

SYMPOSIA ABSTRACTS

TENNET Symposium: Category-Specific Deficits: Getting at the Nature of Semantics and Dissociations

What Do Dissociations Prove? Guy Van Orden, Arizona State University.

If behavior comprises additive component effects, within a nearly decomposable system, changing on its own characteristic time scale, then functional dissociations may individuate cognitive components. But the vast dissociation literature has not produced a coherent basis in evidence for underlying components and, instead, yields standoffs as to how dissociations should be interpreted (are they pure cases or not?). A vast standoff has also emerged from factorial studies of intact performance that use response time to individuate cognitive components. An alternative view sees behavior as the product of interacting constraints that change on multiple time scales (not the sum of components on a single characteristic time-scale). This view is corroborated in the phenomenon of $1/f$ noise: long, intermediate, and short range correlations (changes occurring on multiple time scales) are observed in the ordered sequence of trial response times from cognitive tasks. Additionally, that constraints combine interactively is corroborated in the lognormal shape of response time distributions from all cognitive tasks. Values of constraints are sampled as random variables. Products of random variables are distributions with the lognormal shape. Thus, interactions among constraints combine as products (not sums) to compose the total measure of response time performance—a lognormally distributed probability-density-function.

TENNET Symposium: Syntax in Broca's Area: A Comparative Perspective

Causativity in the Syntax of Agrammatism. Hiroko Hagiwara,* Takane Ito,† and Yoko Sugioka,‡* Tokyo Metropolitan University; †University of Tokyo; and Keio University.

Exploration of the functional role of Broca's area in language processing is one of the extensively studied topics, and various kinds of proposals have been put forward to account for the nature of language processing in this area. We have elsewhere suggested that not only syntactic processing but also the processing of a certain type of word-level unit is subserved by Broca's area and its vicinity (Hagiwara et al., 1999). In this talk, we report three agrammatic aphasics' performance on two types of causative sentences in Japanese, i.e., the lexical causatives and the -sase causatives, providing further supportive evidence for the view that productive morphological processes are similar to syntactic computational operations. Both the results of the production task (a sentence completion task) and those of the comprehension task (a forced-choice task) exhibited that the aphasic patients' performance on the sentences with the -sase causative morpheme was significantly worse than those with the lexical causatives whereas the normal controls did significantly better in producing the target causative morphemes ($F(2, 8) = 15.6, p < .01$) and selecting the correct complex predicate ($F(1, 4) = 10.6, p < .05$). These results indicate that the aphasics' poor performance on the -sase causatives fall outside of the explanation of trace theory on syntactic disorders. Japanese causative sentences with -sase morphemes involve neither movement of a phrasal constituent (though it may involve head movement) nor empty categories. Instead, our findings suggest that the performance described by Grodzinsky's TDH is a subtype of syntactic disorder in agrammatic Broca's aphasics. Needless to say, our findings for the disruption of the -sase causatives cannot be accounted for by the working memory hypothesis nor the storage hypothesis in that neither the -sase causative sentences nor the lexical causative sentences have syntactic dependency relations, and therefore, there are no elements which could be attributed to the difference in processing resources. (Supported by COE08CE1001 & No. 12610500.)

Agrammatic Comprehension of Simple Active Sentences with Moved Objects: The Case of Hebrew OVS and OSV Structures. Na'ama Friedmann,* †Lewis P. Shapiro,† and David A. Swinney,* *University of California, San Diego; and †San Diego State University.



This study examined agrammatic comprehension of OVS and OSV structures in Hebrew. These structures are simple active sentences that are created from the basic order SVO by moving the object to the beginning of the sentence (to spec-CP), forming a focalization or topicalization structure (Shlonsky, 1997). In the OVS sentences the verb undergoes an additional movement to C°.

Since these structures are simple active sentences that involve movement of a noun phrase, they form an interesting test case for agrammatic comprehension and allow for empirical examination of several aspects of the Trace Deletion Hypothesis (Grodzinsky, 1995) and its comparison to other accounts.

The participants in this study were native Hebrew-speaking agrammatic patients who were diagnosed as nonfluent Broca's aphasics following left frontal lesions. Sentence comprehension was assessed using a sentence–picture matching task, in which the patients heard a (semantically reversible) sentence and selected the picture that correctly described the sentence. The foil was a picture in which the roles were reversed. The experiment included OVS and OSV sentences, as well as SVO sentences, randomly ordered.

The main findings were that although OVS and OSV are simple active sentences, agrammatic comprehension of both of them was at chance. The comprehension of active SVO, on the other hand, was significantly above chance.

These results have three main theoretical implications: First, they show that agrammatic comprehension is impaired even when a simple active sentence is presented, if it involves a movement of a noun phrase.

Second, the lack of difference between OVS and OSV shows that verb movement does not have an additive contribution to the impairment and therefore supports the claim that verb movement is not impaired in agrammatic comprehension.

Third, taken within current linguistic framework according to which the subject moves as well, not only the moved object but also the subject cannot receive its thematic role directly from the verb, and therefore the TDH in its current formulation predicts below-chance performance in OVS and OSV structures, contrary to our findings. Two suggestions will be discussed that will allow the TDH to accommodate these findings. One would constrain impaired movement to specific landing sites or types of movement; the other would suggest that in the course of sentence comprehension agrammatics do not move constituents if they are not forced to do so (namely, unless word order forces them to do so). If this is the case, then agrammatics would leave the subject in the VP if they can, and it will receive its theta role directly from the verb.

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Binding and Movement in Broca's Aphasia: Two Types of Intrasentential Dependency and Their Theoretical Implications. Yosef Grodzinsky and Jennifer Greene, Tel Aviv University and Aphasia Research Center, Boston University School of Medicine.

This study investigated the interaction between two types of intrasentential dependencies in aphasia: *binding relations* and *transformational movement*. It is well known that Broca's aphasics have trouble in establishing movement relations (cf. Grodzinsky, 2000, for a review). By contrast, there is evidence to suggest that their linguistic abilities in binding are unimpaired (e.g., Grodzinsky, Wexler, Chien, Solomon, and Marakovitz, 1993). In this study we investigated aphasics' abilities in constructions that involve a complex interaction between these two grammatical modules. Specifically, we looked at how they judge the grammaticality of structures that involve both. We have shown in the past that they are severely impaired in judging violations of movement (Grodzinsky & Finkel, 1998). Here, we tested a series of structures which combine the two. Patients were asked to reject or accept sentences, which were either grammatical or ungrammatical where the violation was one of gender (*himself* vs *herself*). Thus in (1) wh-movement interacts with condition A of the binding theory, whereas in (2a-b) NP-movement does (movement indicated by a link between the trace and its antecedent, reflexivity by bold font, “*” marks ungrammaticality):

- (1) Which man_i does Mary think t_i likes **himself**/**herself*?
 (2a) [pictures of **himself**/**herself*]amuse Johnt.
 (2b) **John** seems [t_i to like **himself**/**herself*].

We conducted the test with a large set of syntactic controls. The results which we will be reporting indicate that indeed, binding in Broca's aphasia is intact, whereas movement is impaired. Thus, a patient's ability to detect violations of binding is compromised just in case movement is involved. By contrast, the ability to detect movement violations is severely impaired.

The results have implications to a neurological model of language: specifically, it has been claimed that working memory is housed in Broca's area (cf. Smith & Jonides, 1999, for a review in *Science*). Clearly, some kind of memory is required for the computation of transformational relations, but crucially, the online computation of binding relations also depends on memory. The impairment of the former, but not the latter, forces the account of working memory in Broca's area to be more restrictive.

Finally, our results once again demonstrate the modular nature of syntax: binding is dissociated from movement.

TENNET Symposium: Functional Imaging of Language: Addressing the Limitations

Using PET to Disentangle the Neuroanatomy of Word and Picture Processing: Problems and Methodological Solutions. Howard Chertkow, Department of Neurology and Neurosurgery, Bloomfield Centre for Studies on Aging, Lady Davis Institute, McGill University.

PET activation studies hold tremendous promise for uncovering the neural basis of cognitive processes. At the same time, the subtleties of the method have resulted in many results to date which have been confusing, if not downright contradictory! We will discuss several methodological innovations which may address these limitations. We have demonstrated the importance of factoring out activation related to “ancillary processes” that are brought into play unintentionally in a PET experiment. We have also examined the nature of subtraction tasks used during picture naming. We found that considerable activation of higher level perceptual and semantic regions can be generated by visual processing of nonsense figures, given the propensity of the human cognitive apparatus to find “meaning” in an object even if explicitly there was none. Use of pure abstractions prevents such activation. Finally, we have recently addressed the limitations of the subtraction paradigm itself. Subtractions are inherently unreliable in language studies, because we have only incomplete knowledge of which tasks isolate particular stages of processing. Use of a “regression analysis” statistical approach, which looks at the effect of task difficulty (i.e., their picture naming ability) across a set of individuals, avoids the necessity of subtractions. This approach has been found to reliably uncover brain regions concerned with semantic processing, which escaped notice in conventional protocols. These powerful new tools can help uncover particular components of language processing, as well as showing the abnormal functioning of these brain regions in early Alzheimer’s disease subjects.

Cognitive Contributions to Functional Neuroimaging of Language. Martha W. Burton, Department of Neurology, University of Maryland School of Medicine.

A rapidly growing number of brain imaging studies are examining the neurobiological underpinnings of language. Imaging techniques with high spatial resolution, such as functional magnetic resonance imaging (fMRI), are currently widely used to show the location and magnitude of changes in blood flow/oxygenation associated with brain activity during sound, word, or sentence processing. A recent challenge in these investigations is whether functional neuroimaging can not only tell us “where” a cognitive process takes place, but also “how” it is accomplished. Neuroimaging studies are focusing on isolating specific component operations of language processing using increasingly sophisticated experimental designs, though sometimes without reference to previous psycholinguistic studies. By combining activation patterns in imaging studies with behavioral data from tasks motivated by models of language processing, it is possible to investigate the mapping between brain regions and their function. The results of such studies suggest that the different neural structures that are implicated in language processing subserve different functional roles. Furthermore, regions of the brain that are activated by particular tasks may not correspond to traditional components of language, such as phonology, but rather to operations such as those involved in specific language processes (e.g., segmentation of speech sounds) and in verbal working memory (e.g., rehearsal). Thus, functional neuroimaging may reveal new information about the organization of the brain by systematically varying task demands in order to clarify the role of brain regions, such as Broca’s area, in language processing.

Timing-Based Mechanisms for Representation in Speech and Language. David Poeppel, Departments of Linguistics and Biology, University of Maryland.

The hemodynamic functional imaging methods (fMRI and PET) have generated a large body of new functional anatomic data. The success of these methods stems from their ability to localize the source of neuronal activity, although with a temporal resolution that only indirectly reflects neuronal activity. Importantly, a variety of recent results in neuroscience and cognitive neuroscience suggest a central role for neural information representation in the millisecond time domain (Bialek & Rieke, 1992; Joliot, Ribary, & Llinas, 1994; Singer, 1993). The recording methods that can be used to investigate timing in the central nervous system are necessarily based on the electromagnetic signals that directly reflect

neuronal activity. The noninvasive recording methods available include electroencephalography (EEG) and magnetoencephalography (MEG). These techniques have the millisecond temporal resolution appropriate to the recording of neuronal activity. Several types of timing-related phenomena have been investigated, including precise latency shifts and oscillatory activity. These two types of information exemplify possible neuronal encoding mechanisms that are invisible to hemodynamic recording techniques and that are of potential significance in de- and encoding processes for speech and language processing.

TENNET Symposium: 20th Century in Retrospect

Cognitive Neuropsychology: The 'English' School 1942–1999. John C. Marshall and Jennifer M. Gurd, University Department of Clinical Neurology, Radcliffe Infirmary, Oxford.

A distinctive 'style' of neuropsychological inquiry began to emerge in the UK in the 1940s. The 'grandfathers' of the 'new' movement (with roots in classical French and German neuropsychology) were R. C. Oldfield and O. L. Zangwill. Neither man had any degrees or 'training' in psychology (let alone neuropsychology): They hence came to the problem of describing the neuropsychological fractionation of cognition with minds sharpened by the Cambridge Natural Science Tripos, but uncluttered by textbook 'knowledge.' Their interests were wide: amnesia and paramnesia, aphasia (with special reference to naming), dyslexia, visuospatial neglect, handedness, and cerebral dominance. Crucially, Oldfield and Zangwill set the scene for later developments in the 60s by encouraging both the detailed investigation of striking single cases and the application to cognitive pathology of experimental psychology's concern with adequate stimulus construction, methodology, and statistical analysis. The paper will follow how the intellectual 'children' of Oldfield and Zangwill have continued to extend and deepen their original insights.

Henry Goddard, Howard Knox, and the Development of Performance Tests. John T. E. Richardson, Brunel University.

In the early years of the 20th century, it was widely held in the United States that intelligence was a unitary and biologically determined trait and, conversely, that mentally retarded people were degenerate individuals who were responsible for social problems and who endangered the biological fitness of the nation. The identification of mental retardation had become a major issue with the introduction of compulsory education toward the end of the 19th century, and yet the earliest mental tests proved inappropriate for use with mentally retarded individuals. Henry Goddard, the director of research at the Vineland Training School, introduced the work of Binet and Simon to the United States and advocated the use of the Binet scale in diagnosing mental retardation. In 1910, in the face of public concern that the prevalence of mental retardation was being boosted by immigrants from southern and eastern Europe, Goddard was invited to advise on the assessment of intelligence in potential immigrants at Ellis Island, and he concluded that the majority of cases of mental retardation went undetected. Howard Knox and the other physicians at Ellis Island shared Goddard's view that mental retardation was a fixed and wholly inherited trait, but they rejected his conclusion, partly on the ground that predominantly verbal tests like the Binet scale were unsuitable for illiterate immigrants. They set about devising new 'performance' tests that did not rely on verbal skills. Between September 1913 and April 1914, Knox published a series of papers describing different tests and proposed that these could be used as a single scale. These tests were being used at Ellis Island well into the 1920s. They were also incorporated into later performance scales, such as the Pintner–Paterson scale and the Army Performance Scale, and some tests continued to be used in neuropsychological research through the 20th century. Because of the early work at Ellis Island, it is nowadays taken for granted that any adequate measure of intelligence must include both verbal and performance subtests.

The Concept of Cortical Columns. C. U. M. Smith, Vision Sciences, Aston University, United Kingdom.

The roots of the concept of the cortical column can be traced back to the phrenology of the early part of the 19th century (1). Although this early belief that the cortex must contain discrete units of activity was soon discredited it reemerged at the beginning of the 20th century in the hands of Campbell, Brodmann, von Economo, and others in the form of cytoarchitectonics. At about the same time the careful histological investigations of Golgi and Ramon y Cajal provided the foundation for the concept of vertical chains of neurons in the cortex. This concept was placed firmly before the neuroscientific community in the chapter Lorente de N6 contributed to Fulton's 1938 (and subsequent editions) important textbook *Physiology of the Nervous System*. (2). Lorente de N6 writes that these chains constitute 'elementary units' of cortical activity. With the advent of microelectrode recording first Vernon Mountcastle (1957)

and then David Hubel and Torsten Wiesel (1959) gave these putative units physiological validity. The anatomical reality of columns of activity in the cortex was established by clever histochemical techniques in the 1970s and the cellular histology culminated in Szentogthai's brilliant iconography of the late 1970s. This paper reviews this midcentury counterpoint between neuroanatomy and neurophysiology and places it in the context of the long-term drive to understand the physiology of the cortex in terms of modular units.

Building a Window on the Brain: The Development of Brain Mapping and Functional Imaging 1980–2000. Anne Beaulieu, University of Bath.

Brain mapping is said to have opened up the possibility of a new collaboration between the sciences of mind and the sciences of the brain. This collaboration, brain mappers claim, will yield a new kind of science and scientist, sometimes called cognitive neuroscientist. It is precisely what makes up this new "close working relationship" and its effects that will be investigated in this paper. A key part of the working relationship will be shown to be constituted through the development a digital space in which to measure mind and brain.

New possibilities for collaboration between mind and brain sciences and for learning about the mind through exploration of the brain involve a number of changes and innovations in the way functional imaging is pursued and organized. New brain imaging technologies certainly play an important role in this process, but not all can be attributed to new technologies. This paper will consider the changing participation of various clinicians and scientists and will show how closely this is linked not only to the development of scanners, but also to the development of a set of representational conventions embedded in digital technologies. As with any other new technology, correlation between measures and a meaningful context must also be established; in a context of clinical care, measures must make sense in terms of concepts of disease. This is also true in research settings, where measures must make sense in terms of phenomena, which disciplines take to be their object. The development of meaningful 'scans,' providing important information to both brain and mind scientists, is not solely the result of having "a window on the brain," opened up by scanners, but of continuous efforts to build, frame, and learn to look through it.

The Issue of Recovered Memories: Historical Developments That Have Led to Two Views about How Memories Are Stored. Stuart Zola, University of California, San Diego.

There is continuing debate about the credibility of "recovered memories"—reports by adults of recovered memories of childhood sexual abuse and trauma that were allegedly repressed for many years. This phenomenon has been variously referred to as 'decades delayed discovery,' 'recovery of repressed memories,' the 'false memory syndrome,' and 'recovered memory' (the term that will be used in the present article). Much of the debate revolves around two different views of how memories are stored. By one view, a popularly held and long-standing view that has its roots in Freudian ideas of repression, *memories are static* and can lie dormant in the brain unchanged for decades. Using special techniques, e.g., hypnosis and free association, these memories can be accurately recovered.

An alternative view, referred to here as *the dynamic view of memory*, is that memory storage in the brain changes over time. Moreover, memory storage can be affected by such things as the intrusion of new events and by the act of retrieval itself. By this view, when an earlier event is recalled (whether it is an event from yesterday or an event from 20 years ago), some components of the recalled event may be different than the original occurrence, and some of the information may have been entirely lost. If this were the case, then it is possible that the recollection of an earlier event could be incomplete or could contain distortions or false memories or the recollection for the whole event could be a false memory. It turns out that biological facts about how memory is organized in the brain, as well as views about brain function derived from connectionist models, brain imaging studies, and experimental and behavioral studies of how memory operates all support the dynamic view of memory. These two views will be described in terms of their historical development and in terms of how they can inform us about two hotly debated aspects of the recovered memory issue, i.e., whether memories for traumatic events change over time and whether memories can be created for traumatic events that did not actually happen.