

Contents

Preface.....	xvii
Abbreviation.....	xi
Acknowledgement.....	xxiv
1. INTRODUCTION.....	1
1.1 NEW TIME WITH NEW REQUIREMENT.....	1
1.2 THE ASR APPLICATIONS.....	2
1.2.1 <i>The History</i>	3
1.2.2 <i>Analysis on the Consumer Applications</i>	5
1.2.3 <i>Using ASR to Drive Ship –One Application Example</i>	7
1.3 INTERFACE DESIGN	9
1.3.1 <i>Neuroscience and Cognitive Psychology</i>	9
1.3.2 <i>Speech Interaction Studies</i>	10
1.3.3 <i>Multidisciplinary Aspects</i>	11
1.3.4 <i>Task Orientated or Domain Orientated System</i>	12
1.4 USABILITY AND USER-CENTERED DESIGN.....	13
1.4.1 <i>Usability Issue</i>	13
1.4.2 <i>Understand the User</i>	14
1.4.3 <i>About Design Guidelines</i>	15
1.5 RESEARCH PHILOSOPHY	17

1.5	RESEARCH PHILOSOPHY	17
	<i>I Ching Philosophy</i>	
	<i>Research and Design Methodology</i>	
	<i>Research Validity</i>	
1.6	CONCLUSION	25
2.	BASIC NEUROPSYCHOLOGY.....	27
2.1	INTRODUCTION.....	27
2.2	GENERAL ASPECTS OF NEUROSCIENCE.....	28
	<i>Basic Neuron Structure and Signal Transfer</i>	
	<i>The Principles of Brain Functioning</i>	
	<i>Methodology of Neuropsychological Studies</i>	
2.3	PERCEPTION	33
	<i>The Sensory System</i>	
	<i>Sensory Modality</i>	
	<i>Cortical Connection and Function</i>	
	<i>Perception and Recognition Theories</i>	
2.4	LANGUAGE.....	39
	<i>Neurology of Language</i>	
	<i>Speech Perception</i>	
	<i>Word Recognition</i>	
	<i>Language Comprehension</i>	
2.5	LEARNING AND MEMORY	45
	<i>Learning Theory</i>	
	<i>Memory</i>	
	<i>The Mechanism of Memory</i>	
	<i>Working Memory</i>	
	<i>Forgetting</i>	
2.6	CONCLUSION	50
3.	ATTENTION, WORKLOAD AND STRESS.....	53
3.1	INTRODUCTION.....	53
3.2	ATTENTION	54
	<i>Neuroscience Perspective</i>	
	<i>Focusing Attention</i>	
	<i>Dividing Attention</i>	
3.3	MULTIPLE-TASK PERFORMANCE	58
	<i>The Resource Concept</i>	
	<i>The Efficiency of Multiple Task Performance</i>	
	<i>Individual Differences</i>	
3.4	STRESS AND WORKLOAD	61
	<i>Stress</i>	
	<i>Workload</i>	

3.5	THE RELATIONSHIP BETWEEN STRESS AND WORKLOAD	63
	<i>Stressors Classification</i>	
	<i>Stress: Its Cognitive Effects</i>	
	<i>Stress: Its Physiological Effects</i>	
	<i>Stress: Its Effects on Speech</i>	
	<i>Fatigue</i>	
3.6	THE MEASUREMENT OF STRESS AND WORKLOAD	68
	<i>The Measurement of Stress</i>	
	<i>Workload Assessment</i>	
	<i>Performance Measurement</i>	
	<i>Subjective Rating Measures</i>	
3.7	PSYCHOPHYSIOLOGICAL MEASURES	72
	<i>Psychological Function Test</i>	
	<i>Physiological Function Test</i>	
3.8	ENVIRONMENTAL STRESS	78
	<i>Acceleration</i>	
	<i>Vibration</i>	
	<i>Noise</i>	
	<i>Auditory Distraction</i>	
3.9	WORKLOAD AND THE PRODUCTION OF SPEECH	83
3.10	ANALYSIS OF SPEECH UNDER STRESS.....	85
	<i>Emotion and Cognition</i>	
	<i>Speech Measures Indicating Workload</i>	
	<i>Acoustic Analysis of Speech</i>	
	<i>Improving ASR Performance</i>	
3.11	RESEARCH PROBLEMS	91
3.12	CONCLUSION.....	94
4.	DESIGN ANALYSIS.....	95
4.1	INTRODUCTION.....	95
4.2	INFORMATION PROCESSING THEORY.....	97
4.3	THE ECOLOGICAL PERSPECTIVE.....	98
	<i>Ecological View of the Interface design</i>	
4.4	DISTRIBUTED COGNITION.....	103
4.5	COGNITIVE SYSTEM ENGINEERING.....	104
4.6	WORK AND TASK ANALYSIS	106
	<i>Task Analysis</i>	
	<i>Cognitive Task Analysis</i>	
	<i>GOMS—A Cognitive Model</i>	
	<i>Cognitive Work Analysis</i>	
4.7	INTERACTION DESIGN PROCESS	115
	<i>Human-System Interface</i>	
	<i>Design Process</i>	

Designing human interface in speech technology

Interaction Design

4.8	SCENARIO-BASED DESIGN	119
4.9	DISCUSSION.....	120
4.10	CONCLUSION.....	122
5.	USABILITY DESIGN AND EVALUATION.....	123
5.1	INTRODUCTION	123
5.2	DIFFERENT DESIGN APPROACHES	123
5.3	THE CONCEPT OF USABILITY	125
	<i>Definitions</i>	
	<i>Usability Design</i>	
	<i>Usability Evaluation</i>	
5.4	HUMAN NEEDS AND SATISFACTION	135
	<i>Trust</i>	
	<i>Pleasure</i>	
5.5	USER-CENTERED DESIGN	141
	<i>What is UCD Process?</i>	
	<i>Planning the UCD Process</i>	
	<i>Specifying the Context of Use</i>	
	<i>User Analysis</i>	
	<i>User Partnership</i>	
	<i>Usability Requirements Analysis</i>	
	<i>UCD Process in Practices</i>	
5.6	SOCIAL TECHNICAL ISSUE.....	152
5.7	ADAPTIVE AND INTUITIVE USER INTERFACE.....	153
5.8	USAGE-CENTERED DESIGN.....	155
	<i>Creative Design</i>	
	<i>Design Criteria and Process</i>	
	<i>Ecological Approach</i>	
5.9	UNIVERSAL ACCESS.....	160
5.10	ETHNOGRAPHY METHOD FOR CONTEXTUAL INTERFACE DESIGN .	163
5.11	CONCLUSION.....	164
6.	HUMAN FACTORS IN SPEECH INTERFACE DESIGN.....	167
6.1	INTRODUCTION.....	167
6.2	THE UNIQUE CHARACTERISTICS OF HUMAN SPEECH.....	169
6.3	HUMAN SPEECH RECOGNITION SYSTEM.....	171
	<i>Automatic Speech Recognition System</i>	
	<i>Speech Feature Analysis and Pattern Matching</i>	
	<i>Speech Synthesis</i>	
	<i>National Language Processing</i>	
	<i>Language Modeling</i>	
6.4	HUMAN FACTORS IN SPEECH TECHNOLOGY.....	179

6.5	SPEECH INPUT	180
	<i>Human Factors and NLP</i>	
	<i>Flexibility of Vocabulary</i>	
	<i>Vocabulary Design</i>	
	<i>Accent</i>	
	<i>Emotion</i>	
6.6	ASSESSMENT AND EVALUATION	186
6.7	FEEDBACK DESIGN.....	188
	<i>Classification of Feedback</i>	
	<i>Modality of Feedback</i>	
	<i>Textual Feedback or Symbolic Feedback</i>	
6.8	SYNTHEZIZED SPEECH OUTPUT.....	192
	<i>Cognitive Factors</i>	
	<i>Intelligibility</i>	
	<i>Comprehension</i>	
	<i>Emotion</i>	
	<i>Social Aspects</i>	
	<i>Evaluation</i>	
6.9	ERROR CORRECTION	199
	<i>Speech Recognition Error</i>	
	<i>User Errors</i>	
	<i>User Error Correction</i>	
6.10	SYNTAX	205
6.11	BACK-UP AND REVERSION	206
6.12	HUMAN VERBAL BEHAVIOR IN SPEECH INPUT SYSTEMS.....	208
	<i>Expertise and Experience of the User</i>	
	<i>The Evolutionary Aspects of Human Speech</i>	
6.13	MULTIMODAL INTERACTION SYSTEM.....	212
	<i>Definitions</i>	
	<i>Advantages of Multimodal Interface</i>	
	<i>Design Questions</i>	
	<i>Selection and Combination of Modalities</i>	
	<i>Modality Interaction</i>	
	<i>Modality for Error Correction</i>	
	<i>Evaluation</i>	
6.14	CONCLUSION.....	224
7.	THE USABILITY OF SPOKEN DIALOGUE SYSTEM DESIGN	225
7.1	INTRODUCTION	225
7.2	THE ATTRACTIVE BUSINESS.....	226
7.3	ERGONOMIC AND SOCIO-TECHNICAL ISSUES.....	228
	<i>The User Analysis</i>	
	<i>The Variance of Human Speech</i>	

7.4	SPEECH RECOGNITION ERROR.....	232
	<i>Error Correction for Dialogue Systems</i>	
7.5	COGNITIVE AND EMOTIONAL ISSUE.....	234
	<i>Short-Term Memory</i>	
	<i>Verbal/Spatial Cognition</i>	
	<i>Speech and Persistence</i>	
	<i>Emotion, Prosody and Register</i>	
7.6	AFFECTIVE COMMUNICATION	237
7.7	LIMITATIONS OF SUI.....	238
	<i>Speech Synthesis</i>	
	<i>Interface Design</i>	
7.8	USABILITY EVALUATION.....	241
	<i>Functionality Evaluation</i>	
	<i>Who Will Carry Out Usability Evaluation Work?</i>	
	<i>The Usability Design Criteria</i>	
	<i>Evaluation Methods</i>	
7.9	CONCLUSION	249
8.	IN-VEHICLE COMMUNICATION SYSTEM DESIGN	251
8.1	INTRODUCTION.....	251
	<i>Intelligent Transport System</i>	
	<i>Design of ITS</i>	
8.2	IN-VEHICLE SPEECH INTERACTION SYSTEMS	256
	<i>Design Spoken Input</i>	
	<i>Multimodal Interface</i>	
	<i>ETUDE Dialogue Manager</i>	
	<i>DARPA Communicator Architecture</i>	
	<i>SENECs</i>	
	<i>SmartKom Mobile</i>	
8.3	THE COGNITIVE ASPECTS.....	266
	<i>Driver Distraction</i>	
	<i>Driver's Information Processing</i>	
	<i>Interface Design</i>	
	<i>Human Factors</i>	
8.4	USE OF CELLULAR PHONES AND DRIVING.....	272
	<i>Accident Study</i>	
	<i>Types of Task and Circumstances</i>	
	<i>Human Factors Study Results</i>	
8.5	USE OF IN-VEHICLE NAVIGATION.....	276
	<i>Accident Analysis</i>	
	<i>Types of Tasks</i>	

	<i>Navigation system-Related Risk</i>	
8.6	SYSTEM DESIGN AND EVALUATION	281
	<i>System Design</i>	
	<i>System Evaluation/Assessment</i>	
8.7	FUTURE WORKS	286
8.8	CONCLUSION	287
9.	SPEECH TECHNOLOGY IN MILITARY APPLICATION.....	289
9.1	INTRODUCTION.....	289
9.2	THE CATEGORIES IN MILITARY APPLICATIONS	291
	<i>Command and Control</i>	
	<i>Computers and Information Access</i>	
	<i>Training</i>	
	<i>Joint Force at Multinational Level</i>	
9.3	APPLICATION ANALYSIS	294
9.4	COMPARISON BETWEEN SPEECH INPUT AND MANUAL INPUT	297
	<i>The Argumentation between Poock and Damper</i>	
	<i>Effects of concurrent tasks on Direct Voice Input</i>	
	<i>Voice Input and Concurrent Tracking Tasks</i>	
9.5	AVIATION APPLICATION	301
	<i>The Effects from Stress</i>	
	<i>Compare Pictorial and Speech Display</i>	
	<i>Eye/Voice Mission Planning Interface (EVMPI) Model</i>	
	<i>Application in Cockpit Fast Jet</i>	
	<i>Battle Management System</i>	
	<i>UAV Control Stations</i>	
9.6	ARMY APPLICATION	312
	<i>Command and Control on Move (C2OTM)</i>	
	<i>ASR Application in AFVs</i>	
	<i>The Soldier's Computer</i>	
	<i>Applications in Helicopter</i>	
9.7	AIR TRAFFIC CONTROL APPLICATION.....	316
	<i>Training of Air Traffic Controllers</i>	
	<i>Real Time Speech Gisting for ATC Application</i>	
9.8	NAVY APPLICATION.....	320
	<i>Aircraft Carrier Flight Deck Control</i>	
9.9	SPACE APPLICATION	321
9.10	OTHER APPLICATIONS	322
	<i>Computer Aid Training</i>	
	<i>Aviation Weather Information</i>	
	<i>Interface Design for Military Datasets</i>	
9.11	INTEGRATING SPEECH TECHNOLOGY INTO MILITARY SYSTEMS...	324
	<i>The Selection of Suitable Function for Speech technology</i>	

<i>Recognition Error, Coverage and Speed</i>	
<i>Interface Design</i>	
<i>Alternative and Parallel Control Interface</i>	
<i>Innovative Spoken Dialogue Interface</i>	
9.12 CONCLUSION.....	330
References.....	331
Index.....	377