

Contents

About the Authors	xvii
Acknowledgments	xviii
Preface	xix
1 INTRODUCTION	1
1.1 Changes in topics of HCI research over time	3
1.2 Shifts in measurement in HCI	5
1.3 Inherent conflicts in HCI	9
1.4 Interdisciplinary nature of HCI research	11
1.5 Communicating your ideas	13
1.6 Research and usability testing	14
Summary of Chapters	14
Discussion Questions	15
Research Design Exercise	16
References	16
2 EXPERIMENTAL RESEARCH	19
2.1 Types of behavioral research	20
2.2 Research hypotheses	22
2.2.1 Null hypothesis and alternative hypothesis	23
2.2.2 Dependent and independent variables	25
2.2.3 Typical independent variables in HCI research	25
2.2.4 Typical dependent variables in HCI research	26
2.3 Basics of experimental research	27
2.3.1 Components of an experiment	27
2.3.2 Randomization	28
2.4 Significance tests	30
2.4.1 Why do we need them?	30
2.4.2 Type I and Type II errors	32
2.4.3 Controlling the risks of Type I and Type II errors	34

2.5	Limitations of experimental research	34
	Summary	36
	Discussion Questions	37
	Research Design Exercises	38
	References	38
3	EXPERIMENTAL DESIGN	41
3.1	What needs to be considered when designing experiments?	43
3.2	Determining the basic design structure	44
3.3	Investigating a single independent variable	45
	3.3.1 Between-group design and within-group design	46
	3.3.2 Choosing the appropriate design approach	49
3.4	Investigating more than one independent variable	53
	3.4.1 Factorial design	53
	3.4.2 Split-plot design	54
	3.4.3 Interaction effects	55
3.5	Reliability of experimental results	57
	3.5.1 Random errors	57
	3.5.2 Systematic errors	57
3.6	Experimental procedures	63
	Summary	64
	Discussion Questions	65
	Research Design Exercises	65
	References	66
4	STATISTICAL ANALYSIS	69
4.1	Preparing data for statistical analysis	70
	4.1.1 Cleaning up data	70
	4.1.2 Coding data	71
	4.1.3 Organizing data	73
4.2	Descriptive statistics	73
	4.2.1 Measures of central tendency	73
	4.2.2 Measures of spread	74
4.3	Comparing means	74
4.4	<i>T</i> tests	76
	4.4.1 Independent-samples <i>t</i> test	76
	4.4.2 Paired-samples <i>t</i> test	76
	4.4.3 Interpretation of <i>t</i> test results	77
	4.4.4 Two-tailed <i>t</i> tests and one-tailed <i>t</i> tests	78

4.5	Analysis of variance	78
4.5.1	One-way ANOVA	79
4.5.2	Factorial ANOVA	80
4.5.3	Repeated measures ANOVA	82
4.5.4	ANOVA for split-plot design	83
4.6	Assumptions of t tests and F tests	86
4.7	Identifying relationships	86
4.8	Regression	89
4.9	Nonparametric statistical tests	91
4.9.1	Chi-square test	92
4.9.2	Other non-parametric tests	94
	Summary	94
	Discussion Questions	95
	Research Design Exercises	96
	Team Exercises	96
	References	96
5	SURVEYS	99
5.1	Introduction	100
5.2	Benefits and drawbacks of surveys	101
5.3	Goals and targeted users for survey research	102
5.4	Probabilistic sampling	103
5.4.1	Stratification	105
5.4.2	Response size	106
5.4.3	Errors	106
5.5	Non-probabilistic sampling	107
5.5.1	Demographic data	107
5.5.2	Oversampling	108
5.5.3	Random sampling of usage, not users	109
5.5.4	Self-selected surveys	109
5.5.5	Uninvestigated populations	109
5.6	Developing survey questions	111
5.6.1	Open-ended questions	111
5.6.2	Closed-ended questions	112
5.6.3	Common problems with survey questions	113
5.7	Overall survey structure	113
5.8	Existing surveys	115
5.9	Paper or online surveys?	116

5.10	Testing the survey tool	118
5.11	Response rate	119
5.12	Data analysis	120
	Summary	121
	Discussion Questions	121
	Research Design Exercise	122
	References	122
6	DIARIES	125
6.1	Introduction	126
6.2	Why do we use diaries in HCI research?	127
6.3	Participants for a diary study	130
6.4	What type of diary?	132
	6.4.1 Feedback diary	132
	6.4.2 Elicitation diary	133
	6.4.3 Hybrid feedback and elicitation diary	134
6.5	Data collection for the diary study	134
6.6	Letting participants know when to record a diary entry	136
6.7	Analysis of diaries	137
	Summary	138
	Discussion Questions	138
	Research Design Exercise	138
	References	139
	Appendix A Frustration Experience Form (Time Diary)	140
	Appendix B Excel Time Diary Form	141
7	CASE STUDIES	143
7.1	Introduction	144
7.2	Observing Sara: a case study of a case study	145
7.3	What is a case study?	147
	7.3.1 In-depth investigation of a small number of cases	147
	7.3.2 Examination in context	147
	7.3.3 Multiple data sources	148
	7.3.4 Emphasis on qualitative data and analysis	149
7.4	Goals of HCI case studies	150
	7.4.1 Exploration	150
	7.4.2 Explanation	151
	7.4.3 Description	152
	7.4.4 Demonstration	154

7.5	Types of case study	156
7.5.1	Intrinsic or instrumental	156
7.5.2	Single case or multiple cases	156
7.5.3	Embedded or holistic	160
7.6	Research questions and hypotheses	161
7.7	Choosing cases	163
7.8	Data collection	164
7.8.1	Data sources and questions	164
7.8.2	Collecting data	165
7.9	Analysis and interpretation	167
7.10	Writing up the study	168
7.11	Informal case studies	170
	Summary	172
	Discussion Questions	174
	Research Design Exercises	174
	References	175
8	INTERVIEWS AND FOCUS GROUPS	177
8.1	Pros and cons of interviews	178
8.2	Applications of interviews in HCI research	180
8.2.1	Initial exploration	180
8.2.2	Requirements gathering	184
8.2.3	Evaluation and subjective reactions	186
8.3	Who to interview	187
8.4	Interview strategies	189
8.4.1	How much structure?	189
8.4.2	Focused and contextual interviews	191
8.5	Interviews vs focus groups	192
8.6	Types of question	194
8.7	Conducting an interview	197
8.7.1	Preparation	197
8.7.2	Recording the responses	198
8.7.3	During the interview	199
8.8	Electronically mediated interviews and focus groups	203
8.8.1	Telephone	204
8.8.2	Online	204
8.9	Analyzing interview data	206
8.9.1	What to analyze	207
8.9.2	How to analyze	208

8.9.3	Validity	212
8.9.4	Reporting Results	212
	Summary	213
	Discussion Questions	214
	Research Design Exercises	214
	References	215
9	ETHNOGRAPHY	217
9.1	Introduction	218
9.2	What is ethnography?	219
9.3	Ethnography in HCI	221
9.4	Conducting ethnographic research	224
9.4.1	Selecting a site or group of interest	225
9.4.2	Participating: choosing a role	227
9.4.3	Building relationships	230
9.4.4	Making contact	231
9.4.5	Interviewing, observing, analyzing, repeating, and theorizing	232
9.4.6	Reporting results	236
9.5	Some examples	237
9.5.1	Home settings	237
9.5.2	Work settings	238
9.5.3	Educational settings	239
9.5.4	Ethnographies of mobile and ubiquitous systems	240
9.5.5	Virtual ethnography	241
	Summary	246
	Discussion Questions	246
	Research Design Exercises	247
	References	248
10	USABILITY TESTING	251
10.1	What is usability testing?	252
10.2	How does usability testing relate to traditional research?	254
10.3	Types of usability testing or usability inspections	256
10.3.1	Expert-based testing	256
10.3.2	Automated usability testing	258
10.4	User-based testing	260
10.4.1	Types of usability testing	260
10.4.2	Stages of usability testing	262

10.4.3	How many users are sufficient?	263
10.4.4	Locations for usability testing	264
10.4.5	Task list	268
10.4.6	Measurement	270
10.4.7	The testing session	271
10.4.8	Making sense of the data	274
10.5	Other variations on usability testing	275
	Summary	276
	Discussion Questions	276
	Research Design Exercise	277
	References	277
11	ANALYZING QUALITATIVE DATA	281
11.1	Introduction	282
11.2	Stages of qualitative analysis	282
11.3	Grounded theory	283
11.4	Content analysis	285
11.4.1	What is content?	286
11.4.2	Why do we need to collect text or multimedia information?	286
11.4.3	Questions to consider before content analysis	287
11.5	Analyzing text content	289
11.5.1	Procedure	289
11.5.2	Identifying coding categories	290
11.5.3	Coding the text	292
11.5.4	Ensuring high-quality analysis	294
11.6	Analyzing multimedia content	300
	Summary	301
	Discussion Questions	302
	Research Design Exercise	303
	References	303
12	AUTOMATED DATA COLLECTION METHODS	307
12.1	Exploiting existing tools	308
12.1.1	Web logs	309
12.1.2	Stored application data	315
12.2	Using software to observe and record	317
12.2.1	Web proxies	317
12.2.2	Instrumented software	321

12.2.3 Custom-built software	324
12.2.4 Handling stored data	327
12.2.5 Keystroke and activity loggers	328
12.2.6 Analyzing log files	329
12.3 Hybrid data collection methods	330
12.4 Automated interface evaluation	333
12.5 Challenges of computerized data collection	333
Summary	336
Discussion Questions	337
Research Design Exercises	338
References	339
13 MEASURING THE HUMAN	343
13.1 Eye tracking	344
13.2 Physiological tools	350
13.2.1 Physiological data	351
13.2.2 Challenges in data collection and interpretation	356
13.3 Examples of physiological research in HCI	359
Summary	361
Discussion Questions	362
Research Design Exercise	363
References	363
14 WORKING WITH HUMAN SUBJECTS	367
14.1 Identifying potential participants	368
14.1.1 Which subjects?	369
14.1.2 How many subjects?	371
14.1.3 Recruiting participants	373
14.2 Care and handling of research participants	376
14.2.1 Protecting participants	376
14.2.2 Informed consent	381
14.2.3 Institutional review boards	384
14.2.4 Potentially deceptive research?	387
14.2.5 General concerns	388
14.3 Online research	389
14.3.1 Appropriate topics for online research	389
14.3.2 Recruiting	389
14.3.3 Study design	391

14.3.4 Ethical concerns	391
14.3.5 Data collection	392
Summary	393
Discussion Questions	394
Research Design Exercises	395
References	396
15 WORKING WITH RESEARCH PARTICIPANTS WITH IMPAIRMENTS	399
15.1 Introduction	400
15.2 How many participants?	401
15.2.1 Small sample sizes	401
15.2.2 Distributed research	401
15.2.3 In-depth case studies	402
15.3 Proxy users	403
15.4 Multi-Population Studies	404
15.5 Recruiting users through community partners	405
15.6 Pilot studies	407
15.7 Scheduling users with impairments	408
15.8 Documentation for users with impairments	409
15.8.1 Human subjects forms	409
15.8.2 Research documentation	410
15.9 Differing levels of ability	412
15.10 Bringing extra computer parts	413
15.11 Payment	415
Summary	415
Discussion Questions	415
Research Design Exercise	416
References	416
Index	419