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BOOK REVIEW

Redefining recovery from aphasia, by Cahana-Amitay, D. and Albert, M. L., New York, NY, Oxford University Press, 2015, x + 281 pp., \$89.95/£59.00 (hbk), ISBN 978-0-19-981193-9

In *Redefining Recovery from Aphasia*, Dalia Cahana-Amitay and Martin L. Albert make a case for a shift from aphasia rehabilitation solemnly focusing on language functions to a broader inclusive approach, based on knowledge from neurobiology, cognition and emotion research. They explain how the understanding of different interacting non-linguistic and linguistic phenomena can define aphasia recovery. In this sense, the book differs from what one might typically expect from aphasia treatment studies: the essential focus, as well as the chapter division, is based on the “nonlinguistic factors that participate in reshaping the neural networks supporting recovery of language functions in aphasia” (pp. ix–x).

In “What We Know and Do Not Know about Recovery from Aphasia” (Chapter 1), the authors explain their three-step approach: first, they provide a succinct comparison of psycholinguistic models of language representation in healthy versus brain-damaged subjects. Then they analyse the neural substrates of several non-linguistic cognitive functions and unveil how these influence neural reorganisation during aphasia recovery. Based on the concept of (neural) “multifunctionality”—understood as “cognitive and neural interactions that influence recovery from aphasia” (p. 3)—they finally build up a new theory for aphasia recovery and treatment.

The chapter “Language in the Healthy Brain” (Chapter 2) provides an overview of contemporary functional and neuroanatomical models of language of healthy individuals; a background for the models and theories on the lesioned brain is set out in the following chapters. After explaining the classical “lesion-deficit model of aphasia” (p. 13), including careful pinpointing of its shortcomings, the authors discuss different psycholinguistic accounts developed to relate the vast array of neural networks to different linguistic (sub-) processes. The authors analyse the issues on the basis of the distinction between the different psycholinguistic models that have been developed to account for brain–language relations until today and evaluate whether there is room for a multifunctional account. Prior research claiming simultaneous recruitment of several interplaying linguistic and non-linguistic cognitive functions—including language—is discussed on pages 19–20. However, the authors suggest that—as much of the previous research is based on meta-analysis and group analysis maps—inter-individual neurofunctional specificity is underestimated. Also, the effects of age-related cognitive decline might confound such analyses. Some alternative approaches are cited (e.g., “functional localizer”, p. 22), and it is suggested that the resolution of currently available imaging techniques may be insufficient to allow for a more complete description of neurofunctional relationships. As such, an analysis at the neuronal/neurochemical level is argued to be of merit.

In “Executive Functions and Recovery from Aphasia” (Chapter 3), the authors demonstrate how executive dysfunctions and spared executive functions influence aphasia recovery. This is not a straightforward endeavour, as confounding variables such as age as

well as inter-individual differences in aphasic patients influence functional outcome. The authors provide an introduction to the current models of executive functions, including an overview of the neural correlates, as well as limitations in neural mapping (pp. 38–43). They discuss the relation between executive functions, language and the possibly related neural correlates in healthy individuals, and establish a comparison with the aphasic population. The tables included in the chapter are useful instruments for any researcher with an interest in executive functions in the healthy and damaged brain. The authors give an overview of a meta-analysis of the different executive functions assessed by a number of well-known tasks as well as their neuroanatomical substrates. Moreover, they provide an overview of (non-verbal) executive tests considered apt for an aphasic population. They investigate whether and how it is possible to dissociate executive dysfunction from language impairment. Whereas some researchers have argued that the occurrence of simultaneous language and executive deficits can be brought down to the topographical proximity of the neural substrates of these functions, the authors argue on the basis of several correlation studies in healthy and aphasic individuals that this is not necessarily the case. They point out the intricate relationship between both functions and discuss how they interact in practice (e.g., in semantic control) (pp. 48–52). They argue that the spared executive skills of aphasic patients are indicative of their engagement in therapy and their therapeutic outcome (pp. 54–55). Finally, they formulate hypotheses with respect to the influence of therapy targeting executive functions on neural reorganization (pp. 56–57).

In “Attention Systems and Recovery from Aphasia” (Chapter 4), the authors start off explaining how previous research has already accounted for the intricate relation between language processing and attention (e.g., the phenomenon of cocktail speech). In what follows they try to maintain the same set-up as for the previous chapter: they first explain what “attention” is; including subdivisions, such as selective attention, sustained attention, alternating attention, divided attention, as well as which variables influence its functions (p. 76). Cahana-Amitay and Albert choose to divide attention into *basic* and *complex attention functions* because of previous use of these concepts in clinical settings (recovery) and possibly also because of their urge to provide the reader with a transparent overview and not lose them in a “terminological maze”.

Basic attention harbours sustained attention or “vigilance”, and arousal (pp. 76–77). This arousal system allows for the instigation of sustained attention. However, both systems seem to be dissociated, and the arousal system itself is influenced by biomarkers that are equally associated with stress (Chapter 6). Complex attention comprises selective attention (the attention filter), focused attention (allows for diminishing interference), divided attention (simultaneous attention to multiple stimuli) and alternating attention (switching). To complete a task requiring complex attention, different resources must be engaged. This can require either little effort (*automatic* attention) or conscious effort (*controlled* attention). Factors influencing this resource distribution and possible consequences thereof are discussed on page 79. Neural underpinnings of attention and the relation with language (including evidence from functional neuroimaging studies) in healthy individuals are discussed on pages 80–85. For aphasic patients, it seems that the defective functioning of basic and complex attention has detrimental effects (reduced accuracy and reaction time) on (language) tests tapping into these mechanisms. Some researchers have posited that the neural deficit is reflected through a reduced ability to activate, select and inhibit certain linguistic elements. According to the authors this is possibly due to the fact that “task demands exceed the available processing resources”, resources are “misdirected due to poor evaluation of task demands” and/or “resources are mobilized inefficiently (slowly)” (p. 89) (see also “resource allocation deficit”, pp. 88–89). Lastly, the authors critically evaluate how

attention deficits have been and can be treated in an aphasic population, with approaches ranging from a more conservative attention training to a more neurally driven treatment (ranging from increased engagement of the right hemisphere, and language-therapy induced neuroplasticity targeting the “default mode network” (DMN) to pharmacological interventions, pp. 89–94).

In Chapter 5, “The Role of Memory Functions in Recovery from Aphasia”, Cahana-Amitay and Albert first give an overview of research on memory deficits in aphasia and provide the reader with a condense, though critical overview of the frameworks and models that have been traditionally used to describe and analyse the concept of memory. The authors inform the reader on how language interconnects with memory, especially short-term (STM) and working memory (WM), in different cognitive theories and models, as well as from a neurobiological point of view. They give ample attention to the relation between sentence processing and working memory functions on pages 104–116. They then analyse how memory deficits in an aphasic population relate to their linguistic phenotype. They clearly explain their focus on STM and WM, due to diverging methodological approaches when investigating long-term memory effects in aphasia. The authors carefully investigate how phonological and semantic deficits in aphasic patients inform models in which activation of verbal STM is dependent on phonological and semantic processing. These deficits were principally interpreted as problems with access to linguistic information and alternatively regarded as problems with executive control causing the access problem. Although the relationship remains a matter of discussion, the debate nicely fits the authors’ multifunctional viewpoint. Lastly, the authors discuss how memory training can aid aphasia recovery. Ample attention is given to the aspect of learning, especially implicit learning in anomia treatment. The method of ‘errorless’ vs. ‘non-errorless’ learning is discussed in some detail (pp. 125–126). Many studies, however, show different results and have disregarded long-term benefits. Neuroimaging has revealed some interesting findings concerning effects of learning in aphasia treatment. This demonstrates that a multifunctional approach in aphasia therapy can benefit the patient and positively alter brain function.

In Chapter 6, “The Role of Emotion in Recovery from Aphasia” is reviewed, especially the effects of depression and anxiety-induced stress dysregulation on therapeutic success. First, the authors define emotion, the notions related to it, and how it can affect, or rather disrupt cognition. Neural links between the left inferior frontal cortex and the limbic system—which equally subserves language and other cognitive functions—already hint at the possibility of an interdependency. In a non-aphasic population, it is stated that anxiety limits “command of the full range of speech/language systems available to native speakers” (p. 151). The authors discuss the influence of emotion on executive functions and how they share some neural substrates.

Depression and anxiety are discussed in the context of stroke and an account is given of the effects of emotional change in aphasia patients. Aphasic stroke patients are more prone to depression than non-aphasic stroke patients. The authors briefly evaluate some of the measures and scales used to evaluate depression in aphasic patients. The type of assessment used can have far-reaching consequences. For example, the finding that non-fluent patients are more likely affected by depression than fluent patients is explained as a possible bias towards disregarding fluent patients in such tests due to reduced comprehension during examination. Due to the great inter-individual variability and differences in aphasia severity, it is difficult to generalize as to which factors affect depressed patients. They go on to evaluate how psycho-behavioural as well as pharmacological treatment,

electroconvulsive therapy and repetitive transcranial magnetic stimulation (rTMS) have been beneficial in some depressed aphasic patients. The authors consecutively investigate the relation between anxiety and aphasia. They start from the framework of *linguistic anxiety*, how language in aphasic patients can act as a stressor and lead to psychophysiological alterations. The accompanying allocation of supplementary attention resources to inhibit the anxiety and stress comes at a cost and will further impair language performance. On the other hand, it can equally improve results as a kind of threshold of excitation is arrived at. The authors reason that it is necessary to establish the biomarkers of altered (stress-related) language performance, as this could explain possible mechanisms related to neuroplasticity and neural reorganisation in aphasia recovery. They investigate too how complementary medicine can aid stress reduction and increase performance in combination with conventional language therapy. Pharmacological (beta-blockers) decrease of stress is potentially beneficial. There is, however, a lack of research on which brain areas these drugs target. The authors suggest a role for the inferior frontal gyrus, based on research in healthy individuals, but argue that more research is necessary as it is crucial to unveil its effect in aphasia recovery.

In Chapter 7, the authors investigate the role of “Praxis in Recovery from Aphasia”. Patients suffering from aphasia often experience problems with (non-linguistic) voluntary motor action. However, is the system in play in praxic disorders dependent on, or dissociable from, the aphasic impairment? The authors describe the cognitive basis of the language-praxis links on pages 189–191. They evaluate which neural underpinnings could be shared by both systems—which in itself already hints at a more unitary view. The authors discuss the theory of cognitive embodiment as well as the motor theory of speech, which relates to the discovery of mirror neurons; hypothesized to constitute one of the phylogenetically oldest connections between gestural communication and speech. This, of course, equally constitutes a transition to the neural connections between motor movement and speech. However, the authors equally explain how other researchers have discarded theories of a relation between action understanding and mirror neurons for a number of reasons (p. 195). In what follows, they describe how apraxia and aphasia are related in more detail. First the comorbidity of apraxia and aphasia is discussed (pp. 196–198). They set out a series of neurobehavioural models and discuss the neuroanatomical links (shared left frontoparietal networks). Studies investigating the functional neuroanatomy of apraxia (here ideomotor tasks) have implicated topographical regions considered correlates for executive functions (frontal functions in goal assessment tasks). In this way, they nicely tie the account to their multifunctionality theory. The authors continue with further discussion on the link between aphasia and mirror neurons (pp. 203–204). Lastly, they review how the use of gestures in therapy can affect outcome. Even though researchers propose opposing views on the use of gestures, the authors argue that improvement in aphasic patients indicates how neural changes can be induced through multifunctional therapy, addressing both linguistic and non-linguistic cognitive processes. They acknowledge that opposing ideas could equally account for some of the variability seen in aphasia during rehabilitation.

Chapter 8, “Visual Processing in Recovery from Aphasia”, begins with the observation that all speakers use visual information to aid language processing. However, it is not a prerequisite for speech comprehension. Does it in any way aid language processing, and if so, can it increase therapeutic gains after brain damage? Indications for some shared neural networks are discussed, but dissociations have been demonstrated between, for instance, networks for responsive naming and visual naming via fMRI. Eye-tracking studies and event-related potential (ERP) studies on sentence verification with congruent

and incongruent scene-sentence matching stimuli have demonstrated a positive effect for congruent stimuli. For the ERP studies, response times were predicted—amongst other variables—by measures of verbal working memory. This ties well with the multifunctional neural view the authors hold. For aphasic patients, neuroimaging studies are required to confirm the plus-value of visual cues in comparison to, for instance, verbal ones. Evidence is provided by performance of aphasic patients with deficits in important multimodal networks on simple (pure perceptual: visual matching in Raven Coloured Progressive Matrices) versus complex, multimodal tasks (relational reasoning in RCPM) (p. 238). What is the case for audiovisual stimuli (pp. 238–240)? Lesion studies have shown that audiovisual capacities and visuospatial functions are dissociable but more studies on the audiovisual effects in aphasia are necessary. Cahana-Amitay and Martin discuss how aphasia treatment studies employing visual stimuli can be evaluated (pp. 240–243). Many therapists employ pictorial stimuli in aphasia treatment, but without knowing exactly how the aphasic brain analyses these visual cues. A number of neuroimaging studies have shown that in chronic aphasic patients, perilesional regions are activated in picture identification tasks. Studies comparing aphasic patients and healthy controls have provided some supplementary evidence for the engagement of perilesional sites, possibly due to visual lexical processing (picture–word matching task). Model-oriented therapy studies (spreading activation theory), on the other hand, have argued for the involvement of the left precuneus in therapy-related benefits for trained visual stimuli. Phonological cueing—which falls under audiovisual stimuli—is another well-known strategy within aphasia therapy. The authors, however, state that there remains some controversy whether it involves lexical or sublexical processes. Finally, they discuss how for anomic patients, with a disruption between phonological and semantic systems, such cues may improve production skills. Other researchers have applied the technique of audiovisual cues in non-fluent aphasia. Departing from the view that the lesioned brain areas are also activated during speech perception and audiovisual speech, the authors discuss some evidence in favour for audiovisual cueing in this population as well.

The final chapter, Chapter 9: “Redefining Recovery from Aphasia”, summarizes how evidence in all chapters supports their multifunctionality model of the brain-language system and stresses the importance of it for a redefinition of aphasia therapy. On pages 255–257, they summarize how the seminal work of researchers such as Antonio Damasio, David Poeppel, Gregory Hickok, Angela Friederici and Sheila Blumstein has been of great influence and importance to the field and paved the way for their model. The interaction between non-linguistic and linguistic functions should be taken into account in future descriptions of brain-language models in the healthy and neurologically impaired brain. They state that more research based on a multifunctional approach is necessary, and that more attention should be paid to the aspect of *timing*. How does the brain maintain or create new, “dynamic” interactions and interconnections between networks subserving linguistic and non-linguistic functions? The authors refer to the space-time notion in physics and introduce the notion of the *neuronal space-time field* (p. 262). They briefly reconsider the effects of neural plasticity and of right hemisphere engagement in aphasia therapy as well as therapy tapping on non-linguistic and linguistic functions: multifunctional therapy; whether it is via active engagement of these functions (e.g., therapy with gestural or [audio-]visual aid) or rigid suppression of the latter (constrain-induced language therapy, not allowing for non-verbal communication).

The authors’ multifunctional viewpoint makes this book a pleasant and informative read; not only for speech and language therapists, but also for everyone with scientific

interests ranging from neuropsychology and behavioural neurology to speech and language pathology. It presents a manifesto to see language, and its breakdown, as a 'whole-brain phenomenon' (p. 262).

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