Vorlesung Mensch-Maschine-Interaktion

Albrecht Schmidt

Embedded Interaction Research Group LFE Medieninformatik

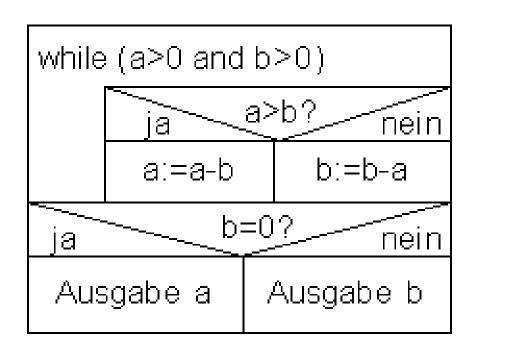
Ludwig-Maximilians-Universität München

http://www.hcilab.org/albrecht/



Ben Shneiderman in Munich Saturday, Nov. 5th 16-20Uhr

- Nassi-Shneiderman diagram (1972)
- Split menu (1992/1994)







Outline of the course

- Introduction
- 2 Basics of HCI and History
- 3 Designing Systems for Humans
- 4 Analysis
- 5 Designing Interactive Systems
- 6 Implementing Interactive Systems
- 7 Evaluation



Chapter 2 Basics of HCI and History

- 2.1 Motivation
- 2.2 Principles for UI-Design
 - Principle 1: Recognize User Diversity
 - Principle 2: Follow the Eight Golden Rules
 - Principle 3: Prevent Errors
- 2.3 Understanding Errors
- 2.4 Consistency
- 2.5 Basic Models
- 2.6 A Brief History of HCI



Chapter 2 Basics of HCI and History

• 2.1 Motivation

- 2.2 Principles for UI-Design
- 2.3 Understanding Errors
- 2.4 Consistency
- 2.5 Basic Models
- 2.6 A Brief History of HCI



What the User Sees



Users see only what is visible!



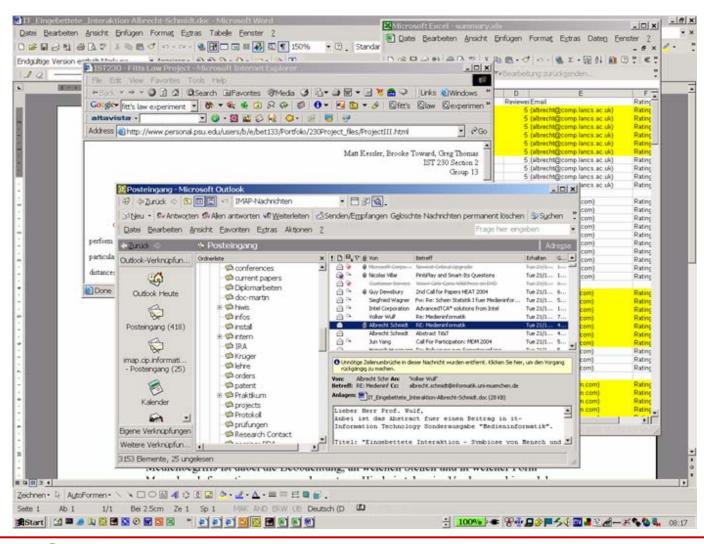


What the Developer Knows

- Users see only what is visible!
- users have little idea about:
 - architecture,
 - state transitions,
 - dependencies
 - application context
 - system restrictions
 - ..
- And users often do not want to know about it.



Practical Motivation



What do we see?

What is shown?

What is the meaning?



Skilled Computer Users Answers

- Win2000 desktop
- Text and figures
- Icons and toolbars
- Overlapping windows
- Scroll bars and menus
- Task bar and status information
- Handles and a pointer
- Representations of documents

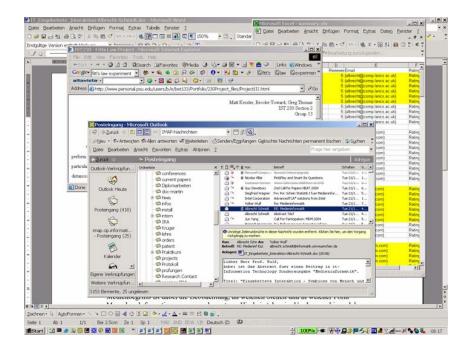


IDIXI - 8X

and the second		it View Favorites T → → → ③ ③ ④ ◎	Search GilFavorites @Media 3	10	₩ .		Links Windows *	D	E	17
27	Gorge	fitt's law experiment	· * • • • • • • • • • •	0.		· @ Bftt's	Ralaw Resperimen *	Reviewes Email		Rating
	altavi			010	8			5 (albrecht@com 5 (albrecht@com		Rating
		the state of the s	psu.edu/users/b/e/bet133/Portfolo/.			Provide settle based	•] @Go	5 (albrecht@com	p lancs.ac.uk)	Rating
	MULTERS	anutp://www.personal	.psu.edu/users/b/e/bect33/Portbolo/	230410	gect_nes	/Hojecult.htm	1 000	5 (albrecht@com		Rating
							Toward, Greg Thomas	5 (albrecht@com 5 (albrecht@com		Rating-
					M30	P. SIME, DIOOKS	IST 230 Section 2	5 (albrecht@com	p lancs ac uk)	Rating
							Group 13	5 (albrecht@com	p lancs ac uk}	Rating
	L .	and the second s	and the second se					5 (albrecht@com	p lancs ac uk)	Rating
		Posteingang - Min						-02	sincs.sc.uk)	cours.
		😔 🗢 Zurück 🗢 🖾	IMAP-Nachrichten		· E	84.			com)	Rating
		Neu - C. Antworte	en Ø Alen antworten Weiterleiten	1235	enden/Er	nfangen Gelsso	hte Nachrichten nermaner	nt kischen SSuchen	cóm)	Rating
	1 6		Ansicht Eavoriten Extras Aktioner		100	N 18 61		her engeben	com)	Rating
	100	Para Bearbarau 9	Ausour Eskouseu EStras wedoner	n 12				rne engeden	com)	Rating
	perform	t+Zuruck ⇔	Posteingang						com)	Rating
	particula	Outlook-Verknapfun	Ordneriste	×	109,5	@ Fon	Betreff	Ethaten G	com)	Rating
		CONCR. AGIN PERGAM	conferences	-	0.	Ø Marosoft-Corpo-		Tur-Diffine bere -		Rating
	distance:	CG .	ourrent papers		Q.1	@ Nicolas Villar	PhiliPlay and Smart-Its Question		com)	Rating
	Done	Outlook Heute	Diplomarbeiten			Gustamer Gervice Ø Guy Develhury	West-Cale Cons Wild Press Int DV 2nd Call for Papers HEAT 2004	0 Tue 21/1 6	in the second se	Ratine
	A MARCHINE AND A	OUBCOK Pieute	- 🛱 doc-martin		0.0	Siegfried Wagner			com	Ratine
		(C)	ii: 🗯 hiwis		0.14		AdvancedTCA* solutions from In		com)	Rating
		ेल	d infos		9.4	Volker Wulf	Re: Medeninformatk RE: Medeninformatk	Tue 21/1 7	com)	Rating
		Posteingang (418)	- Chinstal		0	Abrecht Schmidt		Tue 21/3 4	com)	Rating
		(a)	# 🗭 intern		04	Jun Yang	Call For Participation: MDM 2004	Tue 21/1 5	com)	Ratine
		P.	Kruger	-	0	Bernstelle bit stress and	. No believe as we found and	14.0 Tro 11/1 # 4	com)	Rating
		map.op.informati - Posteingang (25)	- Chiefre		O Unnöbi rückga	je Zelenunbrüche in di rgig au machen.	eser Nachrichit wurden entfernit. Kä	kken Sie hier, um den Vorgang	com)	Rating Rating
		9	orders catent			Brecht Schir Are	içêer Wull' Avertit schnichtiger(ormatik uni-mu	and an at	n com)	Ratine
		E	H C Praktikum				ibredik.schmidtigerformadik.urv-mu nteraktion-Albrecht-Schmidt.doc (2		n.com)	Rating
		Kalender	- projects		-			28 KB)	n.com)	Rating
		0 1	Protokol			Herr Prof. W.		-	n.com)	Rating
		🖬 🗉	c prüfungen				ct fuer einen Beitrag gy Sonderausgabe "Rec			21
		Eigene Verknüpfungen	Research Contact						1.000	11
		Weitere Verknüpfun		- Čl	Titel:	"Eingebettete	Interaction - Symbic	ore yon Mensch und 🔝	1	
		3153 Elemente, 25 ung	niesen							
			to the lat direct die Deood						e.,	

Basic (Naive) Technical Answers

- 2-D surface
- Controllable pixels

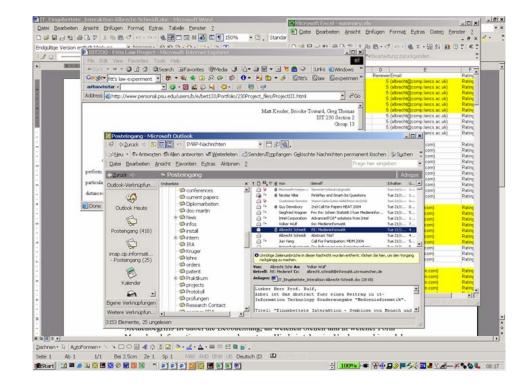


- Image with a resolution of 1400x1050 pixels
- For each pixel the colour can be set
- The change of colour can be controlled rapidly



Perfect User's Answers

My work environment



- Meeting notes
- Budget for next year
- Request to write a technical article
- Background information on a psychological phenomenon



Example I – Overlaying Windows

- What is the meaning that a window is behind another window?
- What is real? What is illusion?
- What does iconizing do?

 Models? Conceptual... Implementation... Represented...

Utige Version er	File Ed	3 Fitte Low Project It View Favorites To			£3	Bearbeitung zuruchgende	n	
			Search ElFavorites @Media 3 4	or other than a support of the suppo	Unks Windows "	D E Reviewei Email	F	2
		fitt's law experiment			Glaw Glexpermen "	5 (albrecht@comp.la	ncs.ac.uk) Ratin	÷.
	altavi	And the second se		And a local distance of the second seco		5 (albrecht@comp.la 5 (albrecht@comp.la		
	Address	http://www.personal.	psu.edu/users/b/e/bet133/Portfolio/230	Project_files/Project[1].html	• @Go	5 (albrecht@comp.la		
						5 (albrecht@comp la		
				Matt Kessler, Brooke	Toward, Greg Thomas	5 (albrecht@comp.la 5 (albrecht@comp.la		
					IST 230 Section 2 Group 13	5 (albrecht@comp.la		
					Group 13	5 (albrecht@comp la	ncs.ac.uk) Ratin	A. 1
		Posteingang - Micr	osoft Outlook		1000 C		ncs.sc.uk) Ratin	5
		3 +Zuruck + (B)	IMAP-Nachrichten	· C20.		Latron and the second sec	om) Ratin	é l
		for all the second second second	n ØvAlen antworten Weterleiten		and the sharehold being a second second		om) Ratin	
	1.0						om) Ratin om) Ratin	
		Datei Bearbeiten Ar	nsichit Eavoniten Egtras Aktionen	2	Frage h	0.0100001	om) Ratin	
	perform	e Znuk 🗠	Posteingang			Adresse	om) Ratin	1 <u>0</u>
	particula	the second s	Configuration and a sector and	x 1D B.Y EVON	Betroff		com) Ratin com) Ratin	
	1	Outlook-Verknapfun	Conferences	A B Marcoolt Corpo-			om) Ratin om) Ratin	
	distance:	\$	a ourrent papers	😥 🖻 🖉 Nicolas Villar	Pint/Play and Smart-Its Questions		om) Ratin	
	Done		- C Diplomarbeiten	Custamer Serves	2nd Call for Papers HEAT 2004	Tue-21/1 6	om) Ratio	
	And in success	Outlook Heute	- 🗭 doc-martin	Segfred Wagner		and a state of the second s	om) Ratin om) Ratin	
		A	H 🗯 hiwis	Intel Corporation			om) Ratin	
		Cer (110)	- Chinfos - Chinstal	Voker Wulf Kareda Schwidt	Re: Medeninformatik RE: Medeninformatik		om) Ratin om) Ratin	
		Posteingang (418)	H Contem	Abrecht Schmelt			om) Ratin	
		A	S IRA	E C* Jun Yang	Call For Participation: MDM 2004		om) Ratin	
			Krüger	a month through	e. No. Bolicon ere ere fonsstar of an	E	om) Ratin	
		imap.cip.informati - Posteingang (25)	- Ø lehre	 Unnötige Zelenunbrüche in d nückgängig au machen. 	leser Nachrichk wurden entfernt. Klicke		om) Ratin om) Ratin	
		- Poster gary (co)	- 🖾 orders	The second se	Voller Wull			* I I I
		1	d patent	Betreff: RE: Hederirf Co.	abrecht schnidtiğinformatik. uni-muerc		com) Ratin	
		Kalender	🗄 🍏 Praktikum	Anlagen: T_Engebetiete_	Interaktion-Albrecht-Schmidt.doc (28 K)		com) Ratin com) Ratin	
		ruato i doi	- CA projects - CA Protokol	Lieber Herr Frof. W	ulf,		com) Ratin	
		🖬 🗉	prüfungen		oct fuer einen Beitrag i	IB 45-	1 51	Ê.
		Eigene Verknüpfungen	Research Contact	Information Technol	ogy Sonderausgabe "Redie	ininformatik".	1.	12
		Weitere Verknüpfun		Titel: "Eingebettet	e Interaktion - Symbiose	r von Mensch und 🔳		
		3153 Elemente, 25 unge	denor de la companya			10		
	- 1		CLILIS ISI GROCT GIC DCOORCE	THE WEIGHT	TEAL TO THE TAXABLE TO	A.		
				1 11. 1 . 1	1 1/ 1	1. 11		
3 4						Apple Described		- 225



Example II – Scrolling vs. Hand

 Moving up the scroll bar Moves down the document

- What happens in realit
 What do we imagine?
 What is the metaphor?
 Haupthontakt Account Sector (10) 1007445617
 - einen Buchungsbeleg, Als Buchungsbeleg gellen ungsseile, die Bestäligungs-E-Mail oder Ihr



In 101%

Example II – Scrolling vs. Hand

 Moving up the hand Moves up the document

 What happens in reality? What do we imagine? What is the metaphor?





MMI 2005/2006

Chapter 2 Basics of HCI and History

- 2.1 Motivation
- 2.2 Principles for UI-Design
 - Principle 1: Recognize User Diversity
 - Principle 2: Follow the Eight Golden Rules
 - Principle 3: Prevent Errors
- 2.3 Understanding Errors
- 2.4 Consistency
- 2.5 Basic Models
- 2.6 A Brief History of HCI



Principles for UI design

Implementation and technology independent

 Shneiderman's principles: (see http://media.pearsoncmg.com/aw/aw_shneiderma_dtui_4/chapter2.pdf)

- Principle 1 : Recognize User Diversity
- Principle 2 : Follow the Eight Golden Rules
- **Principle 3 : Prevent Errors**
- Restated in different variants basically telling the same story



Principle 1: Recognize User Diversity

- Simple and obvious nevertheless in reality extremely difficult
- Example: consider a online travel agent
 - Travel agent booking many flights a day everyday
 - A teacher organizing a field trip (once a year) and making bookings for a large group
 - A business person changing bookings while travelling
 - A family looking for a package holiday
- Basic concepts to structure the problem
 - Usage profiles
 - Task profiles



Usage Profiles "Know Thy User"

- What is the background of the user?
- Different people have different requirements for their interaction with computers.
- Issues to take into account:
 - goals, motivation, personality
 - education, cultural background, training
 - age, gender, physical abilities, ...
- Experience:
 - Novice users
 - Knowledgeable intermittent users
 - Expert frequent users



User-Needs and Task Profiles

- Find out what the user is trying to do! The Goal!
- Needs of users, goals and resulting tasks
- Supported tasks should be determined before the design starts
- Functionality should only be added if identified to help solving tasks
 - Temptation: If additional functionality is cheap to include it is often done – this can seriously compromise the user interface concept!
- Frequency of tasks related to user profiles



Hypothetical Frequency of Tasks (Example of a booking system for travel)

Task Position	Group reservation	Change of itinerary	Booking child care	Comparing sales agent performance
Sales agent	0.2	0.1	0.1	0
Manager	0	0	0	0.3
Family	0.05	0.05	0.3	0
Business traveler	0.01	0.2	0.01	0



Task Frequency

Helps to shape a menu structure

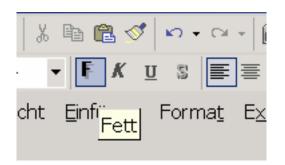
- Frequent action should be simple and quick to carry out
- Infrequent action may take longer

Example

- Frequent actions: Toolbar or special key
- Intermediate frequent actions: Pull-down menu, key combination (Ctrl+S)
- Infrequent actions: Sequence of menus or dialogs
- Problem if many (all) actions occur with very similar relative frequency...



Task Frequency - Examples



Zeichen		? ×
Schriftart: Arial The Arial Black The Arial Black The Arial Narrow The Atlantic Inline The Aurora BdCn BT	Schriftschnitt: Standard Fett Kursiv Fett Kursiv	Schriftgrad: OK 18 Abbrechen 20 24 28 32
Effekte Unterstrichen Schattiert Relief	 Hochgestellt Versetzt: -25	Farbe:
Für den Ausdruck u	TrueType-Schriftart. Ind die Bildschirmanzeige wird dieselbe	e Schriftart verwendet.

- Bold is available in the toolbar
- Subscript requires menu and dialog
- Assumption for the standard UI is that user needs more often bold than subscript
- For users with different needs the customization is available

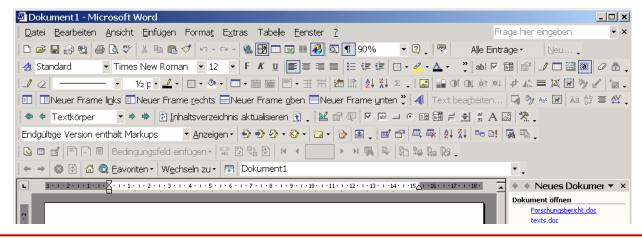


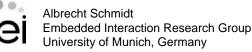
Task Frequency: Trade-off between quick access and over-crowed interface

🖥 Dokument 1 - Microsoft Word	
Datei Bearbeiten Ansicht Einfügen Format Extras Tabelle Eenster ?	Frage hier eingeben 🔹
🗅 😂 🖶 🖨 93% 🔹 🦹 🏄 Standard 🔹 Times New Roman 🔹 12 🔹 F 🕺 🗵 🧮	‡≣ • ₩ ₩ ₩ ₩ ₩ • ▲ • ▲ •
B + 1 + 2 + 1 + 1 + E + 1 + 1 + E + 1 + 1 + 2 + 1 + 3 + 1 + 4 + 1 + 5 + 1 + 6 + 1 + 7 + 1 + 8 + 1 + 9 + 1 + 10 + 1 + 11 + 1 + 12 + 1 + 13 + 1 + 14 + 1 + 15 + 1 + 16 + 1 + 17 + 1 + 18	🔹 🔺 🔹 Neues Dokumer 🔻 🔅
	Dokument öffnen

Example toolbar

- More tasks directly available in the toolbar make it quicker to do these tasks
- Increasing the number of options in the toolbar increase the time needed to locate them
- Screen area that is used





Chapter 2 Basics of HCI and History

- 2.1 Motivation
- 2.2 Principles for UI-Design
 - Principle 1: Recognize User Diversity
 - Principle 2: Follow the Eight Golden Rules
 - Principle 3: Prevent Errors
- 2.3 Understanding Errors
- 2.4 Consistency
- 2.5 Basic Models
- 2.6 A Brief History of HCI



Principle 2: Follow the 8 Golden Rules

- Strive for consistency
- Enable frequent users to use shortcuts
- Offer informative feedback
- Design dialogues to yield closure
- Error prevention/handling
- Permit easy reversal of actions
- Support internal locus of control
- Reduce short-term memory load

Shneiderman, chapter 2



8 Golden Rules - Consistency

- Within an application it is the developer's job (see earlier slides...but that is the easy part)
- In a specific environment it is defined by guidelines (e.g. for GNOME, for KDE, for Mac OSX, for Win XP, for JAVA Swing)



Wintersemester 2003/2004 Heinrich Hußmann, Albrecht ...

www.medien.informatik.uni-muenchen.de/ de/lehre/ws03/mmi/ - 44k - Cached - Similar pages



8 Golden Rules - Shortcuts

- Improves speed for experienced users
- Shortcuts on different levels
 - Access to single commands, e.g. keyboard shortcuts (CTRL+S) or toolbar
 - Customizing of commands and environments, e.g. printer preset (duplex, A4, ...)
 - Reusing actions performed, e.g. history in command lines, macro functionality
- Shortcuts to single commands are related to consistency
 - CTRL+X, CTRL+C, CTRL+V in Microsoft applications for cut, copy and paste
 - However CTRL+S (saving a document) is only implemented in some applications...



8 Golden Rules - Feedback

- For any action performed the user should have appropriate and informative feedback
- For frequent actions it should be modest, peripheral

PowerPoint speichert "C:\Documents and Settings\schmidta.ALBRECHT\Desktop\2003-11-27_001.ppt":

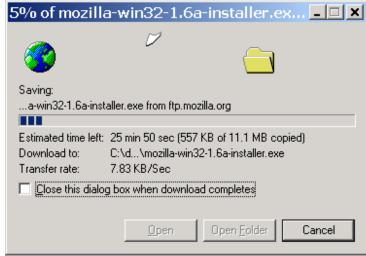
 For infrequent action is should be more substantial

🍜 Stop a Hardware device 🛛 🙎 🗙
Confirm devices to be stopped, Choose OK to continue.
Windows will attempt to stop the following devices. After the devices are stopped they may be removed safely.
Microsoft ACPI-Compliant Control Method Battery
Cancel



8 Golden Rules - Closure

- Sequences of actions should have a beginning, middle, and end.
- For non-instantaneous actions
- On different levels
 - E.g. in the large: Web shop it should be clear when I am in the shop, and when I have successfully checkout
 - E.g. in the small: a progress bar





8 Golden Rules – Prevent Errors

- Create UI that make it hard to make errors (e.g. menus instead of commands)
- Detect errors or possible errors
- Is related to "easy reversal of actions"
- Examples
 - Leaving a editor without saving
 - Writing to a file that already exists



- Different options how to handle it:
 - Involve the user (current practice)
 - Prevent the error or its consequences on system level (e.g. create backups/versions when a file is overwritten, keep all files that have been created by the user)



8 Golden Rules – Permit Easy Reversal of Actions

- As a basic rule all actions should be reversible
- Providing UNDO functions (possibly with infinite depth)
- Allow undo of groups of actions
- Undo is not trivial if user is not going sequential
 - E.g. write a text, copy it into the clipboard, undo the writing
 → the text is still in the clipboard!
- Reversal of action becomes a usage concept
 - Browser back-button is used for navigation (for the user a conceptual reversal of action)
 - Formatting of documents e.g. "lets see how this look, ... don't like it, ... go back to the old state"



8 Golden Rules - Feeling in Control

- Users should feel to be in control of the system
- User should initiate actions (initiator instead of responder)
- Avoid non-causality
- The system should be predictable
- Some current developments are in contrast:
 - Proactive computing
 - Intelligent agents
- Have to be aware when designing these!



8 Golden Rules – Reduce Short-term Memory Load

- 7 +/- 2 chunks of information
- The system should remember, not the user
- Examples that create problems
 - Multi-page forms where the user has to know at form N what she filled in in form N-1
 - Abbreviations introduced in one step and used in the following (e.g. user selects a



Albre cht Schrüft Albre cht Sc

Chapter 2 Basics of HCI and History

- 2.1 Motivation
- 2.2 Principles for UI-Design
 - Principle 1: Recognize User Diversity
 - Principle 2: Follow the Eight Golden Rules
 - Principle 3: Prevent Errors
- 2.3 Understanding Errors
- 2.4 Consistency
- 2.5 Basic Models
- 2.6 A Brief History of HCI



Principle 3: Prevent Errors - Examples

- Correct matching pairs
 - Examples:
 - Making some text bold will make too much bold if the is omitted or mistyped
 - IDE often provide {} match checking
- Complete sequences
 - Assistance for the user to complete a sequence of actions to perform a task
 - Example: Wizards
- Command correction
 - Aim: Trying to prevent users entering incorrect commands
 - Examples:
 - File completion on Unix
 - Helpful error messages



Chapter 2 Basics of HCI and History

- 2.1 Motivation
- 2.2 Principles for UI-Design
- 2.3 Understanding Errors
- 2.4 Consistency
- 2.5 Basic Models
- 2.6 A Brief History of HCI



Human Error

Top News

OMBARDIER CREATIONAL PRODUCTS

Bombardier 'Stands Down' Against Human Error

Wed, 26 Oct '05

Event Aims To Reduce Pilot Mistakes

More than 420 pilots, crewmembers, safety specialists, industry officials and media representatives have gathered at

Bombardier's 9th Annual Safety Standdown in Wichita, KS. The event, billed as the industry's foremost safety event, is being held Oct. 25-27.

The only safety seminar of its kind to be offered by a civil aircraft manufacturer, Bombardier's Safety Standdown is taking clear aim at the cause of 78 percent of all accidents in aviation -- human error.

"The intent of Safety Standdown is to reduce accidents caused by human failure across the aviation industry as a whole, whether they occur during corporate, commercial or military missions," stated Bob Agostino, director, flight operations, Bombardier Business Aircraft. "While we believe ADVERTISEMENT

current training programs using simulators and other training devices are excellent, we also recognize that accident prevention requires more than simply perfecting technical skills."

This year's event will focus of "Winning The War On Error," enabling aviation professionals to better understand why and how crucial mistakes occur by providing in depth, knowledge-based training in areas such as fatigue, nutrition and psychological factors.

http://www.aero-news.net/index.cfm?ContentBlockID=cda9332e-b872-4d41-960a-2352e5f47744



Albrecht Schmidt Embedded Interaction Research Group University of Munich, Germany

Human Error

Blame Subway Accidents On Human Error



Oct 5, 2005 11:36 am US/Eastern (1010 WINS) (NEW YORK) Human error has caused all of the subway derailments and crashes over the past 20 months, according to The Daily News. No one was seriously hurt in the eight accidents which occurred from January 2004 to last month. But Transit Authority reports say the accidents cost more than 600-thousand dollars worth of damage and included emergency passenger evacuations.

In one incident, a motorman fell asleep at

the throttle as the Times Square shuttle was coming into Grand Central and slammed the train into a bumper. The worker was demoted.

Most of the mishaps involved workers and supervisors not following the rules.

http://1010wins.com/topstories/local_story_278071424.html



αh

Human Error

PITTSBURGH TRIBUNE-REVIEW Back to headlines

TT Larger Text TTT Smaller Text

Barring human error made area firm a health leader

By <u>Rick Stouffer</u>

TRIBUNE-REVIEW

Wednesday, October 19, 2005

More than 30 years ago, bar codes began showing up on the bottoms, backs or sides of everything from blocks of cheese to 2-by-4s.

Medicine, however, was a late arrival to tracking equipment and medications using bar code technology. In the early 1990s, it was a Pittsburgh-based start-up, Automated Healthcare, that jump-started the use of the vertical black and white lines for tracking medicine in hospitals.

"It really was quite amazing that we were bar coding ketchup, but not bar coding things that could kill you if an error was made," said Sean McDonald, who founded Automated Healthcare in 1990, sold it to drug distribution giant McKesson in 1996 for \$65 million, then stayed for five years to continue running the company. Today, the company is known as McKesson Automation. Founded: Healthcar Sean McI student a University

McKesso

Acquired Healthcai by drug d McKesso million.

Headqua

Presiden Souerwir

http://pittsburghlive.com/x/tribune-review/business/s_385507.html



Albrecht Schmidt Embedded Interaction Research Group University of Munich, Germany

MMI 2005/2006

more (Human) Errors...

TAIPEI #TIMES

Published on TaipeiTimes

http://www.taipeitimes.com/News/taiwan/archives/2003/10/18/2003072381

Fighter pilots find panic button at last

MISTAKE MANAGEMENT: Two crashes blamed on human error have prompted the developers of the IDF to remind the air force about a built-in emergency function By Brian Hsu STAFF REPORTER Saturday, Oct 18, 2003, Page 4

emergency function that minimizes the chance of a plane crash due was also caused b	sh
id beauco	
to human error, pilots have only now found out about it. The previous two accidents involving IDFs this year were caused by human error, defense sources said yesterday. the flight instructor created	G- nich t

...In an attempt to prevent similar accidents in future, the air force has asked the AIDC to help teach pilots how to use the fighter's emergency function.



About (Human) Errors...

- "If an error is possible, someone will make it" (Norman)
- Human Error may also be a starting point to look for design problems.
- Design implications
 - Assume all possible errors will be made
 - Minimize the chance to make errors (constraints)
 - Minimize the effect that errors have (is difficult!)
 - Include mechanism to detect errors
 - Attempt to make actions reversible



Understanding Errors

- Errors are routinely made
 - Communication and language is used between people to clarify – more often than one imagines
 - Common understanding of goals and intentions between people helps to overcome errors
- Two fundamental categories
 - Mistakes
 - overgeneralization
 - wrong conclusions
 - wrong goal
 - Slips
 - Result of "automatic" behaviour
 - Appropriate goal but performance/action is wrong

Norman, Chapter 5



Understanding the types of Slips Users Make

- Capture errors
 - Two actions with common start point, the more familiar one captures the unusual (driving to work on Saturday instead of the supermarket)
- Description errors
 - Performing an action that is close to the action that one wanted to perform (putting the cutlery in the bin instead of the sink)
- Data driven errors
 - Using data that is visible in a particular moment instead of the data that is wellknown (calling the room number you see instead of the phone number you know by heart)
- Associate action errors
 - You think of something and that influences your action. (e.g. saying come in after picking up the phone)
- Loss-of-Activation error ~ forgetting
 - In a given environment you decided to do something but when leaving then you forgot what you wanted to do. Going back to the start place you remember.
- Mode error
 - You forget that you are in a mode that does not allow a certain action or where a action has a different effect

Norman, Chapter 5



Confirmation is unlikely to prevent Errors

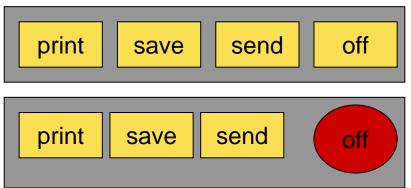
- Example
 - User: "remove the file 'most-important-work.txt"
 - computer: "are you sure that you want to remove the file 'mostimportant-work.txt'?"
 - User: "yes"
 - Computer: "are you certain?"
 - User: "yes of course"
 - Computer: "the file 'most-important-work.txt' has been removed"
 - User: Oops, damm
- The user is not reconsidering the overall action it only prompts to think about the immediate action (clicking)
- A solution is to make the action reversible

Norman, Chapter 5



Preventing Description Errors

- Related to Gestalt theory
- Example Car
 - Different openings for fluids, e.g. oil, water, break, ...
 - Openings differ in
 - Size
 - Position
 - Mechanism to open
 - Color
- Design recommendations
 - Make controls for different actions look different







Preventing Mode Errors

- Why use modes in the first place?
 - User interface trade-off (e.g. number of buttons needed can be reduced, actions within a mode can be speeded up)
- Design recommendations
 - Minimize number of modes
 - Make modes always visible
- Example alarm clock
 - Mode vs. mode free
 - Visualization of mode
- What is your solution?
 - Draw the control elements
 - Provide labels



Setting time and alarm with mode?



Setting time and alarm without mode?

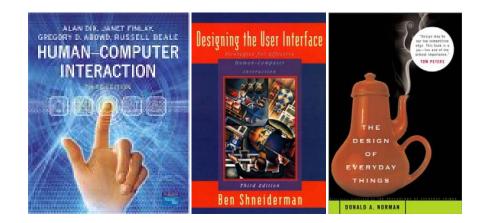


Making things reversible

- Is a great solution but where is the problem with it?
- What is the cost?



References



- B. Shneiderman. Designing the User Interface: Strategies for Effective Human-Computer Interaction, Third Edition. 1997. ISBN: 0201694972 (chapter 2)
- D. A. Norman. The Design of Everyday Things. Basic Books 2002. ISBN: 0465067107 (page 105-114)
- Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale. (2004) Human Computer, Interaction (third edition), Prentice Hall

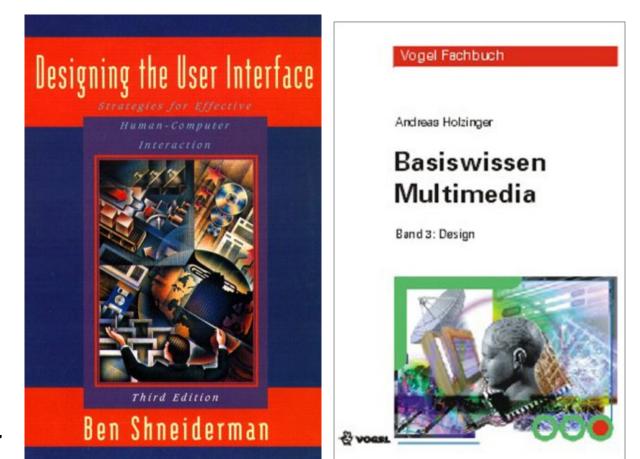


Meet the Authors

5. November 2005 16.00 Uhr AudiMax der LMU

Medieninformatiktreffen and der LMU

Es sprechen Ben Shneiderman und Andreas Holzinger



- Ben Shneiderman. (1998) Designing the User Interface, 3rd Ed., Addison Wesley; ISBN: 0201694972
- Andreas Holzinger. (2001) Basiswissen Multimedia. Band 3: Design; ISBN: 3802318587

