Acknowledgements

I wish to thank all my friends and colleagues who supported this study. Specifically, I wish to express my gratitude to Prof. Dr. Gereon R. Fink and Dr. Peter H. Weiss at the Research Center Jülich for their valuable support of the fMRI experiment and the publication of this study. Moreover, I am grateful to the director of the Institute of Medicine at the Research Center Jülich Prof. Dr. Karl Zilles who gave me the opportunity to accomplish this study in his institute and use the local technical equipment.

Moreover, I wish to say thank you to Prof. Dr. Hans. J. Markowitsch. He provided me with the room for autonomous scientific work during the proceeding of this study and supported me by experienced supervision.

In particular, I appreciate the loyal and confiding cooperation of the volunteers who participated in this study. The experiment would have failed without their frankness during the autobiographical interviews and their cooperative engagement in their tasks during the fMRI measurements.

Also, I thank all my colleagues at the Research Center Jülich and at the University of Bielefeld for their interest in my work, for their constant encouragement, and for our helpful discussions. Specifically, I wish to thank Dr. Peter H. Weiss and Dr. Matthias Brand for their valuable help in the statistical analyses of data.

Bielefeld, 2003
Part I: Introduction

Vivid recollection and emotional re-experiencing of personal past episodes are the key characteristics of autobiographical memory, a subsystem of episodic memory based upon complex interactions between episodic memory, associated emotions, and the senses of self-coherence and -continuity along the time axis of one’s life. In everyday life, engagement in the emotional recollection of personal past experiences is presumably familiar to all humans. We are frequently concerned with our autobiographical memories - for example while thinking about the relevance of a past experience or event with respect to ourselves or while telling each other stories of emotionally significant life events. By means of our interpretations and re-interpretations of a personal past we integrate old and new experiences with current views of ourselves in present life situations. Relying on the emotional evaluation of our autobiographical memories, we reconstruct a subjectively meaningful personal past, thereby meeting the requirements of the common view that our “self” is coherent and continuous throughout lifetime although it may concomitantly undergo considerable changes in many respects.

In this study which is primarily concerned with the functional neuroanatomy underlying autobiographical memory, functional magnetic resonance imaging (fMRI) was used to assess differences in the distributed networks of brain structures involved in the retrieval of old and new autobiographical memories with differential emotional valence. During the fMRI measurement, subjects were required to recollect positively and negatively valenced personal events from recent and remote past. Also, the question of whether there are gender differences in the neural substrates of autobiographical memory retrieval was addressed. To complement the fMRI results, behavioral data were acquired during and immediately after the scanning session.

Additionally, a primarily social psychological approach was employed to elucidate characteristic aspects of autobiographical memory contents. Specifically, a content analysis was accomplished to assess the thematic structure of emotional autobiographical memory in healthy human subjects (university students, age range 22-35). Applying this approach, information on typical topics of autobiographical memory narratives relating to both distinct time periods and emotional valence could be obtained. As with the fMRI data, narratives of personal past experiences were analyzed for gender differences. It was expected, that the content analysis data could turn out to be useful to achieve optimum standardization of future functional neuroimaging experiments on autobiographical memory.
The theoretical part of this dissertation firstly describes the status of autobiographical memory within broader models of human memory developed in cognitive psychology and neuroscience, thereby especially referring to the multiple memory systems view. Focusing on episodic and semantic memory, hypotheses on the brain structures representing the anatomical basis of specific memory systems and processes are discussed. As this study refers to emotional autobiographical memory the discussion is centered upon several regions of the prefrontal cortex and brain structures within medial temporal lobe. Research on the role of the prefrontal cortex, the hippocampal formation, and the amygdala complex in memory and emotion processing is reviewed. Also, studies on putative gender differences in the brain circuits mediating memory and emotion are referred to. Subsequently, central caveats associated with neuropsychological assessment and functional neuroimaging of highly complex emotional autobiographical memory processing are analyzed. Given the various confounds which necessarily emerge in neuropsychological and functional neuroimaging research on autobiographical memory, up to date views of the functional neuroanatomy underlying emotional autobiographical memory retrieval are discussed.

Thereafter, autobiographical remembering is briefly characterized from the point of view of cognitive and behavioral psychology.

The first sections of the empirical part are concerned with the hypotheses which guided this study, and with the subjects investigated. Thereafter, the acquisition of autobiographical stimulus materials for the fMRI investigation applying a semi-structured interviewing method is described, and the qualitative and quantitative content analysis approach to the narrative autobiographical data is specified. Subsequently, basic magnetic resonance imaging (MRI) techniques and the specificities of functional magnetic resonance imaging (fMRI) are explained. Starting from these fundamentals, the experimental design of the present fMRI study on differential types of autobiographical memories is introduced. Also, the methods of preprocessing and statistical analyses of functional MR images are described. Finally, the empirical part presents the results of this study. These include the functional neuroimaging findings, behavioral data acquired during and immediately following the scanning session, and results from the content analysis approach.

Discussion of data and conclusions which can be drawn from the current findings build up the following part of the study. Results of neuroimaging, post-scanning behavioral assessment, and the content analysis are debated in the context of previous research alluding the key issues addressed in the present study. The hypotheses which guided this study are referred to in light of the present data, and the relationship between the neuroimaging and the
behavioral findings is discussed. Also, some prospects on future research on the neurobiology and functional neuroanatomy, as well as behavioral aspects of episodic autobiographical memory are given, referring to the current data and findings from previous invest

Examples of the stimulus sentences used to trigger the subjects’ autobiographical memories during the fMRI measurement and the post-scanning debriefing questionnaires are presented in the appendices.