Posttraumatic Stress Disorder and Traumatic Hand Injuries: A Neuro-Occupational View

Helene Lohman, OTD, OTR/L, is Associate Professor, Department of Occupational Therapy, Creighton University, 2500 California Plaza, Omaha, Nebraska 68178; hgold@creighton.edu.

Charlotte Royeen, PhD, OTR, FAOTA, is Associate Dean for Research and Professor, Department of Occupational Therapy, Creighton University, School of Pharmacy and Health Professions, Omaha, Nebraska.

Using the clinical phenomenon of posttraumatic stress disorder related to traumatic hand injuries, this article conceptually explores the theoretical construct of neuro-occupation on the basis of these conditions. Neuro-occupation is an evolving concept that combines knowledge and understanding of occupation with knowledge and understanding of how the human brain functions in environmental context; thus, the concept is important to the core of occupational therapy practice. The first section of the article introduces the concept of neuro-occupation; the second provides an overview of posttraumatic stress disorder and traumatic hand injury. To help therapists better understand behavior seen in clinical settings, the third section presents key neuro-occupational processes pertaining to posttraumatic stress disorder, using clinical application examples. Finally, a query about the value of neuro-occupation as a developing theoretical construct is put forth.


Occupations are “the ordinary and familiar things that people do every day” (American Occupational Therapy Association [AOTA], 1995, p. 1015). Human occupations are multidimensional, with “emotional, cognitive, physical, spiritual, and contextual dimensions” (AOTA, 1995, p. 1015) and, therefore, possess occupational complexity (Royeen, 2000, 2002; Royeen & Luebben, 2002). Occupational therapy, fueled by occupational science, is at an exciting stage of transformation from alignment with medical model practice and science to rediscovery of foundational roots philosophically grounded in pragmatism, humanism, and holism simultaneously coupled with postmodern methods and views of science.

In part, the maturing of occupational therapy as a profession has allowed for or fostered the development of occupational science (Zemke & Clark, 1996), which is “the systematic study of the human as an occupational being” (Clark et al., 1991, p. 300). As part of this maturation process, the continual revision and development of new ideas and innovations is critical in the formative and creative stages of a scientific discipline. Such fertile mixing of theoretical and scientific development has been seen in the past when mixed-field theories, such as psychohistory, neuropsychology, neuroimmunology, and neuro-ophthalmology, emerged. Blending or mixing two disciplines typically is called “interfield theory development” (Bechtel, 1988), “overlapping academic neighborhoods” (Polanyi, 1958), or “mixed theory.” Currently, such mixing also can be observed in the fluid concepts of neurotheology (Woodward, 2001), astrobiology (Darling, 2001), and neuro-occupation (Padilla & Peyton, 1997).

Neuro-occupation refers to a developing theoretical concept encompassing neuroscience and occupation, hence, construction of the term neuro-occupation. The conceptualization that human neurological processes and occupations are entities embedded in and dependent on each other is a subject explicitly discussed by Padilla and Peyton (1997). Implicitly, however, this holistic perspective is one...
that combines psychosocial, spiritual, physical, contextual, societal, and cultural views and has been part of occupational therapy practice from the profession’s inception (Hemphill-Pearson & Hunter, 1997). To illustrate, Breines (1995) reported that the original schools of occupational therapy promoted the principle of pragmatism and the concept that occupation addressed the relationship of the mind and body of a person in context. Pragmatism as one of the foundations of occupational therapy is discussed by Hooper and Wood (2002).

Padilla and Peyton’s (1997) emerging theoretical concept of neuro-occupation is designed to conflate occupation and neuroscience for application to occupational science and occupational therapy. In neuro-occupation, the nervous system and occupation are considered to be integrated, dynamically interactive, and influenced by the environment (Padilla & Peyton, 1997). On a superficial level, neuro-occupation may mistakenly appear as a reductionistic reversion to a biomedical analysis of human performance components and mechanics. On deeper reflection, however, we believe that neuro-occupation reflects the core of occupational therapy practice in context (the physical, social, and cultural environment or setting in which the participation or occupation occurs). It harkens not to reductionism, but to a holistic approach first advocated by one of the leading founders, Adolf Meyer (n.d.). In fact, Meyer is considered to be a founding leader of occupational therapy (Reed, 1993) as well as a founding leader of neurobiology and psychobiology (Meyer, n.d.). Thus, historical roots exist that have linked the two fields together from their very inception. It is only recently, however, that the overt links between the two are being reestablished, valued, and explicated using neuro-occupation.

Other leading theorists in occupational therapy have built upon the foundations of neuroscience and occupation, but without explicitly naming it neuro-occupation (Ayres, 1963; Dunn, 2001; Farber, 1989; Huss, 1976; King, 1978; Llorens, 1969; Moore, 1975; Reilly, 1962; Rood, 1958; Scardina, 1974). We perceive that all of these theorists ground occupational therapy in a dynamic interrelationship between the neurological and occupational processing of humans in context. To illustrate, a recent reconceptualization of Rood highlighted “the importance of actions that occur between the nervous system and occupation (i.e., the nervous system and occupation coeffect one another in a dynamic, nonlinear manner)” (Royeen, Duncan, & McCormack, 2001, p. 577).

Indeed, Rood’s work foreshadowed neuro-occupation. More recently, additional scholars have reflected a fundamental linking of neurological processing to occupation and of occupation to neurological processing (Christiansen et al., 1998; Karz 1998; So, Toglia, & Donohue, 1997). In the spirit of the scholarship of application and of integration as delineated by Boyer (Glassick, Huber, & Maeroff, 1997), beginning work has been published on explication of neuro-occupation applied to the neonatal intensive care unit (Howell, 1999), meditation (Walloch, 1998), and pediatric play (Way, 1999). Further, neuro-occupation as an emerging concept has been presented at neuroscience meetings (Duncan & Royeen, 2000; Royeen, Duncan, & Zardetto-Smith, 2000; Royeen, Mu, & Zardetto-Smith, 2000).

Neuro-occupation reflects neither a “bottom–up” nor a “top–down” approach (Fisher, 1998), both of which we consider to be a form of reductionism. Rather, neuro-occupation is a holistic approach that assumes a model of complexity based on multiple interactions of multiple variables and systems. Neuro-occupation, therefore, reflects and builds upon current iterations of nonlinear systems thinking based on chaos and complexity theory.

Chaos and the related constructs in complexity theory refer to a radically different world order than that based on linearity. Fundamentally, chaos and complexity theory assume that (a) variables coeffect one another, (b) multiple interactions or coeffects occur in real life (are multivariate), and (c) self-organization emerges from patterns of behavior. General systems theory and dynamical systems theory may be considered precursors to chaos theory. Further elaboration on chaos and complexity theory can be found elsewhere (Abraham & Gilgen, 1995; Rosenthal, 1996; Royeen, 2002; Royeen & Luebben, 2002; Warren, Franklin, & Streeter, 1998).

### Overview of Traumatic Hand Injuries and Posttraumatic Stress Disorder

Traumatic hand injuries resulting from burn, crush, deglovement, or amputation may profoundly affect a person physically and psychologically. These injuries are particularly stressful because the injured person is usually conscious during the trauma, the memory of which can serve as a constant reminder of the injury (Grunert & Maksrud-Sagrillo, 1993). Additionally, hands assume a symbolic meaning within our culture in terms of doing, creating, and acting on the world (Wilson, 1998). The symbolism pertaining to “hands” of a person who has posttraumatic stress disorder secondary to traumatic hand injury is hypothesized to be radically different from the person’s premorbid status.

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1 In fact, the second author was dumbstruck by the number of history of neuroscience posters at the 2001 Annual Meeting of the Society for Neuroscience that dealt with Meyer as the founder of psychobiology.
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2001. Recent research suggests that 4 in every 10 people in lower Manhattan suffer from posttraumatic stress disorder (as reported by Edwards, 2002).

The DSM-IV documents that physical injuries can result in posttraumatic stress disorder (American Psychiatric Association [APA], 1994; McFarlane, 1997). Posttraumatic stress disorder, as described by the DSM-IV, is defined as the client having interfering thoughts (nightmares, flashbacks), sleep disturbances, amplified startle responses, high levels of psychological distress, physiological responses to stimuli that remind the person of the trauma, and cognitive as well as memory disturbances. Posttraumatic stress disorder also can be associated with avoidance of trauma-related stimuli, such as reluctance to return to the workplace where the injury occurred (APA, 1994).

Posttraumatic stress disorder is commonly seen in clients treated by occupational therapists providing services in mental health settings (Froehlich, 1992; Shortt-DeGraff & Engelmann, 1992). The occupational therapy literature has explored the occurrence of posttraumatic stress disorder following major disasters (Roberts, 1995), such as airline accidents, refugee trauma (Driver & Beltran, 1998), homelessness experienced by women (Davis & Kutter, 1998), and work-related back injury (Phillips, Bruehl, & Harden, 1997).  

**Neuro-Occupation: The Neurological Processes of Posttraumatic Stress Disorder**

Within the neuro-occupational perspective (Padilla & Peyton, 1997), a dynamic connection exists among mind, body, and environment for a person who has posttraumatic stress disorder and a hand injury. We believe that the neuroscience literature supports this supposition; to illustrate, Murburg (1997) stated, “all human perceptions, thoughts, emotions, and actions are mediated by the brain and, in turn, impacted on the brain” (p. 356). In fact, complex behavioral and neurological changes can follow a single, brief, stressful event (McFarlane, 1997). We believe that complex behavioral and neurological changes also occur secondary to traumatic hand injury. Persistent intrusive thoughts and emotional stress following a traumatic incident can change the neural system in predictable ways, involving many areas throughout the brain (van der Kolk, 1997), and per chaos theory, we suggest that the neural system also may change in unpredictable ways.

The predictable ways include failure to organize an adequate neural-chemical response to acute stress in (a) the hypothalamic-pituitary-adrenal axis and (b) the sympathoadrenal axis (Lundy-Ekeman, 1998). Other neural systems also are thought to be involved in posttraumatic stress disorder, including the (c) limbic structures and the (d) brain hemispheres (van der Kolk, 1997). An examination of these four neural systems follows to potentially explain the changes in occupational patterns that therapists see with treatment and to provide clues to treatment interventions that affect neuro-occupational systems affected by posttraumatic stress disorder secondary to traumatic hand injury.

**The Hypothalamic-Pituitary-Adrenal System**

Knowledge about the functions of the hypothalamus, pituitary gland, and adrenal gland in the hypothalamic-pituitary-adrenal axis is critical for understanding the theoretical causes of posttraumatic stress disorder. The hypothalamus organizes endocrine and autonomic functions, such as sleep, circadian rhythms, and emotions (Lundy-Ekeman, 1998). The hypothalamus integrates physiological signals with cognitive input from the cortex and subcortical areas. When the cortex identifies a traumatic event, it signals this message to the hypothalamus. The hypothalamus transmits enhanced corticotropin-releasing factors to the anterior portion of the pituitary gland (Baker et al., 1999).

The pituitary gland secretes hormones that influence bodily functions, such as growth and development, metabolism, and reproduction. When the pituitary gland receives the corticotropin-releasing factors from the hypothalamus, it releases adrenocorticotropic hormone and other hormones. These hormones circulate in the blood to the adrenal cortex, where cortisol is released (Campeau, Day, Helmreich, Kollack-Walker, & Watson, 1998).

Initially with posttraumatic stress disorder, an increased production of cortisol occurs. However, the increase in cortisol enhances the responsiveness of the glucocorticoid receptors in the pituitary gland, the hypothalamus, and other places, subsequently leading to a shutdown of additional cortisol production (Yehuda, 1998a). Yehuda's research identified this enhanced negative feedback inhibition of the hypothalamic-pituitary-adrenal axis associated with posttraumatic stress disorder. Yehuda (1997, 1998b) suggested that an enhanced release of corticotropin-
releasing factors combined with an enhanced negative feedback system leads to altered responsiveness of the pituitary gland and overall sensitization of the hypothalamic-pituitary-adrenal axis. This idea might explain the hyperresponsivity to environmental stress often seen in a person with posttraumatic stress disorder (Yehuda, 1997). In the clinical setting, a person with posttraumatic stress disorder may seem overly responsive to aspects of the environment, such as noise or other environmental triggers that were present during the time of injury. In the jargon of occupational therapy, we may identify this as sensory defensiveness secondary to acute trauma.

Low cortisol levels have been identified in persons with posttraumatic stress disorder, especially chronic posttraumatic stress disorder (Yehuda et al., 1995). Low cortisol levels can be correlated with many of the symptoms that occupational therapists observe in clients who manifest posttraumatic stress disorder. These symptoms include emotional withdrawal, evasion of activities related to the trauma, aloofness, decreased emotions, and depression (Wang, 1997). Clinically, the therapist might perceive a client’s withdrawal and bland affect as lack of motivation for treatment. Variations in cortisol levels also may be related to how memories are encoded at the time of the trauma, explaining fragmented or incomplete memory of the traumatic event (Yehuda & Harvey, 1997) and enhanced memory consolidation (Golier & Yehuda, 1998) of the trauma.

**The Sympathetic Adrenal Axis**

The sympathetic adrenal axis also influences posttraumatic stress disorder. It is activated during incidents of extreme fright, fear, or pain, such as with a traumatic hand injury. The sympathetic adrenal axis produces a heightened state of readiness frequently called the “fight or flight” reaction (Cannon, 1914), providing oxygen for energy and allowing the muscles to work harder. Disproportionate sympathetic arousal may result in behavioral disturbances such as rage, irritability, and intrusive thoughts connected with posttraumatic stress disorder (Kolb, 1987). In clinical treatment, a person may seem irritable during treatment sessions. Additionally, he or she may seem inattentive and have difficulty remembering instructions or treatment times.

**Relationship Between Hypothalamic-Pituitary-Adrenal Axis and Sympathetic Adrenal Axis Activity**

When stress occurs, the hypothalamic-pituitary-adrenal axis and the sympathetic adrenal axis interact in a complementary manner. Typically, the catecholamines released by the sympathetic adrenal axis provide needed energy to the body’s organs. At the same time, cortisol released by the hypothalamic-pituitary-adrenal axis shuts down the sympathetic response and suppresses the hypothalamic-pituitary-adrenal axis with negative feedback inhibition (Yehuda, 1998a). This hypothalamic-pituitary-adrenal axis response helps to restore homeostasis. Low cortisol levels and high catecholamine levels are identified with chronic posttraumatic stress disorder (Blanchard, Kolb, Prins, Gates, & McCoy, 1991). High catecholamine levels may contribute to a powerfully imprinted memory of the traumatic event, with invasive remembrances and conditioned emotional reactions (Pittman, 1989). These memory changes manifest clinically with the client not providing an accurate history of the traumatic event.

**Limbic Structure Responses and Functional Implications**

Multiple other neural responses may contribute to behaviors observed with posttraumatic stress disorder. Evidence suggests that the limbic system structures of the amygdala, prefrontal cortex, and hippocampus influence actions of persons with posttraumatic stress disorder (Herman & Cullinan, 1997). Traditionally, limbic structures are thought to regulate behavior and emotions (Aggleton, 2001; Fitzgerald & Folan-Curran, 2002; Guyton, 1991). The limbic structures synapse with the hypothalamic-pituitary-adrenal axis and are involved in the control of the axis (Herman & Cullinan, 1997).

The amygdala, a central fear-processing system, has connections to the hypothalamus (McEwen & Magarinos, 1997), influencing learning and memory. The amygdala represents a link between memory and emotions (Post, Weis, Smith, Li, & McCann, 1997). With posttraumatic stress disorder, the influence of the amygdala may result in an extreme fear reaction to a neutral stimulus (Armony & LeDoux, 1997). For example, a person simulating work activities in a clinic may hear a noise that reminds him or her of the previous trauma experienced at work; the person may become suddenly very anxious as he or she experiences a flashback. The connection of an emotional response to a neutral stimulus results because the amygdala may encode emotional memories differently than other areas of the brain.

The amygdala and hippocampus may be linked with the stress response of posttraumatic stress disorder. Enhanced stimulation of the amygdala causes emotional arousal. Emotional arousal along with decreased hippocampal size (identified in some persons with long-term effects from posttraumatic stress disorder) may account for difficulty processing and interpreting information (van der Kolk, 1997). These neurological changes may explain the emotional withdrawal or aggressive response observed in
persons with posttraumatic stress disorder when they perceive a threat. Atrophy of the right hippocampus also has been linked with short-term memory deficits (Bremner & Narayan, 1998). In the clinic, short-term memory deficits may be observed with follow-through on a person’s description of current life functioning, such as the ability to remember daily activities to be completed.

Other aspects of memory, which again would affect the person’s life functioning, may be influenced by changes in the hippocampus. These include declarative memory (conscious memory, remembering facts) and nondeclarative memory (unconscious memory, such as knowing how to skip) (Bremner, 1999). Finally, right frontal lobe hyperactivity has been identified in posttraumatic stress disorder, which may correlate with hyperreactivity observed during treatment (Rauch et al., 1996).

**Brain Lateralization**

Research indicates that the brain hemispheres also are involved in the stress response to posttraumatic stress disorder. Although contradictions in the literature exist, many researchers associate the left hemisphere with the sympathetic adrenal response (Wittling, 1997). The left hemisphere is generally linked with problem solving. Persons with posttraumatic stress disorder have difficulty with categorization and disassociation, which may be left hemisphere related (van der Kolk, 1997). The right hemisphere, associated with the hypothalamic-pituitary-adrenal axis response, is believed to be the main control area of the stress response (Wittling, 1997). This sensitivity to stress is illustrated by the fact that the right hemisphere shows a strong response to trauma-related emotions in positron emission tomography studies (Rauch et al., 1996). The right hemisphere processes nonverbal, emotional communication, such as body language, facial expression, voice tone, mood, and attitude (Henry, 1997). In the clinic, a therapist may observe a client displaying difficulty in the ability to read body language of the therapist and other clients and inappropriately responding to social situations.

In summary, this section presented neurological considerations of a neuro-occupational view of posttraumatic stress disorder due to traumatic hand injury. The next section focuses on occupational processes; just as neurological processes shape occupation, it is hypothesized that occupation shapes the neurological processes of the human brain (Royeen, in press). The next section will begin to link neuroscience with occupation (i.e., neuro-occupation) more explicitly. It is presented as a beginning heuristic interpretation for development of continued reasoning, clinical application, and exploration in neuro-occupation.

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**Neuro-Occupation: Occupational Processes Related to Posttraumatic Stress Disorder**

Not everyone experiencing a traumatic hand injury will develop posttraumatic stress disorder. Posttraumatic stress disorder secondary to hand trauma was selected for consideration because a literature base related to these two conditions exists and because a link between hand therapy and occupation-based practice is not adequately clear. The concepts presented in this article, however, can apply to other conditions not associated with posttraumatic stress disorder. For those clients having both hand injury and posttraumatic stress disorder, it seems important to understand the integration of the person as a neuro-occupational being. Recognizing and understanding humans as neuro-occupational beings has direct implications for understanding human behavior in context as well as for the redesign of the environment and social systems that support participation in life. The proposed neuro-occupational integration may be analyzed through key variables related to four hypothesized occupational processes: (a) occupational complexity, (b) occupational patterns, (c) occupational identity or meaning, and (d) meta-emotion of occupation. The second author selected these key variables after 5 years of ongoing study grappling with the precepts of neuroscience merged with occupation. Each will be discussed in turn.

**Occupational Complexity**

Occupational complexity refers to the entire collection of factors that influence occupation. Consideration of occupation as complex allows its rightful place among sophisticated, deep, and pervasive theoretical perspectives. Considering occupational complexity, the first question that comes to mind is: Why doesn’t everyone who has a traumatic hand injury develop posttraumatic stress disorder? We speculate that posttraumatic stress disorder does not happen in everyone who has had a traumatic hand injury for four reasons, all related to occupational complexity.

First, chaos theory (Royeen & Luebben, in press) assists us in understanding why not all cases of traumatic hand injury result in posttraumatic stress disorder. Sensitivity to initial conditions is an assumption of chaos theory, which means that final outcomes of complex systems cannot be predicted, suggesting that a final outcome such as presence or absence of posttraumatic stress disorder secondary to hand injury cannot be predicted. Such sensitivity to initial

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3 It is beyond the scope of this article to begin to address the implication of this assumption applied to current operations in outcomes research and critical pathways. Suffice to say, the concepts are incompatible.
conditions is hypothesized to be a part of occupational complexity related to posttraumatic stress disorder secondary to traumatic hand injury.

Second, we hypothesize that sensitivity to initial conditions is a state based on the dimensions of occupation. Golledge (1998) identified these dimensions as, minimally, performance, contextual, temporal, psychological, social, symbolic, and spiritual. How all of these variables or dimensions interact within networks of occupational processes (the temporally based brain), occupational performance (the body), and occupational contexts (the environment) illustrates the complex systems of occupation that exist within a given individual (Royeen, in press). It is proposed that from a neuro-occupational perspective, the interrelationships of the dimensions of occupation, or another aspect of occupational complexity, result in the presence or absence of posttraumatic stress disorder secondary to hand injury.

Third, as previously stated, we believe that occupation shapes the brain. Development of posttraumatic stress disorder secondary to hand injury depends on the occupations and patterns of occupations in which the individual engages. For every occupation so engaged, we hypothesize that the brain of that individual is altered by participation in that occupation. This argument is based on two sources of support: (a) a long-standing “belief” in occupational therapy that meaningful activity changes a person and (b) research on the effect of occupation or meaningful activity on human performance.

Belief in occupation as a power to influence health has been expressed by many. Using the metaphor of weaving, Wood (1995) termed “the philosophical belief that engagement in occupation can favorably influence health” (p. 44) as the *warp* of weaving. Rebeiro and Cook (1999) addressed the belief in occupation-as-means and facilitating health and wellness of persons with disabilities. Law, Steinwender and Leclair (1998) identified the belief in a relationship among occupation, well-being, and health. Further, “occupation as a medium of change” (Wood et al., 2000, p. 586) has been embraced by curricula, and belief in the value of occupation has been generalized to the belief that occupation is inherently good (Paterson, 1997), that “the right occupation could help persons in need” (Peloquin, 1991b, p. 733; see also Peloquin, 1991a), and that humans experience meaning making through occupation (Crabtree, 1998).

Compared to belief in occupation, research on the effect of occupation or meaningful activity on human performance and health is less pervasive in the literature. Rebeiro and Cook (1999) stated that “despite a firm commitment to the construct of occupation by the profession, little empirical evidence has been generated which supports the basic tenets of practice” (p. 176). Law et al. (1998) conducted a critical review of 20 studies in health and social science that provide “moderate to strong” (p. 81) evidence that occupation can facilitate health and well-being. Lin, Wu, Tickle-Degnen, and Coster (1997) conducted a meta-analysis of research based on Nelson’s (1988) model relating occupational form (the social, cultural, and temporal-spatial shape of an occupation) to occupational performance (the doing or carrying out of an occupational form), supporting a hypothesized relationship between occupational form and occupational performance. Rebeiro and Cook (1999) explored occupation-as-means in mental health consisting of a process that affirms, confirms, and actualizes those who participate. Finally, a seminal article by Clark et al. (1997) demonstrated the power of meaningful activity in maintaining health and wellness in elderly people.

Considering these beliefs inherent in occupational therapy and the developing research supporting change in health or wellness based on engagement in occupation, we believe an outcome corollary is the following. We posit that occupation necessarily and logically changes the neurological system of the person and call it occupational shaping of the brain. Consequently, we speculate that our brains are always rebuilding themselves based on occupational engagement.

Related to occupational shaping of the brain, Stewart and Cohen (1997) presented the concept of “wetware” (p. 64). The elegant notion of wetware refers to thinking about the brain not as a hardware system or as a piece of software for operation, but as something that transcends as it both develops and evolves. Thus, as applied in this case, occupational patterns of the present shape or wetware the brain, which, in turn, influence presence or absence of posttraumatic stress disorder secondary to hand injury. Such wetware as proposed herein is a fourth part of occupational complexity. A discrete example of this assumption is the research delineating changes in the hippocampi of London taxi drivers, demonstrating “a capacity for local plastic change in the structure of the healthy adult human brain in response to environmental demands” (Maquire et al., 2000, p. 8).

In the field of psychology, a theory of the psychobiology of attachment was proposed by Kraemer in the 1980s and 1990s. Using animal model research primarily with rhesus monkeys, Kraemer and his colleagues put forward a view that precedes what is proposed herein as wetware. His theory purports that in human infants, attachment to a

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*Whereas Kielhofner (1995) referred to occupational performance as the “interface of the mind-brain-body performance subsystem with the environment” (p. 176), occupational performance as used here refers to the motor activities a human body displays while engaging in occupation.*
caregiver necessarily changes the brain’s cytoarchitecture (e.g., the structure and function of the brain). His research demonstrates long-standing changes in the brains of rhesus monkeys in response to early life events (Kraemer, 1992, 1995, 1997; Kraemer & Bachevalier, 1998; Kraemer & Clarke, 1996). Wetware elaborates on this notion, wherein a cycle of the environment influencing the brain, influencing engagement in occupation, further influencing the brain, and so forth, continuously occurs, leading to the blending of “hardware and software” of the brain and human experience into wetware.

**Occupational Patterns**

The term occupational patterns refers to the discernible organization of meaningful activities that constitute an individual’s life. The scope and sequence of occupational patterns applies to an individual over a stage of life or across the entire life span. Occupational patterns also apply to those meaningful activities across an entire population, such as a group or culture. Consistent with the work of Clark (1997), Kramer and Hinojosa (1995), and Royeen (1995), we hypothesize that if a given individual’s occupational patterns change, perceived meaning related to those patterns of occupation will concomitantly change for that individual. Thus, in the case of a person who experiences posttraumatic stress disorder secondary to traumatic hand injury, given that occupational patterns are likely to differ before and after injury, we postulate perceived meaning or life value will concomitantly change for that person.

Further, Clark (1997) identified that certain behaviors may be health promoting, whereas others may not. We believe it to be even more complex—that health or feelings of wellness are linked not just to specific behaviors or occupations, but rather to patterns of occupations over time. It would follow that occupational patterns operationalized after hand injury will contribute to or mitigate against building health and wellness. Considering changed occupational patterns also involves reflecting on the dynamic interrelationships among a person’s emotions, cognition, and sense of meaning. We speculate that not only do these dynamic interrelationships apply to individuals who have posttraumatic stress disorder, but also occupational patterns influence health and wellness of humans generally.

Discernment of occupational patterns is in a beginning stage as exemplified by the work of Soderback (1999). Presently, we suggest that the most effective way clinically to understand a given individual’s occupational patterns is through self-report by storytelling or narrative as exemplified by Clark (1993). A large part of meaning comes from a lifelong history of neural pathways, what we speculate to be narrative wetware, created from a person’s life story.

Hearing a person’s narrative can provide insight into how occupational patterns are integrated in the brain (Dunn, Brown, McClain, & Westman, 1995). Accordingly, and as pertains in this instance, one can assess how occupational patterns have changed since the traumatic hand injury and how new occupational patterns are being constructed through narrative. Thus, hearing narratives may allow entry into the subjective world of the person beyond the hand clinic, providing insight into changed occupational patterns due to neurologically based posttraumatic stress secondary to hand injury.

**Occupational Identity and Meaning**

As previously discussed, meaning, or ascribed subjective value, can be reflected in a life narrative. Life narratives can allow for understanding a client’s subjective perspective or explain “why” people do occupations (Padilla, 2001). Life narratives are an external manifestation of personal identity; that is, personal identity is the focus through which life experiences are recalled, remembered, and interpreted. Thus, we believe that personal identity is directly linked to meaning gained from occupation—the identity “gifted” from the occupation.

Nelson (1995) described meaning as perceptual, symbolic, and affective. Perceptual meaning involves the incorporation of sensory stimuli into occupations. Not having a functional hand or substituting with a nondominant hand during meaningful activities can influence perceptual meaning or the perceptual experiences of a person with posttraumatic stress disorder secondary to hand injury. According to chaos theory, we speculate that the changed perception and the onset of posttraumatic stress disorder do not occur in a linear, temporal model. Furthermore, how a person with perceptual deficits perceives spatial contexts can be affected (Pierce, 2001). Christiansen (1999) purported that identity is constructed in part from the personal meaning that occupation provides an individual over time from occupational patterns. Consequently, we postulate that changes in perceptual meaning can affect subjective meaning, which can affect occupational identity.

Again related to Nelson (1995), symbolic meaning comprises the sociocultural aspects of occupations. Symbolic meaning results from neurological processes of the brain, which associate certain meanings with certain symbols. We purport that symbolic meaning of occupational patterns is similarly embodied or based in neurological process.

Dunn et al. (1995) suggested that neurologically, a person attaches meaning to objects by cognitive and emotional processes, both of which we believe can be impaired in cases of posttraumatic stress disorder. Furthermore, deriving
meaning likely involves the limbic structures. Meaning and meaning-making, therefore, can be compromised during occupational engagement in persons with posttraumatic stress disorder secondary to hand injury. Our explanation follows.

We suggest that posttraumatic stress disorder can affect the previously specified wetware of the brain such that ability to construct subjective value, or to make symbolic meaning during engagement in occupation, is impaired. For example, in Western cultures work is equated with productivity, and being unable to work during the healing phase of hand injury symbolizes loss of productivity (Pierce, 1997), which can result in feeling devalued or “meaningless.” Furthermore, the meaning of time or temporality could change for the person with neurological effects of posttraumatic stress disorder because of sleep disturbances and changed work habits.

Influences on meaning-making through occupation, such as awareness of pleasure and restoration (Pierce, 1997), provide insight into the meaning of the hand injury. Pleasure is mediated by structures in the limbic system (Pierce, 1997), which we believe can be affected by posttraumatic stress disorder. Changed behaviors, such as lack of pleasure observed in the person’s posttrauma occupational patterns related to previously pleasurable rituals (Pierce, 1997), reflect the interrelationship of occupation and neurological changes. Changes in the typically restorative aspects of occupational patterns are illustrated by sleep disturbances and nightmares, both of which are symptoms of posttraumatic stress disorder.

Thus, understanding a person’s life story and the meaning derived from it provides a larger picture of the current moment in the person’s life. Knowing the person’s life narrative allows perspective regarding changed occupational patterns that can result from a traumatic episode and contributes to a broader picture that takes into account the person as a neuro-occupational being. Thus, we gain insight into a person’s occupational identity on the basis of perceptual, symbolic, and affective meaning.

Meta-Emotion of Occupation

Affective meaning, including values, involves the emotional dimensions assigned to occupations. Meta-emotion of occupation is a hypothesized construct pertinent to neuro-occupation, which directly pertains to this concept. Meta-emotion of occupation relates to the noncognitive evaluation of meaning during occupation; it is the emotional or affective meaning derived from occupation. Meta-emotion is a new concept referring to “the conceptualization and study of the interactions or effects between emotions, the body, and occupation (i.e., ‘feeling while doing’)” (Royeen et al., 2001, p. 578; see also Royeen & Duncan, 2001). Meta-emotion of occupation allows for explicit consideration of the emotional and internal feeling world of occupation. It considers the person while engaged in occupation, emphasizing the incorporeal quality (spirituality) of the dimensions of occupation (Peloquin, 1997). Meta-emotion transcends prior thinking that segments emotions and cognition into separate and discrete functions. Meta-emotion of occupation may be considered to be feeling/thinking about feeling/thinking while doing with meaning. Thus, meta-emotion provides the “neuroanatomical basis for the autobiographical self” (Damasio, 1999, p. 219).

Because of the neurological effects of posttraumatic stress discussed in the first half of this article, an individual’s ability to enact meta-emotion during occupation (e.g., to be feeling or to be aware of feelings while participating in the occupation) is likely compromised. A lack of awareness of emotions also was illustrated in the previous discussion of the classical symptoms of posttraumatic stress disorder as described in the DSM-IV and in the discussion of the impact of low cortisol levels on behavior (Wang, 1997; Yehuda, 1997). Part of the goals of occupational therapy, in this case, would be to assist the individual to recognize, appreciate, and fully experience his or her emotional and spiritual world during occupational engagement, to make explicit the meta-emotion of occupation.

Summary

This article has introduced the theoretical concept of neuro-occupation and related musings of the conditions of posttraumatic stress disorder secondary to traumatic hand injury. The overall purpose of this article was to contribute to the “generative discourse” on occupation-related concepts as identified by Pierce (2001) and to add neuroscience dimensions to clinical reasoning in which an occupational therapist may engage in relation to a client with posttraumatic stress disorder secondary to traumatic hand injury.

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