, concerning the precise capabilities of each component as well as what is needed for that capability to be used in a particular way (for a fuller account see Barnard, 1985; Teasdale & Barnard, 1993).

To close this section there is a key concept that will be used later in my discussion of the processing of meaning in depressed states. This concerns attention to information in the mind and focal awareness. Figure 2 shows attention as a triangle, in this case connecting the content of the multi-modal image to the information flow to the effectors. Because an image is a trace of recent input with temporal extent, actions can then be selected more robustly on the basis of a 'bigger' pattern of longer duration than would otherwise be possible. Within this theoretical approach, attention is focused to select part of an image which then controls and co-ordinates the outward flow of information. While the content of the images in other subsystems contributes to a wider and diffuse sense of phenomenological awareness, the locus of this attentional mechanism indexes what type of information is in *focal* awareness. Just as one might put the spotlight of attention on a particular part of a visual scene, this theory argues that, at any one moment in time, attention can be directed at only one type of image and some part of the wider pattern of information it contains.

Attention can move around the mental landscape in much the same way as we might look over a visual landscape. Were the triangular shape in the diagram positioned over one of the three sensory images it would indicate that some aspect of visual, acoustic or bodily information was in focal awareness – as when we focus our attention on part of a visual scene, a quality of a given sound or sensations in one part of our bodies rather than another.

A four-subsystem architecture of this kind could well be enough to theorize about the behaviour and learning capabilities of most mammals. For instance, in this four-subsystem configuration, if we consider that the multi-modal subsystem assigns affective significance to information states, the owner of such an architecture might well be able to show behaviour such as submission in response to a threat from another member of the same species. However, it would be hard to accommodate the full range of human mental capabilities, or the meanings that humans experience in depressed states. We also have extraordinary limb control, manual dexterity and intricate vocal articulation. We are capable of imagining sounds and scenes as well as having thought, language and beliefs about ourselves, others and about states of the world. Moreover, if we assume that any one of the processes that transforms information is only able to do one thing at a time (Barnard, 1985), the 'basic mammal' architecture would be limited to the control of action in the here and now augmented only by rather straightforward pattern completion from the four memory components. In contrast, we are able to walk, talk, think and manipulate objects at the same time. There are simply not enough basic units in Figure 2 to support all that concurrent activity.

A nine subsystems mental architecture sufficient for human-level ideation and mental experience

Figure 3 shows two extra 'effector' subsystems: EFFECTOR to control limb movements and ARTICULATORY for vocal articulation. We now have four central subsystems with reciprocal flows of information among them: MORPHONOLEXICAL which is specialized to handle information in verbal representation form (required for language processing and verbal mental imagery), SPATIAL-PRAXIC for spatial representations (control of intentional action in the world and visuo-spatial mental imagery) as well as the original ACOUSTIC, VISUAL and BODY-STATE subsystems of the basic plan. The single MULTI-MODAL subsystem is now split into two subsystems: 'PROPOSITIONAL' and 'IMPLICATIONAL,' each specialized to handle qualitatively distinct forms of meaning.

A case can be made on empirical grounds for this particular macro-theory of human mental architecture and its two levels of meaning (Teasdale & Barnard,
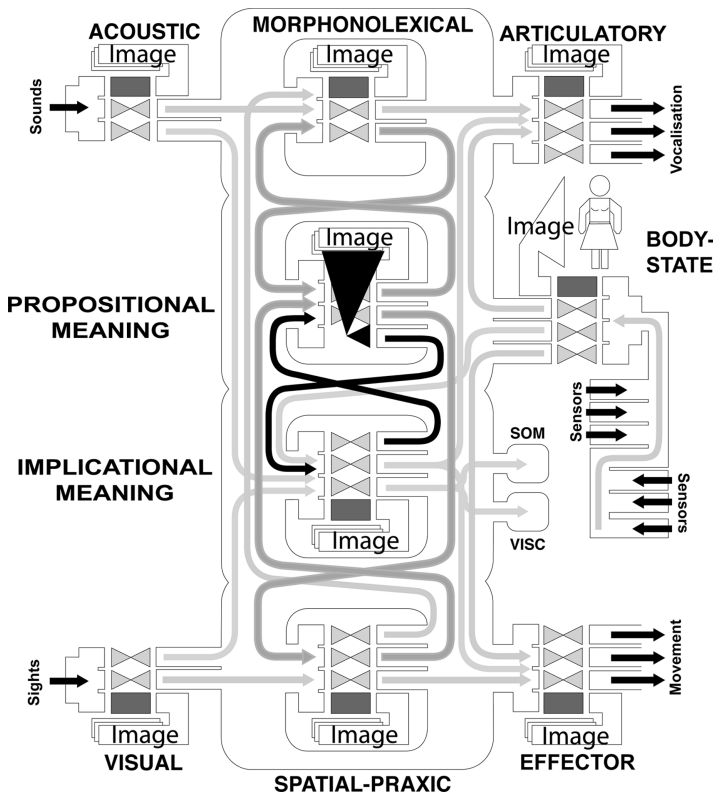

Figure 3.   The full nine-subsystem architecture proposed by Teasdale and Barnard (1993) as a basis for developing an account of depression.

1993). Furthermore, evolutionary considerations dovetail neatly with this model. The evolutionary idea is that additional subsystems evolved in a series of discrete steps out of an original mammalian multi-modal subsystem. New subsystems emerge somewhat in the way that cells divide in biology. At each step, the original multi-modal subsystem of Figure 2 splits into two, forming a daughter subsystem with some new mental functionality (Barnard, Duke, Byrne, & Davidson, 2007).

A brief narrative can help us to understand how, according to this theory, meanings are represented and processed in the minds of modern humans. Barnard et al. (2007) conjectured that a species of monkey with already advanced manual and limb dexterity might have evolved an effector subsystem specialized for the control of its limbs and hands. Once in place, the animal's multi-modal subsystem was able to capitalize on the deep structure of what was common to the control of movement and the contemporaneous changes in the visual world. For instance, the parameters for moving muscles and the feedback from vision would both reflect something akin to 'rotation' in space. Eventually, these deeper invariants would be sufficient to form an independent mental representation, or 'code'. When the neural networks specialized for processing the code separate from other circuitry this would be the emergence of the spatial-praxic subsystem. This would support our ability to create and modify 'visuo-spatial' mental images abstractly – entirely 'in the mind'.

The same reasoning can be applied to the development of verbal communication and meaning – our ability to manipulate underlying structures in verbal communication, both in the form of utterances and as thought. A subsystem controlling vocal articulation would lead on to an ability to handle what speech motor articulation and hearing have in common, namely the invariants of phonology (morphonolexical).

Our brief sketch of a possible evolutionary trajectory has now reached eight subsystems. At this stage there is still only a single multi-modal subsystem. This is assigning affective significance, but now to *internally generated* verbal and visuo-spatial content and imagery as well as to images of what is actually seen or heard. It is reasonable to suppose that our ancestors with this hypothetical eight-subsystem architecture would have been talking about events, actions, agents and their concrete properties as well as perhaps accompanying verbalizations with communicative gestures such as pointing (Noble & Davidson, 1996).

We conceive of the ninth subsystem as emerging out of the memory of the single multi-modal subsystem of the eight-subsystem architecture. The idea is that it acts as a crucible of what will become propositional meaning (Welshon, in press); namely, the invariants shared by spatial-praxic and morphonolexical content. Through extracting and 'modelling' the underlying patterns and events in the world and the mind, propositional meaning – making references to specific objects, agents, events and their properties – becomes a separate domain of encoding.

This architecture specifies three reciprocal loops capable of supporting concurrent control and co-ordination of language, intentional actions and semantic

ideation. The central loop between propositional and implicational meaning is configured so that attention is linked to propositional rather than implicational meaning. The architecture is then able to make propositional meanings the focus of attention in conceptual thought, while implicational meaning generates propositions outside focal awareness. Whereas a four-subsystem architecture could only attend to one central representation, this nine-subsystem architecture allows for attention to be moved around four types of central mental representation. This framework of macro-theory, and the differentiation of subsystems just outlined, reinforces the case we have advanced elsewhere for the existence of two forms of meaning. It is also, we believe, a mental architecture whose configuration renders it vulnerable to depression (Teasdale & Barnard, 1993).

Propositional and implicational meanings

The logic of the argument entails that the new form of propositional meaning, while referentially specific, lacks emotional charge. The emotional markers remain in the residual multi-modal subsystem (now re-named as implicational meaning). This retains its inputs from body states, visual and auditory processing as well as its direct control of visceral and somatic outputs. It follows from this model that we can use implicational meanings to generate referentially specific propositions about different emotions without necessarily experiencing them.

With the emergence of a functionally independent propositional subsystem, the nature of implicational meanings fundamentally changes. The new independent memory component of the propositional subsystem is in a position to work out what related propositions have in common and to pass these as 'summaries' to the implicational subsystem. This, in turn, is positioned to work out deeper, more abstract and holistic relationships, and to link these to affective states. Teasdale and Barnard (1993) describe implicational meanings as capturing holistic schematic models of the self, the world and others. These equate with what we think of as senses, feelings, intuitions or wisdom relating to some domain. It encapsulates latent rather than explicit meanings. Of course, there are other views concerning latent meaning, notably within psychoanalytic theory. The position advocated here aims to be precise about how latent meaning is encoded and processed. However, while Figure 3 might appear 'mechanistic', its format is intended to depict the capacities needed to support rational reflective thought, affect and latent meaning in human ideation.

Latent meaning within the implicational subsystem blends the products of immediate perception of the external world with embodied experience and conceptual thought. A representation of the current overall existential state of the self, in the body in a physical and/or social context, can be synthesized, while the memory component 'models' regularities in the co-occurrences of attributes in this mental code. The nine-subsystem variant is configured to represent our capacities to grasp, propositionally represent and reflect upon abstract generic concepts such as 'success' and 'failure', 'personal adequacy' and how situations might 'otherwise be'. We propose that abstract conceptual content of this kind is

now attached with the markers of different emotions rather than these being fixed to specific propositions, visual images in the mind or words in phrases.

The resulting schematic models, encoded as these implicational meanings, define and constrain the mind's capabilities for generating the internal cognitions that underpin both normal and dysfunctional ideation. Any given trajectory of ideation is viewed as driven by a dialogue between the two levels of meanings: abstract schematic models give rise to specific propositions; patterns in these propositions feed back to sustain, update or modify the current schematic model projected into the 'image' of the implicational subsystem. Teasdale and Barnard termed this 'the Central Engine of Ideation'. There is no homunculus or 'Central Executive' in this. Computer scientists term it distributed rather than centralized control. The configuration is controlled and co-ordinated via the dynamic system-wide patterns of information flow. All subsystems do exactly the same type of thing but use different types of 'code'. This architecture has enough resources to enable the central engine to function while at the same time the different output processes are generating verbal output and/or generating material for the intentional control of action.

Dysfunctional cognitions and affective states arising out of system level interactions

The specification I have set out allows us to probe how the mind might behave were the capabilities of its components to be compromised in one way or another. This might be as a consequence of a problem with underlying neural architecture, a problem with learning from experiences in one or more behavioural architectures, or where the co-ordination of components is disrupted in mental architecture.

Depression as a vulnerability to 'interlocked' processing in the central engine

Using the Interactive Cognitive Subsystems (ICS) model, Teasdale and Barnard (1993) hypothesized that in major depression there is a predisposition for the central engine to enter an 'interlocked' state in which dysfunctional implicational self-models are regenerated in repeated cycles. The central engine, with its reciprocal dialogue between propositional meanings, can be regarded as a 'control' loop. Like any control system, it may malfunction. Under some circumstances control loops are prone to become 'stuck' in a negative feedback; in other circumstances a 'runaway' positive feedback may arise. Manic states have been linked to the central engine entering a positive, runaway and unchecked state of this kind (Barnard, 2004).

In states of depression, the products of propositional processing, framed around narrow themes, feed back to the implicational subsystem and essentially perpetuate the same generic information state. This leads to the generation of yet more propositional material with very similar content. The macro-theoretical

framework allows us to speculate about the requirements which are most likely to reinforce and maintain this interlock. Multi-modal perceptual cues from the external world (perhaps the individual being in the same place and doing little), along with markers of lowered bodily energy, by continually feeding into the implicational subsystem would maintain a pattern of co-occurrence of 'little change'. Through an information loop this blends with the synthesis of recent conceptual content by the propositional meaning subsystem.

The dynamics of attention to meaning are seen as having an especially critical role in depressive disorders. In the normal condition attention is assumed to shift smoothly and appropriately over time among the four different types of central representation and the five perceptual and effector representations. Theory suggests that control mechanisms generally work by evaluating differences or discrepancies and invoking behaviours that might best resolve them. In the context of a highly complex mechanism, attention may not always be focused on the 'right' information. Errors of greater or lesser consequence pervade our everyday lives. For example, if asked the question 'How many animals of each kind did Moses take into the Ark?' most of us will answer 'two' without noticing that it was not Moses in this biblical story but Noah (Erickson & Mattson, 1981). One possible explanation of this kind of error is that attention is focused on propositional meaning and upon the question of 'number' rather than upon the agent. Because Noah and Moses conform to the same generic schematic model of 'bearded-old-testament-figure-with-two-syllable-name' the error is undetected by the generic, implicational processing of meaning.

Figure 4 enables us to define these different 'modes' of attending to meaning in a more systematic way. In Figure 4a at the left of the tripartite diagram we see that the locus of attention is directed at the image of recently generated propositional meanings: this denotes that the contents of the implicational image are outside focal awareness; the implicational component of the central engine is operating on something akin to automatic pilot; recently generated propositions
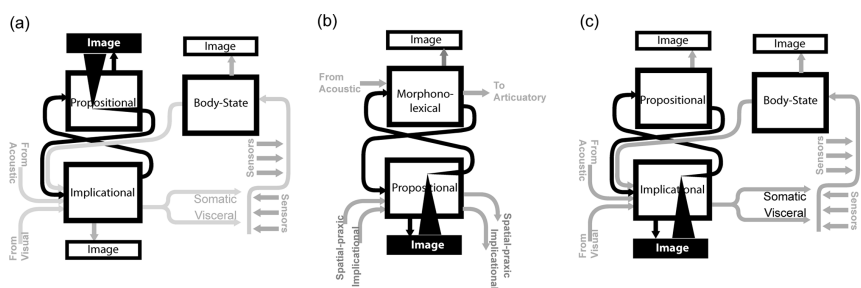

Figure 4.   Three illustrations of different modes of attending to propositional and implicational meanings: (a) attention to propositional meaning within the central engine; (b) attention to meaning within the loop generating verbal expressions of propositions; and (c) attention to implicational meanings within the central engine.

would be 'analysed' in a way which reproduced established implicational themes leading to the regeneration of the same schematic models.

In the central part of Figure 4b attention is again directed at propositional meanings, but this time its locus is between the propositional and morphonolexical subsystems. Here, as in Figure 4a, implicational representations would be outside awareness. The outcome would again be the repeated generation of propositions with highly similar contents. In Figure 4c attention is directed at implicational meanings. In this mode, any discrepancies in the content of schematic models relating to the current self-existential state would be in the focus of attention along with the affective markers that might accompany that content, such as negative feelings or an absence of positive ones.

These various configural possibilities allow us to develop hypotheses about rumination, about why patterns of interlocked thinking might be hard to break, and an alternative explanation of what is known as 'avoidance' in other theoretical frameworks. In verbal rumination it is hypothesized that there would be a predominant pattern of mental reconfigurations topicalized on propositional processing (Figure 4a, b). Avoidance would, for example, be captured by the idea that the focus of attention shifts only infrequently to the implicational image and is likely to dwell there for relatively brief durations in the face of potentially high affective charge and perhaps seemingly irresolvable discrepancies.

Using the 'language' of information processing theory, or the idea that implicational meanings have a latent quality, to explain what might underpin rumination and avoidant thinking are only of value if they lead to predictions that can be validated in laboratory research, translate into effective interventions or enable a better grasp of the commonalities and differences across diagnostic categories. In respect of these issues our group has reported evidence from patients supporting the idea that schematic models do code generic themes and that the schematic models currently 'in place' do change in remission (Teasdale, Taylor, Cooper, Hayhurst, & Paykel, 1995). There is also evidence that key cognitive features of depressed states such as overgeneral memories are positively correlated with ruminative response styles and with relatively undifferentiated generic models of self and others (Barnard, Watkins, & Ramponi, 2006; Ramponi, Barnard, & Nimmo-Smith, 2004). We have studied extensively laboratory tasks analogous to the Moses error, in both normal subjects and those with elevated levels of state anxiety and depression, to test the hypothesized shifts in attention between propositional and implicational meaning (Barnard, Scott, Taylor, May, & Knightley, 2004; Barnard, Ramponi, Battye, & Mackintosh, 2005).

Translating macro-theory into coherent implications for clinicians presents challenges of a different kind (Barnard, 2004). Most notably, Teasdale (1999) used this framework to provide a theoretical rationale for mindfulness-based cognitive therapy. In this case, translation into practice emphasized the development of strategies for controlling and shifting modes of attending to meaning in such a way as to reduce the likelihood of relapse during remission. Two trials have shown this to be effective (Ma & Teasdale, 2004).

According to the theory, in normal ideation focusing attention on implicational image content brings into view the whole range of recently generated material from bodily, external and conceptual origins. The ability to forge connections and links in this information space is seen as supporting a productive progression in thought content. Hence, the focusing of attention on implicational meanings and their content has been seen as a possible target for therapeutic intervention (see Teasdale, 1999; Teasdale & Barnard, 1993). Other clinicians have drawn upon ICS macro-theory to define and evaluate cognitive strategies for bringing about clinically useful change in both depression and psychosis (Bennet-Levey, 2003; Clark, 1999; Gumley & Power, 2000; see Longmore & Worrell, 2007 for a wider discussion). The common strand is that the key to change comes from facilitating the individual's use of adaptive, implicationally encoded, schematic models rather than simply targeting changes in propositional thoughts *per se*.

In my opening discussion of different levels of systems analysis, I pointed out that macro-theory requires a supporting body of empirically validated micro-theory. By itself macro-theory neither generates local predictions for laboratory research nor prescribes specific strategies for clinical interventions. It has to be supported by *additional assumptions and evidence* that require validation either in the laboratory or in clinical settings. What macro-theory offers is a guide about what to test and where to look for answers to key questions concerning clinical interventions. Teasdale (1982) proposed a set of questions that clinicians developing new interventions might want to call upon theory to help them answer. Table 1 shows these, along with possible answers based on the position I have elaborated here.

The specific answers in the table summarize some of the points I have already explained. No doubt they also reinforce our impression that different traditions say similar things in different ways. However, the systematic nature of Teasdale's procedure throws up one important issue – rates of change in implicational representations – which I have not yet discussed. The various strands of my basic evolutionary macro-theoretic argument, and the obligation to translate them into viable clinical strategies that are open to empirical test, both bear upon the issue of why rate of change in implicational representations is a particularly important variable.

From an evolutionary perspective there are persuasive arguments as to why we pay attention to changes of state in the external environment and in our bodies, and why these can be associated with markers of affect that provide information to discriminate which actions might be most adaptive in a particular context: insignificant or low rates of change are unlikely to attract attention; higher rates of change are likely to command it. Our earlier evolutionary sketch was based on the principle that the extra subsystems work in exactly the same way as their precursors. Therefore, *attention to meaning* should be governed by the same rate of change parameter. It seems a reasonable assumption that mental mechanisms have evolved to manage rates of change adaptively within a range

Table 1. Theoretical guidance derived from the ICS analysis of depressed states (adapted from Barnard, 2004).

Question	ICS-driven answers for depression
How should I conceptualize this problem?	Regard depression as involving an inter-locked state of processing between generic (implicational) and referentially specific (propositional) meanings, bolstered by proprioceptive feedback, familiar and relatively unchanging perceptual patterns, and *excessive attention* to specific meanings
Which features (variables) should I focus on?	Low rates of change in implicational meanings The themes and differentiation in schematic models in place during episodes The properties of schematic models available out of episode The amount of attention being paid to generic and specific meanings
What does my conceptualization of this problem suggest needs doing?	Aim to alter the 'avoidant' modes in which the mental dialogue between generic and specific meanings typically occur, as well as alter the schematic models in place Increase repertoire of, and level of differentiation in, available self-models Look for other ways of increasing rates of change in generic meanings
How in practice would this be achieved?	Provide and practice strategies for attending to self related meanings in new ways; e.g. variants of CBT, mindfulness-based cognitive therapy when depression is remitted
How can I measure whether I have effected the changes I was aiming for?	Monitor indices of schematic model in place (differentiation and polarity), mode (rumination) and rates of change

ICS: Interactive Cognitive Subsystems.

that is neither too high nor too low. The interlocked state is marked by a very low rate of change in implicational image content. The rates of change in the specific propositions and ruminative verbal thoughts might be rather higher and as a result attention would tend to focus on propositional meanings rather than implicational ones. This opens up the possibility that avoidant thinking may well be a developmentally acquired pattern with no motivation other than an old means (in an evolutionary sense) of keeping mental processing activity within an adaptive range.

It is generally acknowledged that the diagnostic categories applied to mental disorders are largely based upon descriptive criteria. They may not capture the essence of the underlying disorder of mental functioning. The macro-theoretical

model I have set out also offers novel ways of understanding the features of other mental disorders. For example, bipolar disorder, anxiety disorders, anorexia nervosa and disorders across the schizophrenic and autistic spectra may each find an account in which different parameters governing central engine operation move outside their normal adaptive range of functioning (Barnard, 2004; Park & Barnard, 2005). These are the 'transdiagnostic' implications of macro-theories which may be useful tools in our efforts to identify the deeper problematics operating in mental disorders.

Conclusions

The extent to which this form of macro-theory offers more than what is already offered by other theoretical accounts of specific conditions, such as major depression, remains to be determined. The approach captures the basis of dysfunctional thinking and affect in depressive episodes, allows us to address transdiagnostic concerns and to generate hypotheses to support the development of new interventions. It does not address the interpersonal origins of the condition, which would here be regarded as a target for macro-theories of behaviour architecture, but ICS can be mapped to them (see Figure 1). Its characterization of latent meanings and avoidant thinking is undeniably mechanistic and 'de-personalized'. Critics might also argue that theories of such broad scope have too much explanatory power and tend to verge toward the intractable. Conversely, theories focused on narrow diagnostic categories lack the connective tissue needed to detect common mechanisms operating across diagnostic boundaries. Naturally, a mature body of macro-theory supported by well tried and tested micro-theories remains a long way off. The framework of macro-theory outlined here and its instantiation in Interacting Cognitive Subsystems is perhaps best taken as a case study of what it might be to move more firmly in the direction of theories of broader scope. It will have served its purpose here if it stimulates further debate around these issues.

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