Neuropsychological rehabilitation: The Origins of Contemporary Practice

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Abstract

Neuropsychological rehabilitation is concerned with enabling people with cognitive, emotional or behavioural difficulties after brain injury to achieve their maximum potential in the domains of psychological, social, vocational, leisure and everyday functioning. This paper will trace, from a Western perspective, the origins of the influences that have shaped contemporary practice in neuropsychological rehabilitation. Although the impact of injury to the brain on mental functions was described some 3000 years ago by the ancient Egyptians, it was not until the 20th Century that systematic approaches to rehabilitating people with brain injury emerged. Wars between nations have been important in stimulating the development of rehabilitation, particularly because of the large numbers of soldiers with brain injuries. The contributions of key practitioners such as Goldstein, Zangwill and Luria will be discussed. These ‘grandfathers’ of neuropsychological rehabilitation have directly influenced contemporary practitioners such as Ben Yishay, Prigatano, Christensen and Wilson who have developed the techniques that we use today. Contemporary holistic neuropsychological rehabilitation practice will be described, illustrating both the historical influences, but also the new developments that continue to transform practice to better meet the needs of people with brain injury.

Key Words: Brain injury, neuropsychology, rehabilitation, history

Introduction

Contemporary neuropsychological rehabilitation is concerned with enabling people with cognitive, emotional or behavioural difficulties after brain injury to achieve their maximum potential in the domains of psychological, social, vocational, leisure and everyday functioning (Wilson, 2009). The importance of this definition is that it emphasises that neuropsychological rehabilitation is concerned with how people live their lives after brain injury—the aim is to enable people who have suffered a brain injury to establish a meaningful and satisfactory life (Cicerone et al., 2008). It is also said that neuropsychological rehabilitation is about maximising wellbeing after brain injury (Evans, 2011). Neuropsychological rehabilitation is, therefore, not limited to a narrow focus on attempts to restore impaired cognitive functions. Whilst interventions may be aimed at improving cognitive functions using specific cognitive training methods, neuropsychological rehabilitation will also involve training people with brain injury to use strategies that compensate for cognitive impairments so that they can function effectively in their everyday life. Restorative and compensatory approaches are therefore both important methods of rehabilitation intervention because both are aimed at helping people to function effectively at home, work, in social relationships and in leisure activities.

Another important issue is that neuropsychological rehabilitation focuses not just on cognitive functions, but also on emotions, physical functions and behaviour. There is a complex interaction between brain biology (and

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pathology), physical functions, cognition, emotion and behaviour in everyday contexts. Neuropsychological rehabilitation is concerned with understanding these interactions as a complex system and then working out how to enable people to manage their cognitive, emotional, and physical functioning to help them do the things that are important to them. This attention to the person as a whole is why contemporary neuropsychological rehabilitation is often referred to as being holistic.

A framework that has proved to be very useful in thinking about people after brain injury is the World Health Organisation International Classification of Functioning, Disability and Health (often just referred to as the WHO ICF). The ICF is a classification of health and health-related domains that includes (1) body structures; (2) body functions, (3) activities and participation. In the case of a person who has suffered a brain injury, the ICF allows us to describe a person in terms of which body structures are affected (i.e. the brain, and then which parts of the brain), which mental functions are affected (e.g. memory) and the impact of this on the ability to carry out everyday functions (e.g. difficulty remembering to do important self-care or household tasks) and on the ability to participate in major life areas (e.g. work, education). This framework is the basis for the approach to the formulation of the interaction between brain pathology, body functions (cognition, emotion, and physical functioning) and everyday consequences used at the Oliver Zangwill Centre for Neuropsychological Rehabilitation in the UK (Evans, 2006; Wilson et al., 2009). Formulation is way of representing the strengths, difficulties and experiences of a person in a way that helps understand the complex relationships between the many factors that influence how a person thinks, feels and behaves. A formulation is the starting point for thinking about how to move forward, and what a person needs help with in order to do the things that they want to be doing in their life following a brain injury. A formulation provides an understanding of a person that is shared with the members of the rehabilitation team and, wherever possible, the client/patient and, if appropriate, their family. This shared understanding is one of the six core components of neuropsychological rehabilitation described by Wilson, Gracey, Malley, Bateman and Evans (2009). These six core components are (1) The therapeutic milieu; (2) Shared understanding; (3) Meaningful, functional, goal-directed activities; (4) Learning compensatory strategies and retraining skills; (5) Psychological interventions; (6) Working with families and carers. In the next section each of these core components will be briefly described and after that the historical influences on them will be discussed.

Core components of contemporary practice in neuropsychological rehabilitation

(1) The therapeutic milieu
The therapeutic milieu refers to the physical, organisational and social environment in which rehabilitation takes place. It can relate to the physical environment (when rehabilitation is happening in a centre of some form), making sure that the environment is pleasant, easy to navigate in and becomes familiar and comfortable. The milieu also refers to the way the programme is organised, with a combination of individual and group sessions, opportunities for more informal interaction between clients and with staff. Most importantly it is about the ethos or atmosphere of the rehabilitation programme or environment. It is about conveying that patients/clients, families and staff are all active partners in the rehabilitation process. It is about shared responsibility for the running of the programme, with a culture of everybody lending a hand in order to ensure that things run effectively. Staff work collaboratively across disciplines as part of an interdisciplinary (rather than multidisciplinary) team. An interdisciplinary team is one where there is overlap between the roles of each team member (as well as there being discipline-specific functions) and team members from different disciplines work together towards common goals agreed with the client. So rather than each team member setting a ‘discipline-specific’ goal (e.g. the physio goal, the occupational therapy goal etc), goals are very clearly ‘client-goals’ and each team member
will identify interventions (or plans of action) that will contribute towards meeting the goal agreed with the client. This way of working can help to ensure that team members coordinate different sorts of interventions that may be required to enable a client to achieve the things they want to do in their everyday life.

(2) Shared understanding
A key starting point for neuropsychological rehabilitation is the initial formulation, or summary of assessment. At the Oliver Zangwill Centre an approach was developed which involved each of the members of the team conducting a discipline specific assessment, and then bringing that together in an integrated biopsychosocial formulation. A set of headings are used based on the structure of the WHO ICF. A representation of the template is provided below in Figure 1.

The idea is that details relating to each individual patient are documented using each of the headings, and arrows are drawn to reflect hypothesised relationships between pathology, body functions, functional consequences and the influence of a person’s sense of identity, their social context are recognised. This is typically put together by the team members but then shared with the client and family members to check if the formulation makes sense to them and any adaptations that need to be made.

(3) Meaningful, functional, goal-directed activities
Meaningful functional activity refers to what people do (or want to do) in their everyday life. So, this includes vocational, educational, recreational, social, community and domestic activities of daily living. Models of wellbeing, such as Seligman’s (2011) PERMA model highlight the importance of a range of factors to wellbeing, including Pleasure, Engagement, Relationships, Meaning and Achievement. If rehabilitation is about maximising wellbeing, then it is about enabling people to engage in activities that are pleasurable and meaningful to them, to achieve success, and to ensure relationships are positive. In practice, what this means is about working collaboratively with clients (and families) to set goals for the rehabilitation programme. This can be a complex, challenging process, particularly when clients may have limited insight into their own difficulties after brain injury. However, when done sensitively and skilfully, it results in the client, the family and the team all being clear what they are trying to achieve within the rehabilitation programme. For a more detailed discussion of the goal setting approach see Evans and Krasny-Pacini (2017).

(4) Learning compensatory strategies and retraining skills
People with brain injury attending a neuropsychological rehabilitation programme will typically have one or

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Figure 1  The Oliver Zangwill Centre biopsychosocial formulation framework
more areas of difficulties in the domain of cognition or communication. These could include problems with memory, language, attention, executive functions or perception. Furthermore, they may have difficulties with emotional coping (emotion regulation, anxiety, depression) or physical difficulties (e.g. fatigue, pain, sensory loss etc.). For cognitive difficulties the evidence base to date suggests that for most domains of cognition some form of compensatory strategy is the most effective means of managing the cognitive impairment to maximise functioning in everyday life (Cicerone et al., 2019), though retraining (or restorative) approaches may be useful with some specific functions (e.g. attention, reading, dual-tasking). Compensating for cognitive difficulties can take many forms. For example, memory interventions may involve enhancing residual memory functions (e.g. using errorless learning techniques); mental strategies (e.g. using visual memory to compensate for impaired verbal memory); external aids (e.g. using a mobile phone as reminding system); or environmental (e.g. using labels on doors/cupboards or reducing distractions to enhance learning). For a more detailed account of such strategies see Evans (2014) or Parker, Haslam, Fleming and Shum (2017). A central focus in neuropsychological rehabilitation is to ensure that clients learn to apply strategies in everyday situations. If they are trained in the use of a strategy in a rehabilitation centre, a key part of the rehabilitation process is to be able to apply the strategy in everyday life.

(5) Psychological interventions
There is now a substantial evidence base relating to the efficacy of psychological interventions for mood disorders in the general population, though the evidence base for specific psychological interventions for people with brain injury is much more limited. However, a wide range in therapeutic approaches have been used with people after brain injury and evidence of efficacy is gradually accumulating (Yates and Ashworth, In press). This includes adapted forms of Cognitive Behaviour Therapy, as well as some of the more recent ‘third wave’ therapies such as Compassion Focused Therapy (CFT), Acceptance and Commitment Therapy (ACT) and Positive Psychotherapy (Ashworth, McLeod and Evans, 2017). Psychological interventions are central to holistic neuropsychological rehabilitation programmes and it is recommended that such programmes are provided to reduce functional, cognitive and psychosocial disability after TBI (Cicerone et al., 2019). The development of the shared formulation can be considered an important psychological intervention that helps the client to make sense of her/his experiences after brain injury. This is just an initial, but important, step in the process of managing psychosocial difficulties. Within the holistic programmes, clients may receive individual therapy sessions but also participate in group sessions (see Psalia and Gracey, 2009). Whilst there may be specific therapy sessions, a core principle of holistic programmes is that much of the psychological benefit comes from working collaboratively with staff and other clients within a community, being supported to develop skills and strategies to engage effectively in meaningful activities, to achieve goals, and improve relationships with family and friends.

(6) Working with families and carers
The final core component of neuropsychological rehabilitation is working with families and carers. It has been highlighted several times already that families and carers have a critical role to play in rehabilitation programmes. Firstly, at the assessment stage, given the difficulties with insight that many people with brain injury have, it is vital that relatives contribute to the assessment and formulation process. Wherever possible the formulation is shared with family members to ensure it is accurate but also to provide family members with a way of understanding the changes that may have occurred for their relative. Family members may be experiencing significant loss, stress and burden. Relationship breakdown is common after brain injury and therefore it is important that relatives receive the support they need to make the psychological and practical adjustments necessary. In addition, relatives, friends and work colleagues can be vitally important in facilitating the generalisation of strategies for managing cognitive difficulties that may have been learned in the rehabilitation centre, but need
to be applied at home, work, or in the community.

The opening sections above have attempted to provide a very brief introduction to the core practices of contemporary neuropsychological rehabilitation. But where have these practice principles come from? In the next section, some of the key events and people who have influenced thinking in this area will be discussed. This will inevitably be a very selective history, but the aim is to identify the origins of many of the ideas that remain central to neuropsychological rehabilitation practice today.

**Historical influences on contemporary neuropsychological rehabilitation practice**

Wilson (2017) provides an excellent account of the history of the growth of neuropsychological rehabilitation. She notes that one of the earliest known descriptions of brain injury is from an Egyptian papyrus, dating back some 2500–3000 years. The document describes 48 cases, including 27 head injuries and included the first use of the word brain. However, although there are references to treatment of injuries there is not a discussion of rehabilitation. The Greek physician Hippocrates is said to have remarked in 400 BC that “no head injury is too severe to despair of, nor too trivial to ignore”. This statement remains pertinent to this day.

Rehabilitation has been influenced by the needs of people injured during various wars over the last century. Wilson (2017) argues that modern rehabilitation, as we know it, began in World War One. Improved antiseptic and neurosurgical techniques in the late 19th century meant that more people survived brain injury including gunshot wounds during World War One than in any other previous war. Walther Poppelreuter was a German neurologist and psychiatrist who described cognitive impairments after brain injury. He had an interest in visual disturbances arising from occipital lobe injuries and described attempts to rehabilitate visuospatial and visuoperceptual disorders. He also discussed vocational rehabilitation.

Kurt Goldstein was another German neurologist and psychiatrist who was working with wounded soldiers across both World War I and World War II. He emphasised the importance of the systematic and long term follow up of patients after brain injury. He highlighted the variability between individuals who have suffered a brain injury and variability within people over time. Goldstein argued that psychometric assessment tools were important, but they had their limitations in understanding the consequences of brain injury. He highlighted the importance of understanding emotional responses to brain injury, including what he called the ‘catastrophic reaction’, which referred to the threat that the consequences of brain injury pose to a person’s sense of self. Goldstein also discussed approaches to rehabilitation, highlighting the importance of careful observation of how people respond to difficulties and their natural preference for using one form of compensation or substitution over another. He also emphasised the importance of connecting cognitive rehabilitation to real world activities (e.g. return to work).

Oliver Zangwill is considered the father of British neuropsychology. In 1947 Zangwill wrote “We wish to know, in particular, how far the brain injured patient may be expected to compensate for his disabilities and the extent to which the human brain is capable of re-education. At the present state of our knowledge, alas, no categorical answers can be given” (Zangwill, 1947). This quote reflects a debate which continues to this day as to whether it is possible to restore cognitive function or whether we must teach people strategies to compensate for their impairments. Zangwill also made the important distinction between different approaches to rehabilitation. He referred to three different approaches including (1) Compensation, which he defined as reorganization of psychological function so as to minimize or circumvent a particular disability; (2) Substitution, the building up of a new method of response to replace one damaged irreparably by a cerebral lesion; (3) Direct retraining. Again, here Zangwill was recognizing that whilst it may be possible to retrain or restore an impaired cognitive function,
rehabilitation is often concerned with using some form of compensatory strategy or external aid.

Alexander Romanovich Luria led a Russian research team at an army hospital looking for ways to rehabilitate psychological dysfunctions after brain injury. His ideas are discussed in his books, 'Man with a Shattered World' and 'Restoration of higher cortical function following local brain damage'. Luria placed an emphasis on the importance of assessment to identify primary deficits to guide rehabilitation interventions with an emphasis on the use of intact areas compensating for or substituting for damaged functions.

Yehuda Ben Yishay is considered the father of holistic neuropsychological rehabilitation. Ben Yishay was born in Romania but the family travelled to the newly established Israel. In 1957 Ben Yishay obtained a scholarship to the New School for Social Research in New York and worked with Kurt Goldstein. Ben Yishay and Goldstein adapted the idea of a therapeutic community approach that had previously been used with psychiatric patients for the rehabilitation of people with neurological conditions. Ben Yishay describes the concept of a therapeutic community as one where patients and families are active partners of the professional staff (see Ben Yishay and Diller, 2011). There is a shared responsibility for the daily running of the program. Staff are organised into teams adapted to the needs of the individual patient. All members of the team share the burden of tasks in the programme—there is a culture of everyone lending a hand. Ben Yishay emphasised the importance of being willing to remove staff who will not work in the required collaborative way. He noted that the team should focus on meeting the needs of the person rather than a focus on their deficits and that the programme should be practical and goal oriented.

In 1973 the Yom Kippur war in Israel occurred, with once again, numerous soldiers sustaining head injuries. Leonard Diller and Yehuda Ben Yishay, who were working together in New York at the time, were asked by the Head of the Department of Rehabilitation at the Israeli Ministry of Defence to help rehabilitate these soldiers. They established, with government support, the first intensive holistic neuropsychological rehabilitation programme. Their programme involved 15 patients attending seven hours a day six days a week for one year. The staff to patient ratio was 1:1. A key component of the programme were the vocational trials which supported people in attempting to return to work. In 1976 Diller and Ben Yishay returned to the US and established a model program for holistic neuropsychological rehabilitation of traumatic brain injured patients at the NYU Rusk Institute in New York. Building on their experience in Israel their programme lasted for 20 weeks five hours a day four days a week. They argued that this frequency and consistency creates a sense of familiarity and a feeling of safety. Members of staff were used interchangeably to perform all the program tasks. The patient : staff ratio was 2:1. In each patient cohort there were 13 or 14 patients who formed a peer group to support, critique, inspire and serve as role models to each other. Family members and significant others were involved as active participants in the program. Ben Yishay and Diller (2011) describe the stages of a holistic neuropsychological rehabilitation process. They argue that through awareness and understanding from therapists, patients feel safe, which motivates them to engage in the program. Patients begin to use intact abilities to facilitate learning. They gradually learn compensatory skills, and this improved ability to cope fosters confidence to acknowledge their limitations. The compensatory skills and strategies begin to be applied outside of the programme in daily life leading to a gradual improvement of everyday functioning. This enables the patient to find meaning in life after rehabilitation.

Ben Yishay’s ideas and specific components of his holistic neuropsychological rehabilitation programme have directly influenced several other similar programmes around the world. These have included those led by George Prigatano and Pam Klonoff in Phoenix Arizona (see Prigatano, 1999); Anne–Lise Christensen in Copenhagen; the INSURE programme in Helsinki led by Jaana Sarajuuri (see Sarajuuri et al., 2005); the Inten-
sive NeuroRehabilitation programme in Amsterdam led by Martie Vink (see Holleman et al., 2018); and the Oliver Zangwill Centre programme in Ely, UK led by Barbara Wilson, Jon Evans and Andrew Bateman (see Wilson, Gracey, Evans and Bateman, 2009). These are just some examples of programmes influenced by Ben Yishay, and by each other.

We see therefore in this brief historical overview how people, ideas, issues and challenges have influenced current practice and continue to be relevant. Goldstein’s emphasis on emotional reaction to brain injury and the threat to identity underpins the focus on self and identity in neuropsychological rehabilitation programmes (Gracey, Evans and Malley, 2009; Ownsworth, 2014). Goldstein’s work on developing and adapting the idea of the therapeutic community for rehabilitating people with neurological conditions influenced Ben Yishay, who developed the intensive holistic programme, that has influenced many others. Zangwill articulated some of the challenges we still face today in terms of what are the most appropriate techniques to rehabilitate specific cognitive impairments. Luria emphasised the importance of a detailed assessment and using intact functions to compensate for impaired functions, whilst Goldstein, Zangwill and others have highlighted that compensatory strategies may be necessary to ensure effective functioning in everyday life. Each of the six core components of contemporary practice in neuropsychological rehabilitation can be traced back in part to these early pioneers. However, that is not to say that our current practice is stuck in the past. The specific interventions for both cognitive and emotional difficulties have developed considerably in recent decades and will continue to do so, particularly with the availability and development of technology to retrain/support impaired cognitive functions. The evidence base relating to interventions in specific domains of cognition has now grown sufficiently that systematic reviews and practice guideline documents have emerged (e.g. Cicerone et al., 2019; SIGN 130, 2013).

To illustrate how the core elements of a neuropsychological rehabilitation programme work together in an integrated way, reflecting historical developments, a case example will be described. A more detailed account of the case is provided by Gracey, Malley and Evans (2009)

Case example

Yusuf was 33 at the time of his injury in a road traffic accident. He experienced a severe head injury, was in coma for one week and had a post traumatic amnesia of one month. A CT scan at the time of his injury indicated a left fronto-temporal-parietal subdural hematoma with reduced left ventricle volume. He started the intensive holistic rehabilitation programme three years after his injury and at that time he was living at home with his wife and three children. Before his injury he had been running an import-export trading house business with his brother. Since his accident he had given up most of his business activity apart from one area which was importing fabrics. Yusuf underwent an assessment with each of the members of the interdisciplinary team and the team produced the summary formulation diagram using the template described earlier. This is shown in Figure 2.

The formulation highlights that Yusuf had significant cognitive impairment affecting speed, attention, working memory and executive functions. He was impulsive in many situations. His confidence had suffered, he was frustrated and at times expressed irritability and anger particularly with his family. His irritability was exacerbated when he was fatigued or in pain. As well as fatigue and pain he had right sided weakness, some sensory impairment reduced balance, he was deaf in his right ear and he struggled to stand for more than 2 to 3 minutes without becoming fatigued. This combination of cognitive, emotional and physical difficulties significantly limited his ability to work and was causing strain in relationships with family members. Yusuf was highly motivated to return to work and therefore the main goal of his rehabilitation programme was to develop and implement strategies to enable him to complete work tasks effectively. Related to this broad goal included specific goals concerned with learning and using a memory and planning system, learning how to manage stress, anxiety and
anger and developing strategies to manage his pain. As well as the general summary formulation diagram specific formulations were developed to reflect his thinking feeling and behaviour in work situations. For example, it was noted that Yusuf would deal ineffectively with situations involving unexpected demands at work. When faced with an unexpected demand his stress levels would increase and he reported feeling ‘overloaded’. But rather than taking time to plan a course of action, he would tend to react impulsively feeling that he had to be decisive which meant acting quickly. However, because of his impaired executive functions he tended to make mistakes which would cause more problems for him and the business.

Following a two-week assessment period, Yusuf commenced a 20-week rehabilitation programme. During the first 10 weeks he attended the programme three days per week, then for the second 10 weeks he gradually reduced his time at the centre spending more time at work and on other community activities. In the programme he attended a variety of group sessions as well as having individual sessions with each of the members of the interdisciplinary team. For example, he attended the Understanding Brain Injury group to help him develop a better understanding of the nature of his brain injury its consequences and its impact on his everyday functioning including his work. He attended the Mood Management group to help him develop strategies for managing his frustration and irritability.

Each member of the interdisciplinary team contributed a different intervention, but these interventions were all complementary and geared towards enabling Yusuf to be more effective in his work environment. For example, the occupational therapist and clinical neuropsychologist worked with Yusuf to help him develop strategies for managing situations involving unexpected demand. He participated in an Attention and Goal Management group to learn goal management strategies which he was taught how to implement in the work environment by the occupational therapist. These strategies were designed to enable him to ‘stop and think’, to make a plan of action and to use external aids to support his memory and planning. As part of this intervention he learned mindfulness techniques which helped him to focus on the task in hand rather than becoming overwhelmed with thoughts and worries about what others would think of him. The occupational therapist also worked with Yusuf to develop a list of core tasks in his job and specific strategies designed to enable him to complete these tasks effectively. The physiotherapist and the clinical psychologist worked to help Yusuf to manage his pain and fatigue. This involved teaching him how to pace his activities to avoid impulsive bursts of action and to allocate rest periods more effectively so that he could continue working during a day rather than engaging in a ‘boom and bust’ approach which would leave him feeling exhausted and needing to sleep in the middle of the day. Ses-
sions with the Speech and Language Therapist focused on communication skills and particularly on managing his impulsivity in social situations better. The team also worked with Yusuf’s family to help them understand his brain injury and to help Yusuf and his family to manage situations that tended to previously cause him to be irritable and angry.

Yusuf worked well in the programme and achieved his rehabilitation goals. His brother confirmed that he was functioning more effectively in the business environment and specifically was using a memory and planning system to help him plan and complete his activities at work without excessive fatigue. The situation at home also improved as his general stress from work reduced. Better pacing of his activities also reduced fatigue and improved his ability to manage pain. Gracey et al. (2009) noted that Yusuf’s case illustrates how the development of a shared understanding between Yusuf and the team led to a detailed formulation of his difficulties, which then led to identification of strategies to manage these difficulties in everyday situations such as work. Models of pain behaviour, chronic fatigue and executive function were integrated into a cognitive–behavioural therapeutic framework and were useful in organising interdisciplinary working. What was particularly important was that the strategies developed were designed to maintain Yusuf’s pre-injury identity including his feelings of status and respect within his family and the wider community.

Conclusions

The history of neuropsychological rehabilitation is relatively short, but there is now a well-established set of core principles that underlie contemporary practice. This paper has highlighted the influence of key people who have played a vital role in shaping these core components of contemporary practice. The core principles were illustrated in the approach taken to working with Yusuf. Although the ideas of pioneering thinkers in our field still influence our practice, the specific interventions and techniques used today are drawn from an extensive evidence base that has grown substantially over the last few decades. Although there is a long way to go in developing techniques to manage the cognitive, emotional and behavioural difficulties that arise following brain injury, the evidence base is sufficiently strong that several countries around the world now have practice guidelines to guide the process of rehabilitation after brain injury. It is important that we work towards a situation where anybody experiencing a brain injury, wherever they are in the world, has access to the highest quality of neuropsychological rehabilitation support.

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