A provisional transdiagnostic cognitive behavioural model of post brain injury emotional adjustment

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Running head: Cognitive-behavioural model of post-injury adjustment

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Introduction

People with brain injury are more likely than others to experience significant psychosocial problems. These include increased risk of mental health problems (Anstey et al., 2004), and suicide (Teasdale & Engberg, 2001a, 2001b) family breakdown, criminal justice system contact (Williams, Cordan, Mewse, Tonks, & Burgess, 2010), poorer educational, and vocational outcomes. Psychological factors have been shown to limit responsiveness to rehabilitation following stroke (Clark & Smith, 1998; Goodwin & Devanand, 2008). A National Institute for Health Research Service Delivery and Organisation (NIHR-SDO) review of specialist neurorehabilitation services in the UK indicated that those with 'hidden disability' (cognitive and emotional problems) following traumatic brain injury are most poorly served (Gladman et al., 2007). The emotional consequences of stroke and brain injury are therefore both significant in terms of poor outcomes and social costs, and in terms of lack of services to address these needs.

Evidence for potential application of CBT post brain injury

The development of CBT as applied in the context of acquired brain injury rehabilitation has occurred within a wider historical context of psychotherapeutic approaches. Goldstein's (1952) work with brain-injured soldiers was informed by his 'organismic theory'. This was a precursor to humanistic, self-actualisation approaches, highlighting the natural tendency of people to act so as to maintain a 'holistic' sense of completeness of identity. Yehuda Ben-Yishay (e.g., Ben-Yishay, 2008) further applied this approach to neuropsychological rehabilitation, drawing on Eriksonian ideas about ego-identity and identity 'crisis'. Psychodynamic formulations have been presented that describe the injury as a threat to the ego, with the person's behavioural response being interpreted in terms of defences (e.g., Stern, 1985). A more contemporary and neuropsychologically informed take on the psychodynamic formulation is presented in the work of the neuropsychoanalysis movement (e.g., Kaplan-Solms, 2000). Many of the concepts relating to threat, 'defence" of identity,

conscious, non-conscious and affective processes are present in the current paper within a cognitive-behavioural frame.

There is a growing body of research evaluating cognitive-behavioural therapies (CBT) and results appear encouraging with traumatic brain injury (Anson & Ponsford, 2006; Arundine et al., 2012; Backhaus, Ibarra, Klyce, Trexler, & Malec, 2010; Bradbury et al., 2008; Fann, Hart, & Schomer, 2009; Hart, Vaccaro, Hays, & Maiuro, 2012; Hsieh, Ponsford, Wong, Schonberger, et al., 2012a; Hsieh, Ponsford, Wong, Schönberger, et al., 2012b; Ouellet & Morin, 2007; Soo & Tate, 2007; Tiersky et al., 2005; Topolovec-Vranic et al., 2010) but not unequivocally so (Ashman, Cantor, Tsaousides, Spielman, & Gordon, 2014). Evidence for CBT post-stroke is less encouraging (Lincoln & Flannaghan, 2003), where Motivational Interviewing (MI) interventions appear more effective (Watkins et al., 2007; Watkins et al., 2011). There has been an argument for the application of so-called 3rd wave CBT approaches such as Acceptance and Commitment Therapy (ACT; Kangas & McDonald, 2011), and some indication of possible utility following stroke (Shields & Ownsworth, 2013) and TBI (Compassion Focused Therapy: Ashworth, 2014; Ashworth, Clarke, Jones, Jennings, & Longworth, 2015; Ashworth, Gracey & Gilbert, 2011; Mindfulness Based Cognitive Therapy: Bédard et al., 2014). Whilst techniques work for some they do not for others, treatment effect sizes vary (Anson & Ponsford, 2006; King, 2002; Lincoln & Flannaghan, 2003; McMillan, Robertson, Brock, & Chorlton, 2002) and treatment process variables are rarely measured. Waldron, Casserly, & O'Sullivan's (2013) review indicates that effect sizes of CBT following ABI are greatest when the intervention has a specific focus (e.g., anger or anxiety treated with the respective anger or anxiety focused CBT model). It has been argued that the failure of trials to show a benefit of CBT post-stroke relates to the failure of the model and intervention to be appropriately augmented to address issues specific to post-stroke depression and older age (Broomfield et al., 2011; Laidlaw & Kishita, 2015). Following TBI, there is some suggestion that psychotherapeutic interventions need to be enhanced by integrating memory (Brindley, Bateman, & Gracey, 2011; Khan-Bourne & Brown, 2003; Williams,

Evans, & Fleminger, 2003), attention (Mateer, Sira, & O'Connell, 2005; Tiersky et al., 2005), executive control (Gordon, Cantor, Ashman, & Brown, 2006; Rath, Simon, Langenbahn, Sherr, & Diller, 2003) or motivational (Hsieh, Ponsford, Wong, Schönberger, et al., 2012) strategies depending on the needs and neurocognitive profile of the individual. The concept of identity change appears to be providing a centre of gravity for quantitative and qualitative research into the emotional effects of brain injuries (see Beadle, Ownsworth, Fleming, & Shum, 2015; Ownsworth, 2014). However, because brain injury is so heterogeneous, and because outcome studies have not always linked the interventions to an underpinning model, it is difficult to understand what fails, and what works for whom and why (Whyte, 2006; Gracey, Evans, & Malley, 2009). These authors have argued that psychotherapy (specifically CBT) research and the Medical Research Council (MRC) guidelines for evaluation of complex healthcare interventions (MRC, 2008) should be applied more routinely in order to improve the empirical basis for specific interventions. Clark (2004) and Salkovskis (2002) present clear descriptions of the way in which evidence-based clinical practice of CBT for psychiatric disorders develops through interactions between research into specific disorders, models of disorders, and clinical trials.

Lack of a cognitive-behavioural (CB) model for working with people with brain injury, or of evidence-based guidance about how to adapt existing mental health disorder specific models, may also have implications for governance of practice. For example, one national competency framework for the practice of CBT (Roth & Pilling, 2008) states that knowledge of the model explaining the mental health problem underpins technical and disorder specific competencies. At present, those using CBT following brain injury could only meet this competency by demonstrating knowledge of the model of the specific mental health problem being treated (e.g., major depressive disorder, social anxiety), alongside knowledge of models of the neuropsychological consequences of brain injury. However, it would not be possible to demonstrate competence according to this framework when working with those whose emotional needs do not meet specific diagnostic criteria, present as co-morbidities, and

could be considered “transdiagnostic” in nature. This might include presenting problems such as aggression, socially inappropriate behaviour, low self-esteem, depressed mood, non-specific anxieties, disrupted relationships with others, and sub-optimal coping. A formulation-based rather than diagnosis based understanding of the factors underpinning these common issues and their interactions is therefore a priority for development of clinical and cost effective practice in this area.

Rationale for a transdiagnostic model

One significant challenge posed when working therapeutically with people following ABI is the heterogeneity of presentation in terms of type or nature of emotional response, as well as the nature and extent of acquired difficulties, not to mention socio-economic, pre-injury, family, and other contextual factors. Shields and colleagues (Shields & Ownsworth, 2013; Shields, Ownsworth, O'Donovan, & Fleming, 2015) have argued for the need to develop a transdiagnostic understanding of emotional issues following ABI. Within other mental health populations, variability in presentations within diagnostic categories, and emergence of common factors across disorders, has led to a growth in transdiagnostic approaches. Mansell, Harvey, Watkins, & Shafran (2008) describe different types of transdiagnostic approach: those addressing variability within a specific type of disorder (e.g., eating disorders, PTSD) and those focusing on core processes underpinning a wide range of disorders e.g., Perceptual Control Theory (PCT: Mansell & Carey, 2009), Interacting Cognitive Subsystems (ICS: Teasdale & Barnard, 1993), and Self-Regulatory Executive Functions (S-REF: Wells & Matthews, 1996). For example, PCT proposes that high-level goal conflicts give rise to distress, so techniques aimed at enabling the client’s reflection upon and resolution of these conflicts will lead to therapeutic gains. S-REF suggests that maladaptive “cognitive-affective” cycles are established where perseverative negative thinking impacts upon adaptive executive and attention processes, further disadvantaging the person’s ability to change their mood or situation. Perhaps most revolutionary of these has been the ICS model. The ICS model makes a distinction between two types of meaning: “propositional meaning” is concerned with concrete, rational, and

non-affective meanings such as semantic knowledge or knowledge of logical relationships; "implicational meaning" is extracted from massed autobiographical experiences and these types of representation encode the full range of input from all senses and other subsystems. Implicational meanings can be described as a "felt sense", conveyed not through logical forms but through for example, metaphor, and imagery. The authors argue that traditional cognitive restructuring addresses propositional meanings, but that the central engine of depression is the activation of depressogenic implicational meanings. Propositional "thoughts" have a role in maintaining implicational meaning activation but are not the core focus for treatment. The model triggered a paradigm-busting shift in CBT away from a focus on "propositional" cognitive content towards process and felt-sense, in turn underpinning the development of mindfulness-based approaches which seek to "press the clutch" on the depressogenic central engine of mutually activating propositional and implicational meanings. The development of these models in synchrony with research and clinical practice (Salkovskis, 2002; Clark, 2004) means that underpinning scientific research has been directly translated into clinically applicable models. Using the ICS model to illustrate, Barnard (2004) describes how clinical models act as "bridging representations" as they are consistent with the underpinning scientific research yet reach into clinical practice by representing processes in terms that fit with clinical practice models, which in turn can be readily understood and implemented by clinicians, or translated into treatment manuals for clinical trials.

In the field of adjustment to sudden onset neurodisability, the models presented by Brands, Wade, Stapert, & van Heugten (2012), Park (2010), and Levack, Kayes, & Fadyl (2010) provide useful syntheses of different aspects of the literature. Gracey et al., (2009) have similarly elaborated a model of neuropsychological rehabilitation that targets specific processes related to adjustment to brain injury, further developed by Gracey & Ownsworth (2012). Brands et al.'s model draws heavily on self-regulation theory and stress appraisal models, noting adaptation to arise from an interaction between short term or "proximal" goals and longer-term "distal" goals. Park's model distinguishes

between situational meanings and global meanings, and includes a greater focus on meaning making and subjective sense of threat, loss or discrepancy in the moment. These schematic theoretical models are useful syntheses of the literature, but they may not readily inform CB practice. Ownsworth's (2014) model sets out links between specific experiences, identity, and appraisals, coping style and longer term adjustment, and provides an excellent starting point for considering formulation or case-conceptualisation of adjustment within a broadly cognitive-behavioural framework.

In this paper we seek to address a priority for the future development, delivery, and governance of evidence-based cognitive-behavioural interventions following brain injury. We propose an integrated transdiagnostic model of post-injury emotional adjustment that is supported by current empirical findings, and that constitutes a "bridging representation" that reaches directly into clinical practice. In keeping with the practice of model-based formulation in CBT, we have identified maintenance cycles incorporating pre-injury predisposing factors, triggers or critical incidents, resulting cognitive, affective and behavioural responses, and consequences (practical, social). The components of the model are presented in the context of a summary of relevant literature, extending that presented previously (Gracey et al., 2009; Gracey & Ownsworth, 2012; Ownsworth, 2014), and clinical implications are outlined.

Background literature on emotional adjustment and proposed model components

Social participation and social identity

The model proposes that trajectories of long-term emotional adjustment arise out of the contexts in which the person attempts to return to meaningful activities or experiences. Put simply, the significant alterations of many aspects of a person's life have a direct impact on how someone might feel in both the short and longer term. It has been shown that return to participation in meaningful activity is a predictor of later emotional outcome (Turner, Fleming, Ownsworth, & Cornwell, 2011).

Social identity theory (Turner & Tajfel, 1982) proposes that our interactions with the social world around us (our social identities) are internalised to form our personal identities. Consistent with this, Haslam et al. (2008) found membership of a larger number of social groups prior to stroke, and maintenance of these groups post-stroke, was associated with better emotional outcomes. People post TBI, identify social linkages that facilitate social support and these may reduce likelihood of development of depression (Douglas, 2012). However, the quality and meaning of relationships will moderate this. For example, a "contesting" dynamic may arise in family relationships in the face of perceived lack of awareness of deficits (Yeates, Henwood, Gracey, & Evans, 2007). Alway, McKay, Ponsford, & Schonberger (2012) found family expressed emotion (criticism and emotional over-involvement) to be associated with both anxiety and depression. Our investigation of self-construal following brain injury highlighted the importance of subjective experience of self in social and activity contexts (Gracey et al., 2008). The results showed the important role of specific events or experiences in forming broader feelings and beliefs the individual might hold about themselves, others, and the world around them post-injury. Therefore, after thinking about the direct impact of life changes, and availability of social and practical resources when making sense of the effects of brain injury, we should next turn to the meanings of these changes to the person, and the cognitive processes involved.

Core meanings – "threat to self" in specific activity or relational contexts

The cognitive model holds that earlier life experiences and resulting enduring (pre-injury) tendencies to appraise the world in a particular way shape the nature of subjective experiences elicited in response to specific day-to-day situations. A body of work on adjustment following brain injury has identified possible cognitive content and processes relating to self and identity thought to influence emotional outcomes (Gracey & Ownsworth, 2008), such as self-discrepancy (Cantor et al., 2005), threat appraisal (Riley, Brennan, & Powell, 2004; Riley, Dennis, & Powell, 2010), self-criticism (Freeman, Adams, & Ashworth, 2015) loss and grief (Carroll & Coetzer, 2011), and social and

personal identity processes (Haslam et al., 2008; Jones et al., 2011; Douglas, 2012; Douglas, 2013; Gracey & Ownsworth, 2012; Muenchberger, Kendall, & Neal, 2008). Gracey et al. (2008) found that people with brain injury are especially concerned with their experience of identity in social, practical and intra-personal contexts. Themes that emerged from the analysis included: not fitting in or being a burden on others; feeling useless, loss of skills and knowledge; and feeling "at odds with myself", or being "preoccupied with who I am". Similar themes are evident in other research in the field (e.g., Douglas, 2012; Freeman et al., 2015; Muenchberger et al., 2008; Riley et al., 2004; Riley et al., 2010). The studies by Riley and colleagues indicate that the presence of these types of evaluative threat is not directly associated with avoidance (of the "catastrophic reaction") as predicted by Goldstein (1952). Instead their results suggest that the relationship between threat appraisals and increased anxious avoidance is present only for those with low self-esteem, linking the self-identity literature with the body of work on coping style. Shields et al. (2015) identified correlates of emotional distress including emotion regulation, negative past and current self-concept, appraisal of threat and avoidance, worry, and negative self-focus. Threats to self and emotion dysregulation emerged as significant underpinning factors accounting for nearly 70% of variance in emotional distress. Within cognitive-behavioural models, increased sensitivity to a concern engages emotionally driven processing biases such as selective attention to threat, or selective recall. Consistent with this, Malec, Brown, Moessner, Stump, & Monahan (2010) and Ownsworth et al. (2007) have highlighted how over-sensitivity to symptoms post-injury may result in increased likelihood of depression or poor emotional outcome. This in turn risks the establishment of habitual processing patterns that further maintain problems. Self-esteem has also emerged as a factor associated with poor emotional outcome (Cooper-Evans, Alderman, Knight, & Oddy, 2008). In the mainstream mental health literature, low self-esteem is thought to underpin co-morbid anxiety and depression, with cognitions relating to predicted or feared negative outcomes generating anxiety and safety seeking, and cognitions relating to past failure or rejection leading to low mood and withdrawal or hopelessness (Fennell, 1997). Longworth et al. (in prep) found self-esteem following brain injury to be comprised

of 4 factors: self-efficacy, self-worth (as compared to others), self-regard (intrinsic view of self), and confidence. Self-efficacy and self-worth predicted anxiety, whereas self-regard predicted depression. This provides partial support for the applicability of the cognitive model of self-esteem (Fennell, 1997), where fears about future failure (low self-efficacy) or rejection (low self-worth) could lead to anxiety, whereas a generic negative view of oneself (low self-regard) is more likely associated with depression.

A number of transdiagnostic processes may therefore be applicable to understanding initial reactions in trigger situations. The broad notion of "threat to self" emerges as a central issue, alongside sensitivity to symptoms and components of self-esteem. It is possible that immediate, "in-the-moment" threat-based sense-making of a challenging situation established in the past but activated in the present, may arise rapidly, generating an immediate potential for a disinhibited emotional reaction. This immediate reaction to specific challenges or stressors may therefore be directly, and consciously experienced by the person (in the case of intact self-monitoring or selective attention to problems) or not (in the case of impaired self-monitoring or disinhibited emotional reactions). In the latter case the subjective experience of sense of discrepancy or threat might arise either later when the person reflects on their behaviour, or when another person provides feedback about their behaviour. These processes could further establish increased sensitivity to potential threats to self.

Over the longer-term, both acquired deficits in self-regulation, the person's secondary appraisals of their ability to cope (as influenced for example by their self-esteem or self-efficacy; Riley et al., 2010) and the responses of others, may have a bearing on the behavioural trajectory of the initial threat response. This slower, less immediate, and possibly more cognitively and socially mediated response trajectory leads us to consider the possible role of coping style in determining emotional adjustment.

Coping responses to help protect identity from immediate "threat"

This is perhaps the most developed area of research relating to emotional adjustment following brain injury, and provides a transdiagnostic framework (Godfrey, Knight, & Partridge, 1996) from which interventions have been developed. A number of studies now indicate certain coping styles to be maladaptive, such as emotion-focused, worry, wishful thinking, avoidance, self-blame, and substance use (Anson & Ponsford, 2006a; Brands, Kohler, Stapert, Wade, & van Heugten, 2014; Curran, Ponsford, & Crowe, 2000; Malia, Powell, & Torode, 1995; Moore, Stambrook, & Peters, 1989; Wolters, Stapert, Brands, & Van Heugten, 2010). Adaptive coping styles appear to involve a more active, problem solving approach. Anson & Ponsford (2006) conducted an outcome study to test whether it would be possible to train people with brain injury to adopt a more adaptive coping style, and whether any such changes resulted in improved emotional outcomes. They found that a group coping skills intervention was helpful in changing coping style, however effects were influenced by a range of factors, with self-awareness of deficits being a key determinant of responsiveness to the intervention (Anson & Ponsford, 2006b). Additional studies indicate factors that may interact with coping style. Lubusko, Moore, Stambrook, & Gill (1994) identified lower internal and greater external locus of control beliefs, and a greater sense of hopelessness in those with poorer vocational outcomes post TBI. Riley and colleagues (Riley et al., 2004; Riley et al., 2010) found links between the specific coping strategy of avoidance, threat appraisals, low self-esteem and anxiety: those with low self-esteem being most likely to exhibit anxious avoidance in response to threat appraisals. The person's coping behaviours can therefore be considered as "safety seeking behaviours", maintaining coherence of identity in the shorter term, to stay in line with (perceived) personal or social expectations, and avoid (perceived) personal or social "threats". Over time, reliance on particular unhelpful coping styles will impact upon the individual's social participation, and therefore potentially disrupt opportunities to engage in meaningful and adaptive social activities, create social linkages, and maintain social identity. This generates the longer-term vicious

cycles that could maintain poor emotional adjustment, and potentially contribute to deterioration in functioning and risk of suicide over time. Ultimately, the progressive loss of opportunities for participation across all domains will further maintain or increase unwanted life changes, bringing us back to the direct impact of a negatively changed life.

Influence of acquired cognitive difficulties on cognitive and emotional responses

A significant proportion of people who have survived a brain injury sustain damage resulting in difficulties with executive functioning including inhibition, attention switching, problem solving, and goal neglect. It is possible that these executive problems have an indirect impact on emotional outcome, where specific deficits in problem solving or attention control ability might further limit capacity for adaptive coping, thus maintaining the poor emotional adjustment (Kendall & Terry, 1996). Ledoux's (2000) model of the fear response argues that the frontal lobes play a role in inhibiting a behavioural response to fear. The effect of acquired cognitive deficits, and of damage to brain systems involved in down-regulating emotional reactions means that someone might become aggressive, panicky or withdrawn in the face of a "threat to self" which is, at least initially, not amenable to self-monitoring or self-report. Someone might report only being aware of what they had said or done after it was too late, sometimes after a few moments, sometimes not until much later, or in the case of someone with acquired deficits in understanding consequences of their behaviour, show an enduring lack of concern. Oversensitivity to symptoms and selective attention to such "threats" may result in an over-focus on past or possible future negative outcomes, further activating or maintaining distress. It is theoretically possible that deficits in attention control or executive functioning might increase vulnerability to specific unhelpful cognitive-affective processes such as rumination, selective attention to threat or other "biases" in processing.

There is an established field of research into cognitive processes in emotional disorders, which shows that specific emotional processes (for example rumination or worry) selectively impair

cognitive functions (e.g., attention or executive functioning: Harvey, 2004; Watkins, 2011; Watkins, 2008). For example normal performance of an attention task by people with a specific emotional disorder can be disrupted when emotionally salient material reflecting the key concerns associated with that disorder is introduced. These studies have been interpreted in terms of enhanced selective attention to threat (and related reduced executive control), and have been highly influential in the field of CBT. They have led to the development of innovative interventions that have proven to be effective in treating mental health problems, or preventing relapse, in line with the predictions of the underlying models (e.g., Cognitive Bias Modification: Hallion, 2011; Attention Training: Mohlman, 2004; Mindfulness Based Cognitive Therapy: Williams, Teasdale, Segal, & Soulsby, 2000). Some cognitive researchers have noted the lack of research linking potential interactions between "cold" executive processes in working memory, and self-regulation of emotion and behaviour (Hoffman, 2010). However, a review by Williams, Suchy, & Rau (2009) suggests that individual differences in executive functioning may be a factor in resilience to stress.

Literature in both brain injured and mental health populations therefore suggests that there may be bi-directional influence between acquired neuropsychological deficits, specific cognitive processes and emotional state. However, research into the impact of acquired deficits in cognitive functioning due to brain injury on these important cognitive-emotional processes is at present very limited. Wood & Rutterford (2006) tested Kendall & Terry's (1996) model, which suggests that cognitive problems will impact indirectly upon psychosocial adjustment via the mediating effect of coping style and appraisals. Their findings suggest that, of the cognitive predictors, working memory emerged as predictive of community integration, satisfaction with life, and depression, although self-efficacy was identified as a significant mediator of this relationship. However, Kendall and Terry's prediction of interactions between cognitive impairment, appraisals and coping style was not supported. In contrast, Krpan and colleagues (Krpan, Levine, Stuss, & Dawson, 2007; Krpan, Stuss, & Anderson, 2011) have shown that acquired executive deficits following brain injury may impair

problem solving, further impacting coping and emotional outcome. Bessell, Watkins, & Williams (2008) tested a model linking rumination, autobiographical memory, executive functioning, and depression. Consistent with research into depression, they found that, amongst people with brain injury, ruminative self-focus reduced specificity of autobiographical memory. Salas, Vaughan, Shanker, & Turnbull, 2013; Salas, Gross, Rafal, Viñas-Guasch, & Turnbull (2013) summarise the literature on cognitive concreteness and implications for psychotherapeutic practice, and go on to systematically describe a case of a woman post left prefrontal stroke with a specific deficit in reappraisal. Therefore there is some indication that cognition-emotion interaction may need to be considered for some people post ABI but further research is needed.

We propose therefore that at the core of emotional adjustment are parallel conscious and non-conscious processes relating to threat to self in the moment. Both in the very short term, and over longer time periods, this "threat to self" will be influenced by prior representations (cognitive content relating to self-concept and relationships with others), and self-regulatory systems (cognitive processes including self-regulation) defined by both acquired deficits and altered cognitive-affective processes. Attempts to reduce threat to self or self-discrepancy and maintain coherence of identity in the short term through use of "safety seeking" coping behaviours might in turn lead to progressive loss of social and other activity over the longer term, further compounding both actual, and perceived changes to personal and social identities.

Proposed clinical cognitive-behavioural model

This brief review of the literature provides the basis for our provisional transdiagnostic model presented in Figure 1. This format aims to support clinical assessment, formulation, and intervention within a broad contemporary cognitive behavioural framework and foster collaborative working between rehabilitation professionals. It makes use of the WHO-ICF terminology such as social and personal context to link the components of the model with established practice in rehabilitation.

The “vicious daisy” provided in Figure 2, based upon the model presented by (Ownsworth, 2014; p. 64) re-presents the model in a format suitable for collaborative formulation in therapy. This places the core threat or meaning of the injury to the individual in the centre, and then maps some of the key processes identified in the model (the effect of the injury, immediate reactions, and longer term coping responses) in such a way as to highlight the short-term and longer term effects of different emotional reactions and coping styles, each of which may serve to maintain “threat to self”. We have found the model to be of particular use when formulating “transdiagnostic” adjustment problems such as ambivalence or partial engagement in rehabilitation, engagement but failure to progress or complex, mixed symptom profiles or multimorbidity.

FIGURE 1 ABOUT HERE

Assessment and formulation

1. *Predisposing factors: pre-injury factors, social and personal context, severity and type of injury, and acquired deficits, social participation*

The model highlights the need to consider, in addition to standard neuropsychological assessment domains, pre-injury relationships, roles, coping style, self-esteem, and mental health. In cognitive-behavioural terms, identification of pre-injury core beliefs or assumptions is important. In particular, based on brief review of the evidence, identification of pre-existing self-discrepancy or low self-esteem and coping styles that may confer vulnerability (ruminative self-focus, worry, perfectionism, avoidance, substance use) may be informative to formulating adjustment post-injury. In addition, many people experience at least one challenging event in their post-injury recovery, for example relating to medical procedures, falling, having a seizure in public, incontinence, rejection by others or failure in a previously valued context, such as the day they try returning to work. Assumptions about future performance in a range of situations might also arise from these early post-injury experiences that have a significant impact on the person’s engagement and participation. The identification of

acquired deficits that may be pertinent to adaptive coping (e.g., problem solving abilities; attention control; self-monitoring ability; autobiographical memory) is also an important aspect of assessment of predisposing factors.

Pre-injury experiences, core beliefs, and assumptions based on these experiences may manifest clinically in someone's account of the services or support they have received. People with early experiences of neglect, separation from caregivers or physical or sexual abuse may have assumptions relating to independence, emotional expression or relationships that are likely to become activated if they become more dependent on others and require closer supportive relationships. For some, these experiences may confirm negative beliefs about self, world or others, exacerbating pre-injury emotions and patterns of behaviour. Others may have developed "rules for living" about, for example, being successful or fulfilling certain roles or values that hold their underlying negative beliefs at bay. Here, altered abilities might prevent these rules for living being followed resulting in both pre-post injury self-discrepancy and activation of underlying negative beliefs. These processes can present a significant barrier to accessing and making use of rehabilitation. These kinds of issue are illustrated in the case of a man who experienced a TBI and multiple other injuries when hit by a car. At the end of an episode of community neuro-rehabilitation, he reflected on how his early life experiences influenced his initial responses to engagement in rehabilitation. He had lost his mother at an early age and joined the armed forces as a teenager after becoming estranged from his father. He coped with exposure to traumatic experiences by drinking and using drugs when he left the forces, and after leaving he spent time in prison, and described himself as institutionalised. The injury occurred when these experiences were behind him, he had married, and was working in a regular job. The consequences of his frontal injury coupled with a strong sense of independence meant that initially he did not acknowledge having the head injury. He engaged in rehabilitation for his orthopaedic injuries, however he dismissed any cognitive or emotional issues by saying that his partner or professionals were "making them up" "it's

not me it's them" or that they were due to the orthopaedic injuries "I'm not going out because I can't walk very far". This resulted in additional challenges for the rehabilitation team and those close to him. His early beliefs that had been re-activated were "*emotions are a sign of weakness*", *"others can't be trusted",* and associated assumptions included "*If I complete tasks alone, I can prove others wrong, If I ask for help, I'm a failure (they were right)", and "If I show emotions, I will be vulnerable".* It was helpful to be aware of these pre-injury beliefs and assumptions in order to find a way to work together, and to support him as he gradually became aware of his limitations with regards to memory, attention, and emotional regulation.

2. Specific trigger and immediate threat response

The model suggests that someone's altered life post-injury provides the context for moment-to-moment emotional responses to day-to-day challenges. These may be processed and regulated according to the perceived meaning of these experiences, which in turn will result in short or medium term cognitive or emotional coping responses. Initially, rapid, automatic threat processes may be activated where someone experiences themselves as self-discrepant in some way, perhaps in relation to a current ability, value, or future goal that is of immediate current concern. This immediate threat response will be determined by the particular meaning of that situation in the context of the individual's personal identity, such as their enduring sense of self-worth, which in turn will prompt emotional expression and short to medium term coping responses. Disruption to the integrity of frontal-limbic circuits caused by some forms of brain injury (a possible predisposing factor related to nature and severity of injury) may impact upon these processes, giving rise to a disinhibited threat response. This could be expressed as severe anxiety, aggressiveness, or sad or ashamed withdrawal. Understanding the possible protective function of the person's behaviour (in the context of threat to self) or of subjective experience in the moment at times when their sense of discrepancy is at its greatest and least, could be more relevant than focusing solely on cognitive content such as negative automatic thoughts. This might manifest clinically in someone's subjective

account of a situation described as challenging, or in his or her demeanour. After 3 or 4 weeks of sessions in which someone displayed flat affect, reduced initiative, lack of eye contact, and inability to report emotional states in the context of a severe TBI involving bilateral frontal damage, it appeared that CBT might not be appropriate given the apparent 'frontal' presentation. However, over time the rehabilitation team reported that there was some variation in this presentation. An OT noted that that discussion of vocational issues seemed to trigger a shift from having some social interaction to becoming particularly flat and withdrawn. This was tentatively interpreted as a manifestation of a non-conscious threat response. This enabled a focus on monitoring of this withdrawn behaviour, and discussion in sessions about pre-injury work role and the meaning of this. In time this enabled a collaborative formulation around "threats to self" associated with loss of work and his hopeless, withdrawn response to this. It is also possible to explore this type of immediate response using a focus on felt sense rather than explicit cognitive content. Focusing on an embodied or visualised account can be illuminating. For example one individual described a sense of feeling overwhelmed in a busy shopping centre. When asked to close his eyes, visualise this, and describe how he feels in relation to others in this specific situation he described a profound sense of being small, being physically overshadowed, of being invisible yet vulnerable to being trampled on, and there being no escape from this. This was accompanied by a strong urge to escape, and physiological symptoms of autonomic activation. This compelling embodied subjective account provided a focus for exploring what might help to "grow" in confidence within this situation, including both imagery and behavioural techniques.

3. Cognitive and behavioural responses to threat

Unhelpful coping responses such as avoidance, withdrawal or denial of difficulties, linked to assumptions developed prior to the injury or early in their post-injury recovery, may be adaptive in the short term for reducing these types of aversive threat response. Short term emotional and behavioural responses may themselves be immediately responded to as a further threat, for

example if the individual has behaved in a way that is discrepant to their aspired to identity, as illustrated in the cycle labelled 3a in Figures 1 and 2. This could lead to escalation of the initial trigger situation, especially in relational contexts where the "threatened" response of the other person may also unwittingly exacerbate the situation. Clinically, a trigger may therefore not only include a situation that is challenging such as a busy shopping centre, or a specific work-related task, but also (and possibly related to this) the perceived highlighting of a deficit in functioning, such as forgetting something, going off task, or being insensitive to others. By association, the notion of using a strategy to manage or get around a difficulty might be seen as quite unacceptable to someone who sees an innate ability to function in a particular way as core to their identity. The greater the personal meaning of this skill to someone, the greater the potential for experience of self-discrepancy and threat to self in the face of a challenge. One person who valued his pre-injury mnemonic abilities described his need to adopt an external memory aid as "bad, wrong and disloyal" to himself, akin to changing his support of the football team Manchester City to Manchester United. Behavioural experiments were used to look at the types of people who might use external memory aids (i.e. many non brain injured people in a range of work and other settings) and what he might conclude about himself from this. This enabled a more flexible view about how to be successful paving the way of adoption of strategies as required.

Immediate reactions or coping responses can be clearly shown as natural and understandable attempts to minimise threat-to-self through the process of collaborative formulation with the person (including family or others as necessary), where this can be mapped this out as a simple vicious cycle. Over the longer term these types of coping style might be further motivated by assumptions linked to anxiety about failure or rejection (low self-efficacy and/or self-worth) or increasing negative sense of self and the future (low self-regard), contributing to a longer-tem pattern of maladjustment. Having had some experiences of a strong threat response, which could potentially be disinhibited (such as becoming verbally aggressive), the person may experience lower

self-efficacy with regard to managing difficulties, and/or increased self-discrepancy and lower self-esteem. It would therefore be quite understandable for the person to make decisions about how they spend their time, what goals to set, which situations to seek out or avoid, based on an overarching "hot goal" of avoiding or minimising and potential further threats to self.

Acquired deficits might impact at one or both of 2 levels, via the practical impact, and personal meaning of a loss of cognitive ability, and the effects of altered cognition-emotion interactions. The first of these levels might be apparent for someone with acquired memory problems who struggles to recall the details of day-to-day situations, as in the case of Allan reported by Brindley, Bateman & Gracey (2011). For Allan, his poor recall underpinned a growing sense of anxiety about his ability to trust how he had managed in a situation, which in turn impacted on his general self-efficacy fuelling an avoidant coping style. Attention to these difficulties with recall in terms of adaptations to managing everyday tasks (such as using a combination of assistive technology and paper-based memory systems), and therapy tasks (using behavioural experiments and life-logging photography) was required. The second level, impact of altered cognition-emotion interactions, can often be observed clinically where someone's threat response is accompanied by an increase in a problematic disinhibited behaviour, which could range from increased frequency of inappropriate comments, heightened distractibility, reduced self-awareness or error self-regulation or aggressiveness. In the context of talking through a recent trigger situation, one person demonstrated a reoccurrence of some of the emotional response he had at the time. In CBT this is something a therapist would seek out in order to access and reflect on before working with the cognitive content associated with the emotional response. However, in this case so strong was the re-activation of response that the individual was out of the chair physically re-enacting his aggressive behaviour in a manner akin to a flashback without realising this. Feedback from the therapist on these occasions was met with surprise but also acceptance. Heart rate biofeedback in conjunction with the use of the metaphor of developing the martial arts skills Neo uses in the film the Matrix to

slow down time in a threat situation was used to heighten anticipatory self-regulation and self-efficacy.

Another vicious cycle linking longer-term threat to self, coping, behaviour, acquired deficits and participation, labelled 3b, could therefore also be drawn out. Cognitions about emotional and behavioural responses could be helpfully explored, alongside information about the person's ability to tolerate or process strong emotional experiences. Assumptions may provide useful information about what might underpin a tendency to respond in a particular way. In addition it may be useful to explore self-efficacy beliefs regarding controllability of emotional responses. These vicious cycles may also provide a basis for exploring ambivalence, as the person will likely want to achieve longer term goals that are important to them, and at the same time feel compelled to protect their identity by engaging in coping strategies that minimise immediate or anticipated short-term self-discrepancy.

4. *Longer term trajectory of adjustment – impact on abilities and deficits, social participation and personal identity*

Over time these unhelpful but understandable coping responses may result in further disruption of social participation, relationships and rehabilitation efforts, and potential loss of skills, including those unaffected by the injury (Goldstein, 1952). This could then provide the substrate for development or maintenance of enduring and more generalised negative self-representations pertaining to broader categories of situation or context, e.g., working, going out with friends, being in a relationship, rehabilitation or independent living. In the context of continued expectations to perform at a certain level or achieve certain goals, and rigid assumptions that tie these expectations to particular meanings about self, maintenance or increase in self-discrepancy could arise. This could in turn maintain vulnerability to low self-esteem, mental health issues, and elevated threat response to, or tendency to withdraw from, specific salient issues arising in day-to-day life. For example, following a stroke a previously very active woman was keen to get walking again, and

worked hard in her early physiotherapy successfully being able to walk unaided although with some residual impairment impacting gait and balance. When referred for psychological therapy some 4 years post-stroke, she was back in a wheel chair unable to walk unaided and experiencing symptoms of both agoraphobia and social anxiety. Although she had recovered some function initially, the broader impact of lifestyle, work, and in course relationship and role changes undermined her confidence leading to withdrawal from activities and progressive loss of physical functioning, and reliance on social media to maintain remaining social contacts.

Where more significant mood or affective disorders develop, these might also affect cognitive processes (executive functioning, autobiographical memory) further impacting upon self-regulation and longer-term adaptation. In our experience, it is not uncommon for unmet emotional needs to systematically lead to significant social isolation, itself a factor in driving mental health problems. Collaborative development of vicious cycles that map out this longer-term adaptation process should also be developed with the individual, and others in the system as necessary.

Figure 2 about here

Implications for intervention

Detailed description of all possible interventions is beyond the scope of this paper. We describe below general considerations for therapy, first covering neuropsychological adaptations before giving examples of specific interventions derived from the model, summarised in Figure 3. Selection of interventions should be based upon the individualised formulation developed for and with a particular individual.

Adaptations to address neuropsychological challenges

Across all therapeutic tasks, the individual's cognitive, communication, and sensory strengths and difficulties will need to be considered and adaptations made as required, in line with recent practice guidance (Ponsford et al., 2014; Tate et al., 2014; Velikonja et al., 2014), principles of compensatory strategy development (Wilson, 2000) and the clinical literature on therapy modifications (e.g., Whitehouse, 1994; Gracey, 2002; McGrath and King, 2004; Judd & Wilson, 2005; Bradbury et al, 2008; Klonoff, 2010; Ashman et al., 2014; Hsieh et al., 2012a, 2012b; Brindley et al., 2011). In general, guidance suggests shorter more frequent appointments, integration of cognitive rehabilitation techniques, greater focus on behaviour change (e.g., behavioural activation, behavioural experiments) than cognitive change, and use of memory supports (e.g., notes, dictaphone, smart phone). It has been argued that the structured, concrete approach of CBT, focus on between-session practice and use of tools such as diary records and worksheets lends itself well to application with people with ABI. However, further specific adaptations may also be helpful for specific areas.

Comprehension

Developing a visual formulation is helpful to scaffold comprehension. Enhancing development of a shared understanding and linking this with the exploration of "felt sense" can also be achieved through the use of metaphor. The client and family may also need information to help them understand some of the subtle difficulties the person might be having. It may be necessary to apply principles of learning to development of knowledge, shared understanding, and collaborative rapport in therapy.

Attention/ planning

CBT sessions are structured and involve setting an agenda, which can help people who have difficulties with organising their time and paying attention. CBT is also goal-focused and broadly couched within a collaborative problem solving framework, which sits comfortably with using tools

such as the goal management framework to provide additional structure to working collaboratively on a problem area. Summarising key points more regularly than in standard CBT can also help with staying on track. Sessions require more structure and repetition than traditional CBT, they may also be more specific, frequent and concrete. Khan-Bourne and Brown (2003) suggest shortening sessions to aid attention and making them more frequent. The therapist may need to be more directive if the client has problems with planning, organising, problem solving. Although this goes against the collaborative and question based therapeutic style of CBT, and could be seen as taking an "expert" position, this can be dealt with to an extent with permission-asking and careful phrasing.

Memory

Memory aids can be used to help people remember the content of sessions, including cue cards, making notes, audio-recording small parts of the session such as goals, summaries or homework plans. Attention to the optimal learning or change domain for an individual will be required in the context of their neuropsychological assessment. For example, a greater focus on behavioural practice, and in-vivo work might be required for someone with more significant episodic memory impairment. However, supports for recording and rehearsing information pertinent to therapy might be sufficient for someone who has retrieval deficits. Working with others who can support therapy tasks in context will also be important. Increasingly people are making use of assistive technology in their daily lives, and where appropriate calendar and to do list apps can be used for supporting links between therapy sessions and homework. Reminders can be used for self-monitoring, completion of homework, to help maintain a new perspective or sense of identity, or reminders about strategy use.

Awareness

Many mainstream CBT approaches, including contemporary or 3rd wave approaches, rely upon the individual being in a position to self-report their goals or subjective experience to some extent. However, it is not uncommon to be working with those who struggle to self-report and engage in

CBT due to a combination of pre-injury emotional problems, post-injury adjustment issues, deficits in self-awareness, or a lack of helpful social resources. For these individuals, even approaching a rehabilitation or support opportunity may be threat activating or risky, or serve to enable rehearsal of strategies to avoid or minimise threat to self. Whilst behavioural experiments can provide a means for someone to engage differently with their contextualised experience of their injury, for people still approaching acceptance or self-awareness of difficulties, it becomes more important to place the therapy in the real-world context of the individual through in vivo work, and appropriately structured feedback (Schmidt, Fleming, Ownsworth, & Lannin, 2013; Schmidt, Lannin, Fleming, & Ownsworth, 2011), group, family or couples therapy or smaller clinic based behavioural experiments. It should be emphasised that, as in cognitive behavioural approaches for people with long standing emotional and relationship problems, the first phase, developing therapeutic safety, and the working relationship, may be protracted but cannot be ignored.

Interventions derived from the transdiagnostic model

A natural starting point for intervention, in line with standard rehabilitation practice, would be on tasks, activities and relationships in everyday life, and appropriate support or rehabilitative strategies to access and overcome challenges in these valued contexts. Linking rehabilitation goal setting techniques with activity scheduling or behavioural activation approaches may be helpful.

Where there are more substantial psychological challenges to this process, the therapist will need to begin to conceptualise very specific immediate triggers and reactions, broader contexts, and longer term concerns, linking closely with rehabilitation activity (specifically goal setting), family/relational, and work settings as necessary. It may be that previously valued activities cannot be returned to in the same way. However, it might still be possible for that person to engage in things that satisfy the same underlying meaning or value for them, indicating a potential role for values-based behavioural activation techniques (Kanter et al., 2010). As threats to self remain at the core of the model,

therapeutic safety will need to be fostered in order to focus on the core concerns of the injured person. The cognitive and emotional challenges this presents to the injured person should not be underestimated. Fostering a shared understanding and rationale for any future interventions is essential.

Figure 3 about here

One important aspect of this model is that it predicts that some may experience things getting worse before they get better. If someone is engaging in "safety seeking behaviours", actions or patterns of coping which serve to reduce threat-to-self either immediately or over the longer term, then the process of dropping these behaviours to explore the individual's underlying assumptions and meanings may be aversive. Collaborative formulation with the individual and family members to determine whether such an approach is acceptable is important. MI techniques may be helpful for addressing ambivalence about change or about the acceptance of losses and changes. If someone has unhelpful or risky coping behaviours (such as substance use or aggressiveness) change may need to look at: neurocognitive strategies for managing the emotional response (e.g., shifting attention or disengaging from the reaction; arousal reduction), cognitive affective responses (introducing alternative cognitive or affective materials such as a reassuring or compassionate image, or reframing as a practical issue to be solved rather than a personal failure, exploring, and developing the "felt sense" of a positive experience) as well as cognitive rehabilitation strategies (e.g., metacognitive strategy training, problem solving, reminders, assertiveness). Where someone has high levels of risky coping or lacks pre-injury experiences that have equipped them with helpful ways of managing emotional challenges, it may be especially important to practice relevant skills alongside exploring the nature of threat reactions. Involvement of family will also be critically important. For some, cultivation of a compassionate response to self-criticism or self-attacking (Ashworth, Gracey, & Gilbert, 2011), or development of a mindful approach to stepping back, and

uncritically observing thoughts and feelings in a challenging situation (Bédard et al., 2014) may be helpful.

In our experience, one outcome is that over the course of therapy people become more open to new experiences and able to experiment, to try things out, and appear to spontaneously rediscover the "old me" whilst also incorporating aspects of the "new me". As the person moves from threat responses and maladaptive coping towards hope and curiosity for the future, identification of the recipe of supports, skills, resources, and activities to help maintain and consolidate gains will be needed (Gracey et al., 2009). If therapeutic support is required to achieve this, then again behavioural experiments may be an especially efficient way of integrating neurorehabilitation and psychological therapy to support development of resilience and updated personal and social identities (McGrath & King., 2004; Gracey, Brentnall, and Megoran, 2009). However, at this point one might consider whether the individual is in a position to re-engage with their rehabilitation and other aspects of their life free of the ambivalence and possible threat reactions that marked their earlier trajectory. Identifying social and community opportunities that can foster the person's growth within their own life context may be more important than problem-focussed intervention. Attention may need to be paid to compensatory strategies or structures that enable the person to rehearse their positive experiences sufficiently to help with longer-term adjustment and growth. Kindling and building positive affect and well-being is necessary to consolidate identity changes and to support the person in increasing their investment in personal and social strengths and resources, as described in the Y-shaped model, and in line with the broaden-and-build model of positive affect Fredrikson, 2004).

Summary

In summary, CBT outcome studies following brain injury show promise but have generally failed to contribute to an underpinning theoretical understanding of emotional problems, and effective

interventions. There is sufficient evidence in the literature to begin to identify the necessary components of an evidence-based transdiagnostic model of emotional distress. Our model proposes a series of feedback loops starting with in-the-moment threat reaction, each of which serves to maintain underpinning threat to self, and has a cumulative impact on psychosocial adjustment over time. This clinical model may help provide a focus for improving the reciprocal relationship between clinical practice and research in this area. We have tentatively proposed candidate interventions based on specific maintaining factors that, depending upon individualised formulation, may be considered within a transdiagnostic CBT intervention. Future clinical trials that include measurement of processes highlighted by this model may therefore hold promise for contributing to development of understanding of what works for whom, and why following ABI.

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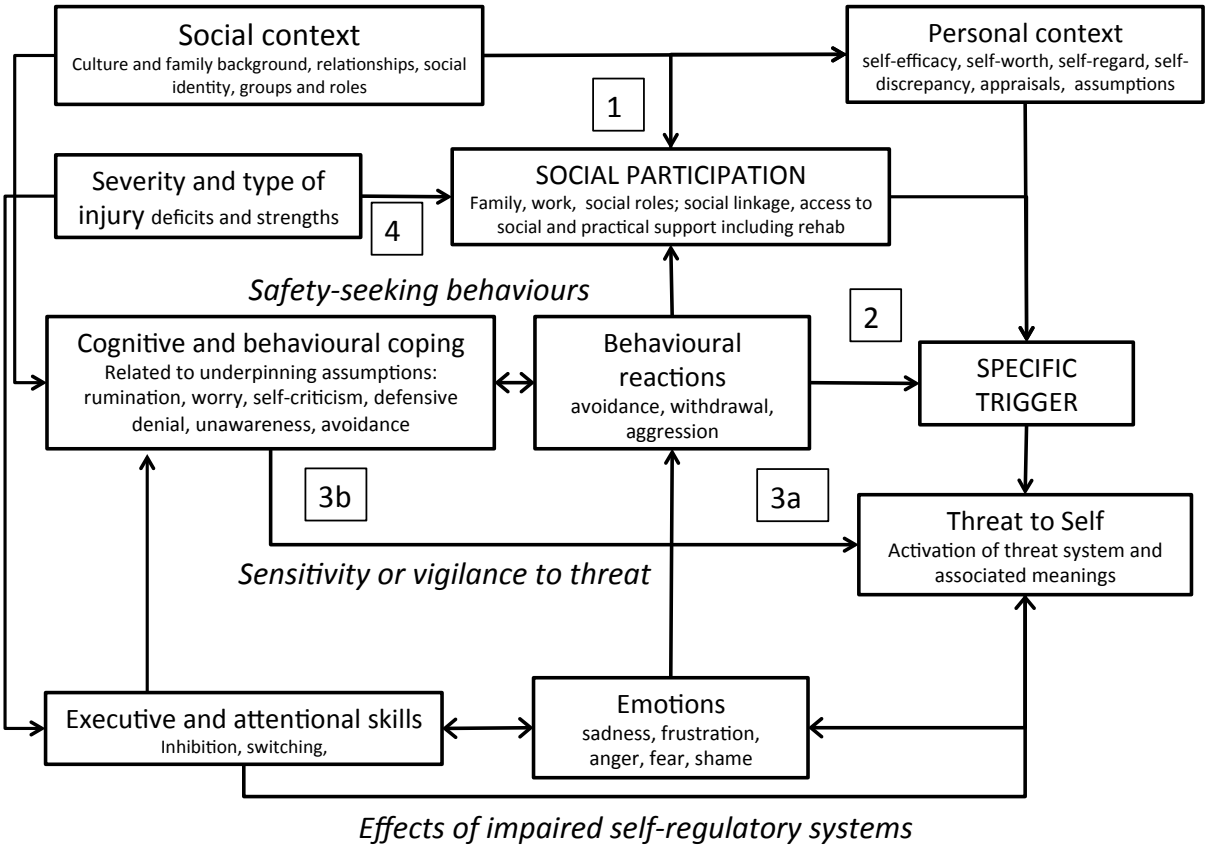

Figure 1: Longitudinal, transdiagnostic cognitive-behavioural model of post-ABI adjustment, highlighting the role of responses to momentary and prolonged threats to self in maintaining poor emotional and psychosocial outcome. Numbers represent domains of the model explained in the text.

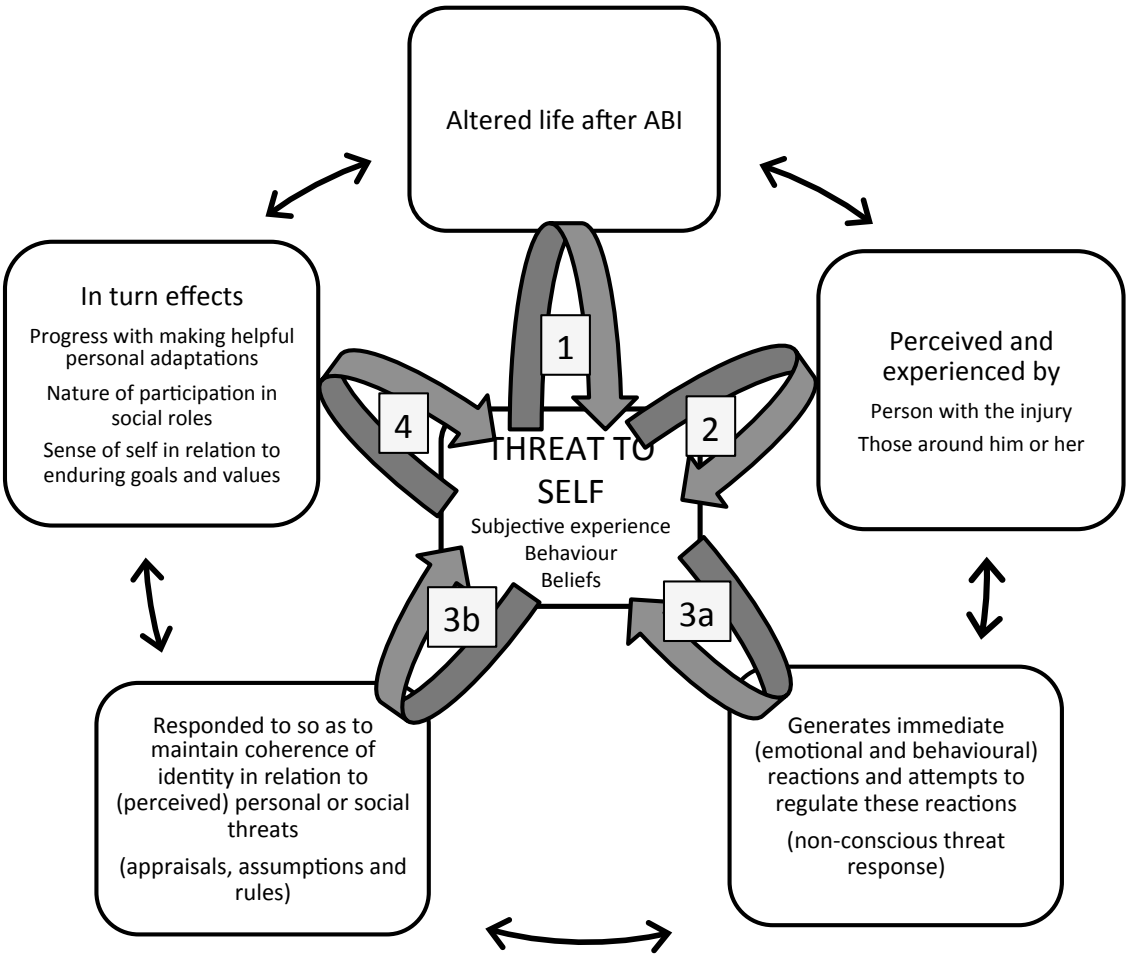

Figure 2: simplified schematic summarising potential for unhelpful cycles affecting short term responses as well as enduring patterns of social outcome, based on Gracey and Ownsworth (2012) and Ownsworth (2014, p. 64). Numbers represent domains of the model explained in the text.

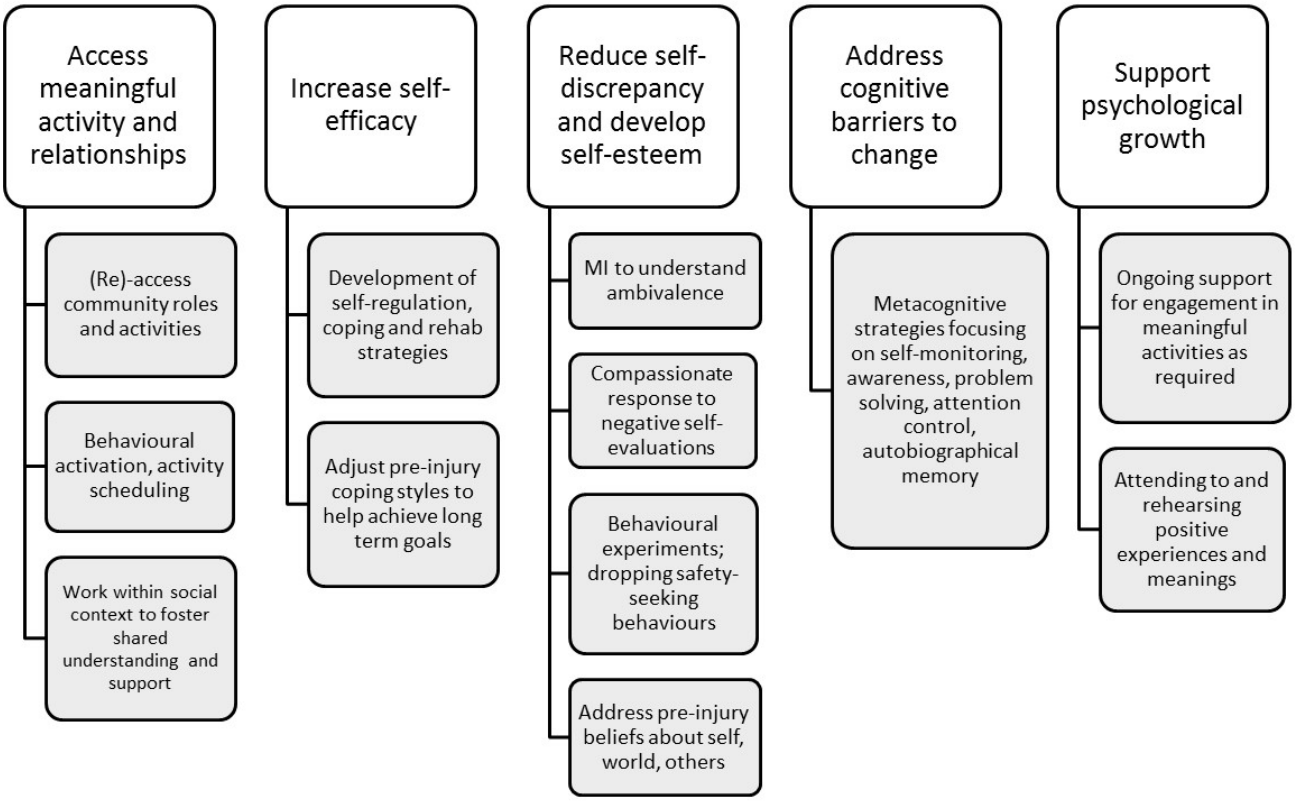

Figure 3: Schematic showing suggested therapeutic tasks and interventions based on a transdiagnostic formulation, to be considered in the context of neurorehabilitation.