Activation Patterns Associated with Explicit and Implicit Processing
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Background
A dissociation between what appears to be intentional, explicit processing of information and that which relies on incidental, implicit processing has been well documented for some time (Schacter, 1987). For example, amnesics who are unable to consciously recall presented material, will be able to demonstrate memory for the material when tested indirectly (e.g., with priming or stem completion tasks). In healthy individuals, manipulations that affect performance on one type of memory task may have little effect on performance of the other type of task. For example, whereas changes in the surface features of presented items (e.g., font, color) will affect implicit memory, this manipulation often has little effect on explicit memory.

One explanation for the dissociations observed between implicit and explicit memory is that the performance differences reflect distinct memory systems (Schacter & Tulving, 1994). An alternative explanation is that dissociations between implicit and explicit tasks arise, not because of distinct memory systems, but because different tasks require different types of processing. Whereas explicit tasks tend to tap into conceptual processing, implicit tasks may be more data-driven (Roediger, 1990). Some of the difficulty in evaluating the two models can be attributed to the ambiguity surrounding the terms explicit and implicit. It is not always clear whether these terms are being used to refer to types of tasks, cognitive states, or theoretical constructs (e.g., memory systems).

Study Goals
• examine explicit and implicit retrieval as a function of initial encoding
• use fMRI to look at the neural correlates of explicit and implicit processing
• produce process models of explicit and implicit processing

Method
Participants: Forty-eight Rutgers undergraduates participated for course credit or cash. Participants were randomly assigned in equal number to the four experimental conditions.

Behavioral Results
Accuracy: In general, participants who had encoded material implicitly made fewer errors on both retrieval tasks than did participants who had encoded material explicitly, F(1,44)=11.81, p<.01. Participants in the implicit retrieval condition also performed significantly more accurately than those in the explicit retrieval condition, F(1,44)=5.46, p<.05.

Response Time: No main effects were found for either encoding or retrieval, however, a significant interaction was obtained, F(4,174)=7.24, p<.01.

Interactivity Between Areas
Encoding
Common areas that were recruited across both conditions of the encoding phase include: cingulate, superior temporal gyrus, and lentiform. These areas are associated with cognitive control, visual search (superior temporal gyrus), and lentiform (lentiform). In addition to these areas, the explicit encoding condition appears to recruit inferior parietal lobule, an area associated with visuotemporal attention. The implicit encoding condition uniquely recruited inferior frontal gyrus, an area associated with attentional selection (Zhang et al., 2004).

Retrieval
Cingulate appears again during retrieval and is, in fact, the only area that appears in all four retrieval conditions. Cingulate was found to have both input and output connections to other areas in all but the explicit encoding, explicit retrieval condition. Inferior parietal lobule appears in all conditions with the exception of explicit retrieval following implicit encoding. In retrieval conditions following explicit encoding inferior parietal lobule was interactive, both receiving and producing input. This contrasts with the role of inferior parietal lobule during implicit retrieval following implicit encoding where inferior parietal lobule exerted a strong influence on cingulate, but did not receive significant input from other areas.

Recent work (Reber et al. 2005) suggests that fusiform gyrus, an area often associated with face recognition, may play a role in priming. It was found in explicit retrieval following implicit encoding. Lentiform, an area associated with learning and possibly executive cognitive functions (Brown et al., 1957) was found to interact with cingulate in retrieval conditions following implicit encoding but not during implicit retrieval. Note also that supramarginal gyrus, an area associated with language processing, appears only in the explicit retrieval condition following explicit encoding.

RUMBA Causal Modelling Method
FSL analysis typically produced 10-12 areas at p<.05 (cluster level). Subsequent clustering (see POSTER #617) was performed in which both subject agreement (number of subjects that had voxels in similar areas >50%) and a significant number of voxels (>50) were used as criteria. This clustering yielded six areas: cingulate, superior temporal gyrus, lentiform, inferior parietal lobule, inferior frontal gyrus, and supramarginal gyrus.

General Conclusions
• differences in performance are consistent with transfer appropriate processing (Blaxton, 1989)
• brain areas are recruited differentially as a function of processing demands
• unlikely that distinct memory systems underlie explicit or implicit processing

Acknowledgements
Supported by NSF (ECI-0209178), and the James S. McDonnell Foundation. Thanks to Yevgeniy Hulshenko, Devran Erdoğ, and Toshiyuki Minakawa.

References