software design why it matters

Daniel Jackson · MIT CSAIL Milan, Paris, Frankfurt · May 16-20, 2016





Copyright Daniel Jackson 2016

introduction



MA in Physics, Oxford University



PhD in Computer Science, MIT



MA in Physics, Oxford University



PhD in Computer Science, MIT



MA in Physics, Oxford University



Assistant Prof, CMU

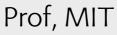


PhD in Computer Science, MIT



MA in Physics, Oxford University







Assistant Prof, CMU

other projects

om	:free : auto (num	nber)	~	comput	ed by formula	a 🗸			
Fo	rmula: sqFoot -	sum[v	:	Occupan [.]	t](v.role.a	llocSpac	e)		Save C
Ro	Room			cupant		Role			
	name	sqFoot		name	role	free		title	allocSpace
•	text	number	•	text	Role	number	•	text	number
	Dungeon Five	480	•	Sirius	Grad. student	436	•	Grad. student	12
•			•	James	Post-doc Grad. student		•	Post-doc	20
				Wormtail			•	Visiting Prof.	45
	Greenhouse Two	561		Bellatrix	Visiting Prof.	496			

cyberphysical security

new programming paradigms



changes in how we live & work

72% of millenials research & shop online before going to a store

72% of millenials research & shop online before going to a store

 ORDER PLACED
 TOTAL
 SHIP TO
 ORDER # 107-4962317-6190632

 May 30, 2013
 \$41.76
 Daniel Jackson *
 Order Details
 Invoice

 Goya Foods Inc Beans, Butter, 15.50-Ounce (Pack of 24)

GOVA Butter Beats Balbas Grands Goya Foods Inc Beans, Butter, 15.50-Ounce (Pack of 24) Sold by: Amazon.com LLC \$41.76

Buy it Again

Write a product review

Archive order

72% of millenials research & shop online before going to a store

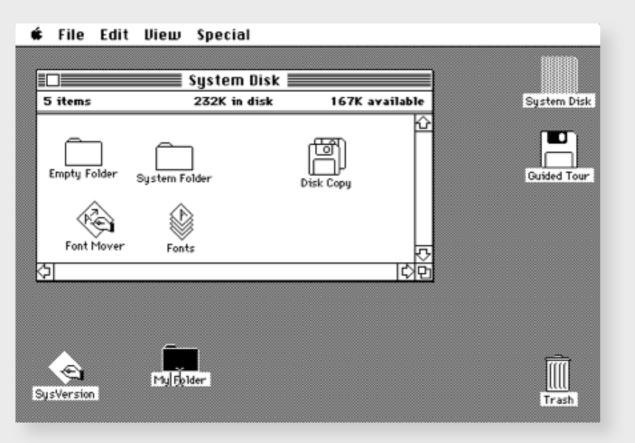


27 metro areas in US

ORDER PLACED May 30, 2013	TOTAL \$41.76	SHIP TO Daniel Jackson -	ORDER # 107-4962317-6190632 Order Details Invoice
GOVA Bitter Reast Hahas Grandey	Goya Foods Inc Beans, B Sold by: Amazon.com LLC	utter, 15.50-Ounce (Pack of 24)	Return or replace items
Butter Beats	\$41.76		Write a product review
Parete	Buy it Again		Archive order

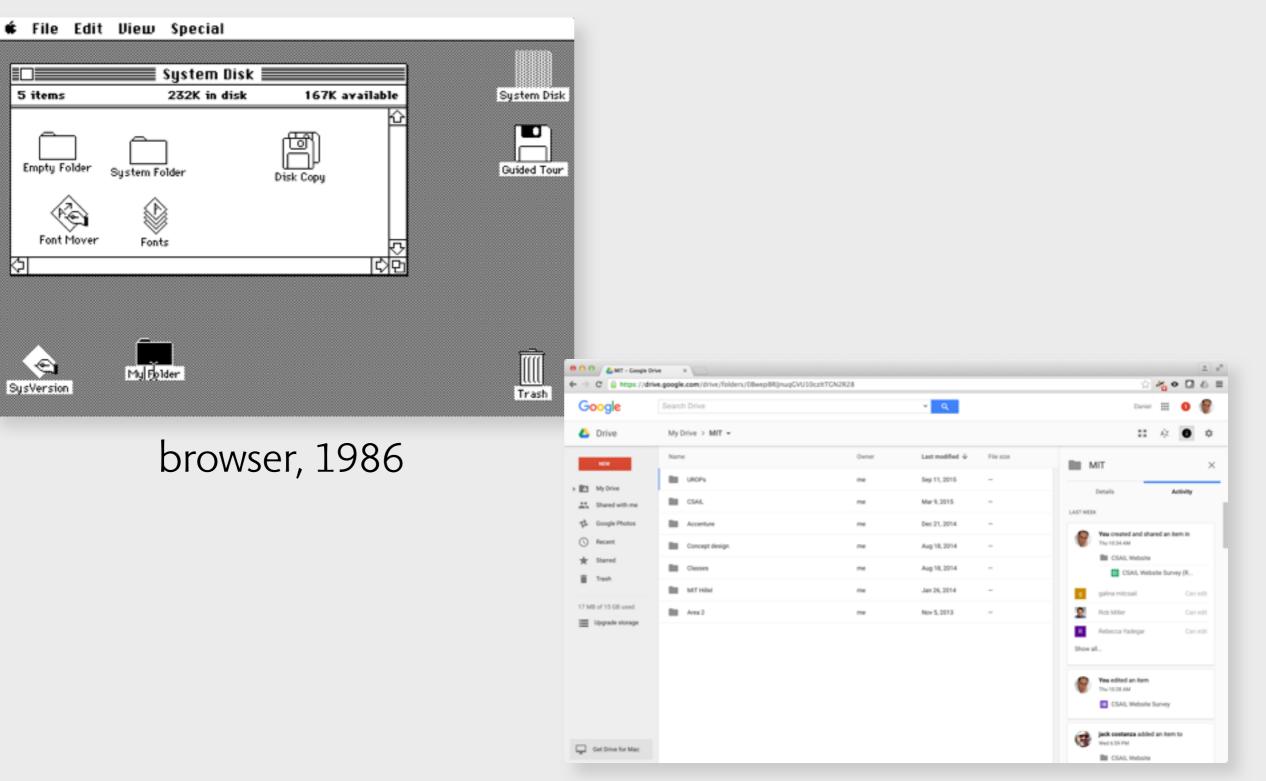
connectivity

connectivity



browser, 1986

connectivity



হা

browser, 2016

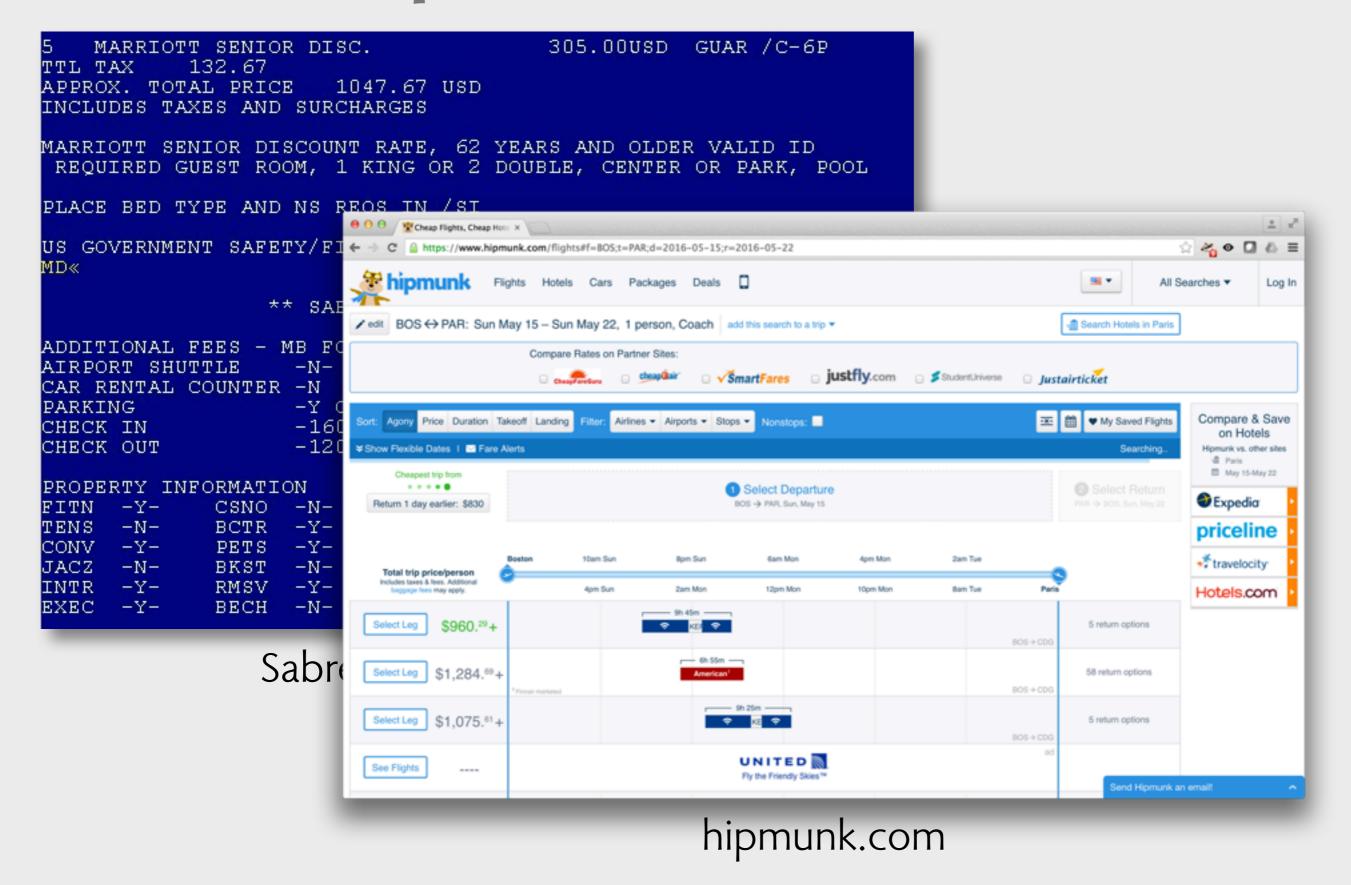
deprofessionalization

deprofessionalization

5 MARRIOTT SENIOR DISC. 305.00USD GUAR /C-6P ITL TAX 132.67 APPROX. TOTAL PRICE 1047.67 USD INCLUDES TAXES AND SURCHARGES													
MARRIOTT SENIOR DISCOUNT RATE, 62 YEARS AND OLDER VALID ID REQUIRED GUEST ROOM, 1 KING OR 2 DOUBLE, CENTER OR PARK, POO	DL												
PLACE BED TYPE AND NS REQS IN /SI													
US GOVERNMENT SAFETY/FIRE APPROVED MD«	¥												
** SABRE DATABASE DISPLAY **	¥												
ADDITIONAL FEES - MB FOR ACCEPTABLE FORMS OF PAYMENT													
이 것은 것은 것 같은 것 같은 것 같은 것 같이 있는 것 이 가지 않는 것 같은 것 같													
CAR RENTAL COUNTER -N - FAMILY -Y-													
DARKING _Y CUARCE MEAT DIAM N													
PARKING -Y CHARGE - MEAL PLAN -N-													
PARKING -Y CHARGE - MEAL PLAN -N- CHECK IN -1600- NBR FLOORS -10 -													
PARKING -Y CHARGE - MEAL PLAN -N- CHECK IN -1600- NBR FLOORS -10 - CHECK OUT -1200- NBR ROOMS -1332-													
PARKING -Y CHARGE - MEAL PLAN -N- CHECK IN -1600- NBR FLOORS -10 - CHECK OUT -1200- NBR ROOMS -1332-													
PARKING -Y CHARGE - MEAL PLAN -N- CHECK IN -1600- NBR FLOORS -10 - CHECK OUT -1200- NBR ROOMS -1332- PROPERTY INFORMATION													
PARKING -Y CHARGE - MEAL PLAN -N- CHECK IN -1600- NBR FLOORS -10 - CHECK OUT -1200- NBR ROOMS -1332- PROPERTY INFORMATION FITN -Y- CSNO -N- GOLF -N- POOL -Y- WCHR -Y-													
PARKING-Y CHARGE- MEAL PLAN-N-CHECK IN-1600-NBR FLOORS-10 -CHECK OUT-1200-NBR ROOMS-1332-PROPERTY INFORMATIONFITN-Y-CSNO-N-FITN-Y-CSNO-N-GOLF-N-FORS-N-BCTR-Y-MEET-Y-KIDS-N-NNE-Y-KIDS-N-	_												
PARKING-Y CHARGE- MEAL PLAN-N-CHECK IN-1600-NBR FLOORS-10 -CHECK OUT-1200-NBR ROOMS-1332-PROPERTY INFORMATIONFITN-Y-CSNO-N-FITN-Y-CSNO-N-GOLF-N-PROS-N-BCTR-Y-DINE-Y-CONV-Y-PETS-Y-DATA-Y-CONV-Y-PETS-Y-DATA-Y-	-												
PARKING-Y CHARGE- MEAL PLAN-N- CHECK INCHECK IN-1600-NBR FLOORS-10 - NBR ROOMSCHECK OUT-1200-NBR ROOMS-1332-PROPERTY INFORMATIONFITN-Y-CSNO-N-FITN-Y-CSNO-N-GOLF-N-PROPERTY INFORMATIONFITN-Y-KIDS-N-FITN-Y-CSNO-N-GOLF-N-POOLFITN-Y-CSNO-N-GOLF-N-POOLFITN-Y-CSNO-N-GOLF-N-POOLFITN-Y-CSNO-N-GOLF-N-POOLFITN-Y-CSNO-N-GOLF-N-NCHRFITN-Y-CSNO-N-GOLF-N-NCHRFITN-Y-CSNO-N-GOLF-N-NCHRFITN-Y-CSNO-N-GOLF-N-NCHRFITN-Y-CSNO-N-GOLF-N-NCHRFITN-Y-CSNO-N-GOLF-N-NCHRFITN-Y-CSNO-N-DCLN-Y-NCHRFITN-N-INPL-N-OUPL-Y-KTCNFITN-Y-SKST-N-INPL-N-OUPL	-												
PARKING-Y CHARGE- MEAL PLAN-N-CHECK IN-1600-NBR FLOORS-10 -CHECK OUT-1200-NBR ROOMS-1332-PROPERTY INFORMATIONFITN-Y-CSNO-N-FITN-Y-CSNO-N-GOLF-N-PROS-N-BCTR-Y-DINE-Y-CONV-Y-PETS-Y-DATA-Y-CONV-Y-PETS-Y-DATA-Y-	-												

Sabre reservation system

deprofessionalization



example: book publishing





complexity



Braun SK4 by Dieter Rams (1957)

complexity

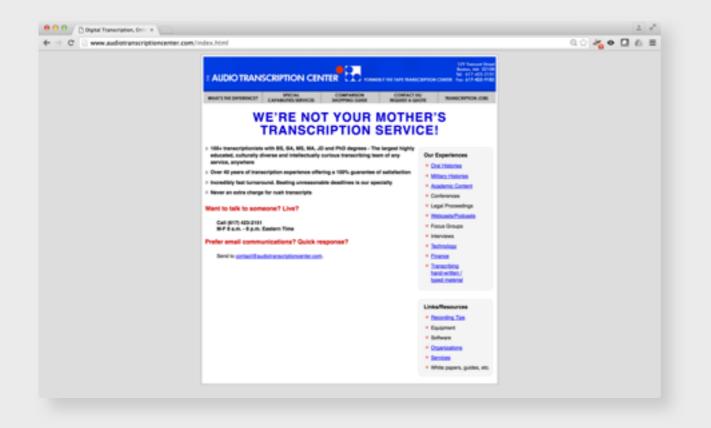


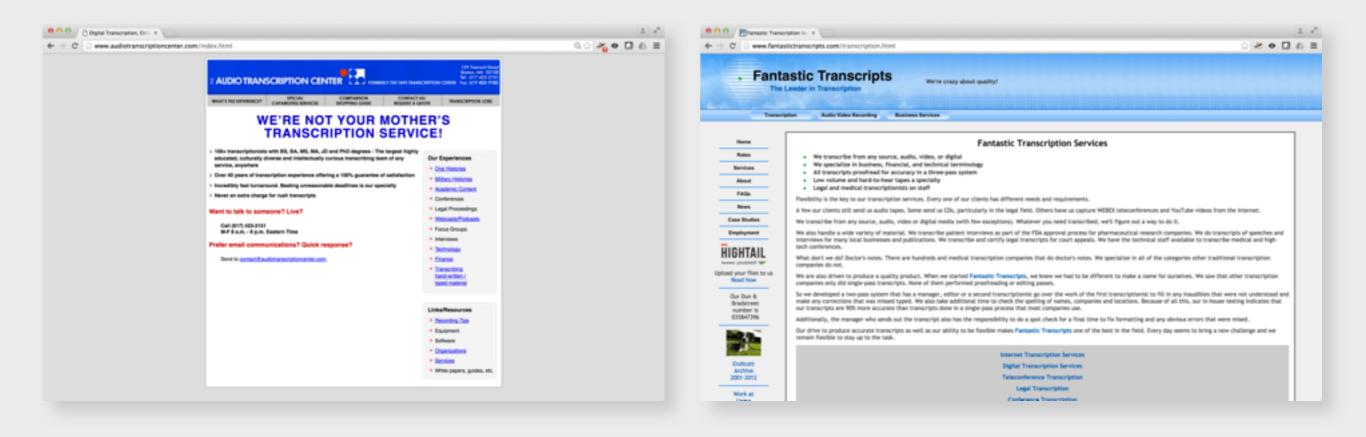
Apple iTunes (2016)

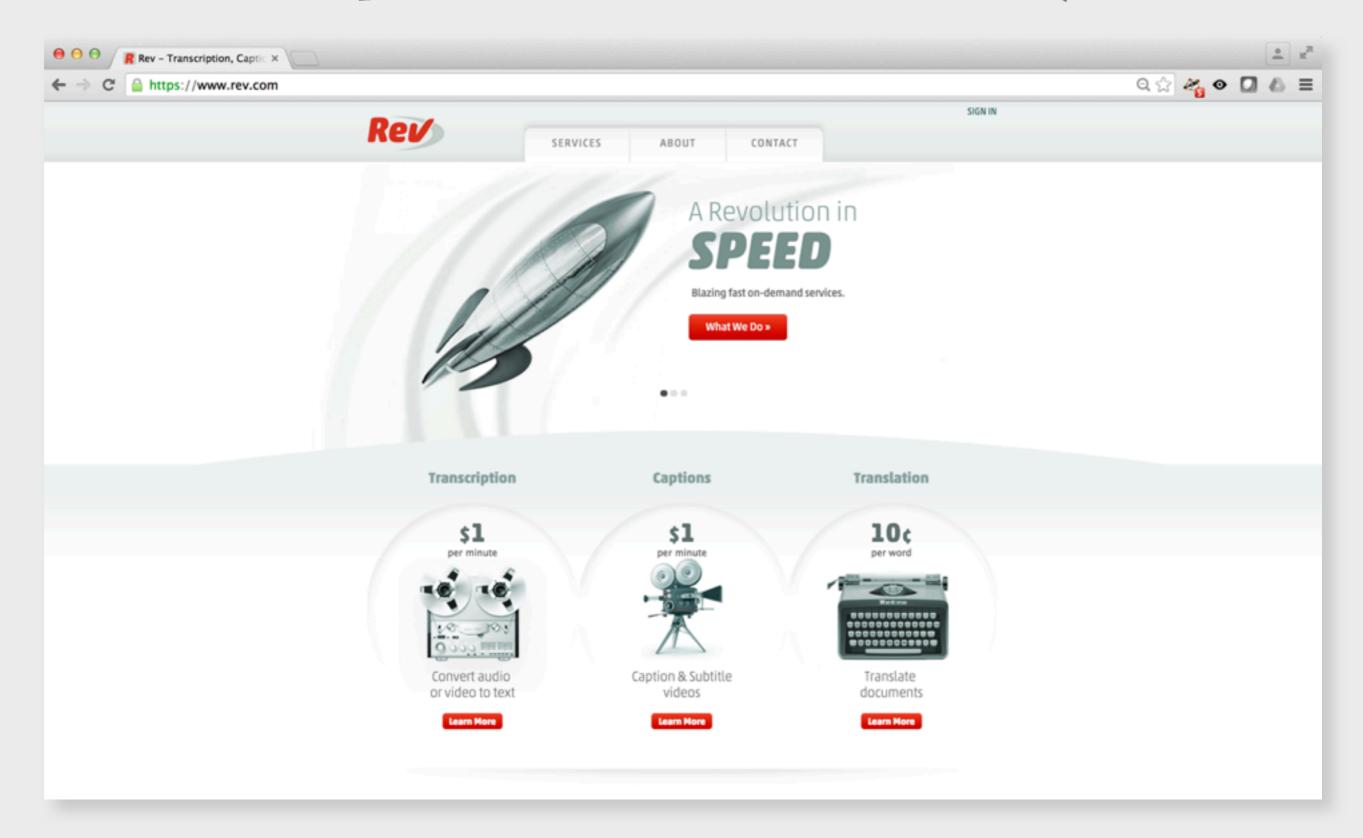
collaboration



changes in how things are made







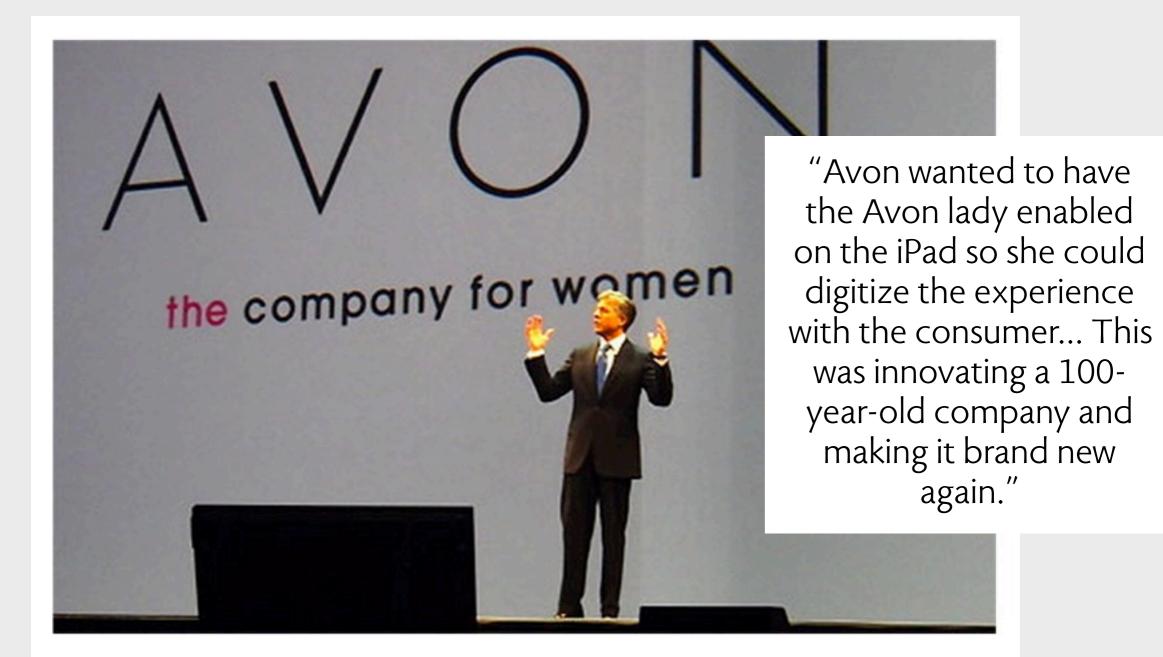
an exciting launch



AVON plans to use mobile technology to connect better with customers

SAP Sapphire Event (2011)

an exciting launch



AVON plans to use mobile technology to connect better with customers

SAP Sapphire Event (2011)

"While the new system based on software supplied by SAP AG **worked as planned**, it was so **burdensome and disruptive** to the representatives' daily routine that they left in meaningful numbers."

Avon spokesperson

"While the new system based on software supplied by SAP AG **worked as planned**, it was so **burdensome and disruptive** to the representatives' daily routine that they left in meaningful numbers."

Avon spokesperson

Avon is pulling the plug on a \$125 million software system...

Wall Street Journal (2013)

"While the new system based on software supplied by SAP AG **worked as planned**, it was so **burdensome and disruptive** to the representatives' daily routine that they left in meaningful numbers."

Avon spokesperson

Avon is pulling the plug on a \$125 million software system...

The failure is the latest – and perhaps most dramatic – example of how **usability has become a critical issue** in the workplace. People who are accustomed to using simple, well-designed applications in their personal lives have no patience for disappointing technology at work...

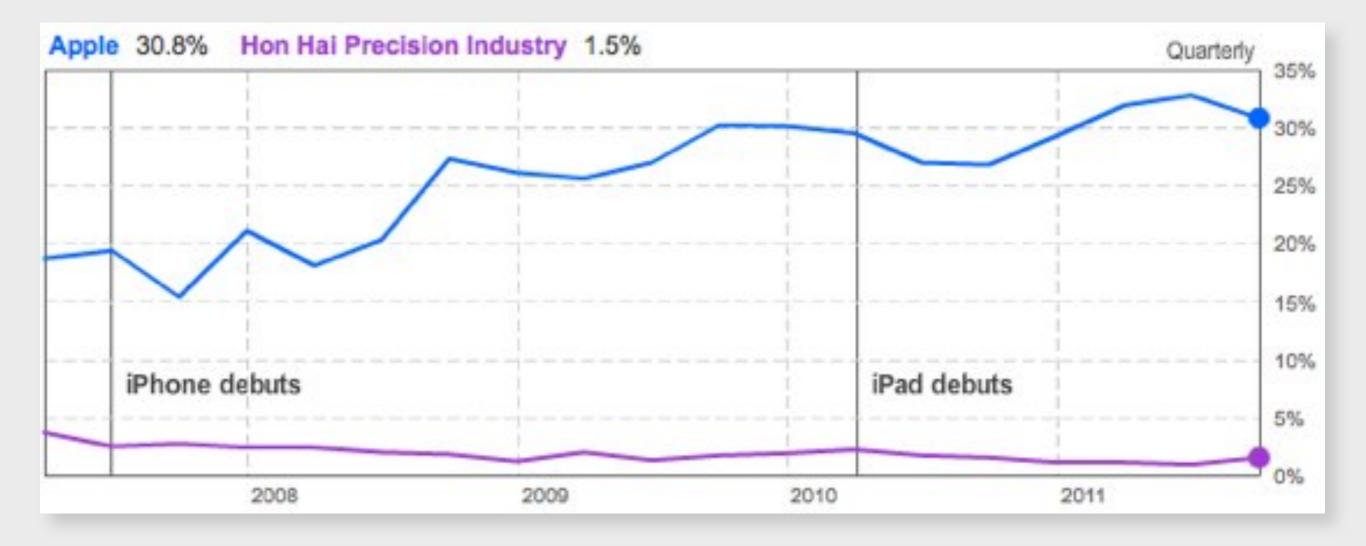
Wall Street Journal (2013)



outsourcing



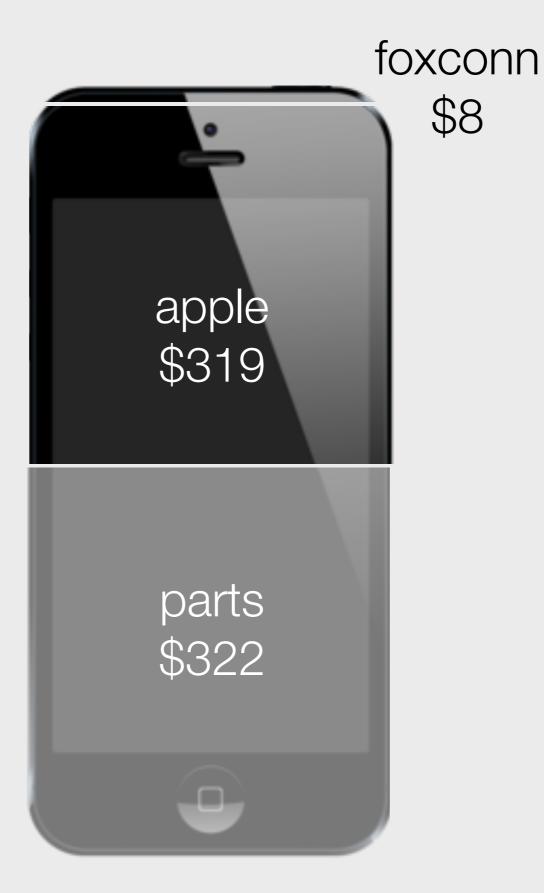
Apple vs Foxconn profit margins











the

emergence of design

progression from craft

context form context form

 $\begin{array}{ccc} C1 & F1 \\ \downarrow & \uparrow \\ \hline \\ C2 & F2 \\ \downarrow & \uparrow \\ \hline \\ C3 & \downarrow & F3 \end{array}$

actual world

mental picture

formal picture of mental picture The first scheme represents the unselfconscious situation described in Chapter 4. Here the process which shapes the form is a complex two-directional interaction between the context C1 and the form F1, in the world itself. The human being is only present as an agent in this process. He reacts to misfits by changing them; but is unlikely to impose any "designed" conception on the form.

The second scheme represents the selfconscious situation described in Chapter 5. Here the design process is remote from the ensemble itself; form is shaped not by interaction between the actual context's demands and the actual inadequacies of the form, but by a conceptual interaction between the conceptual picture of the context which the designer has learned and invented, on the one hand, and ideas and diagrams and drawings which stand for forms, on the other. This interaction contains both the probing in which the designer searches the problem for its major "issues," and the development of forms which satisfy them; but its exact nature is unclear.5 In present design practice, this critical step, during which the problem is prepared and translated into design, always depends on some kind of intuition. Though design is by nature imaginative and intuitive, and we could easily trust it if the designer's intuition were reliable, as it is it inspires very little confidence.

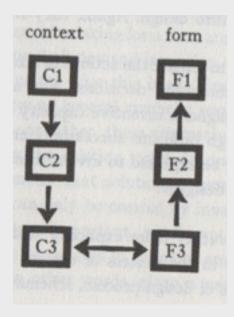
In the unselfconscious process there is no possibility of misconstruing the situation: nobody makes a picture of the context, so the picture cannot be wrong. But the selfconscious designer works entirely from the picture in his mind, and this picture is almost always wrong.

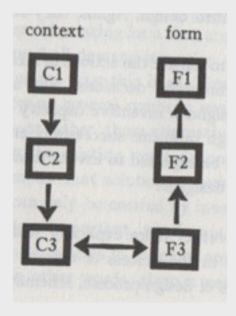
The way to improve this is to make a further abstract picture of our first picture of the problem, which eradicates

77

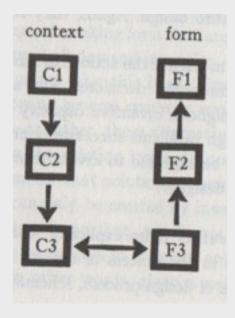
Christopher Alexander, Notes on the Synthesis of Form, Harvard, 1964





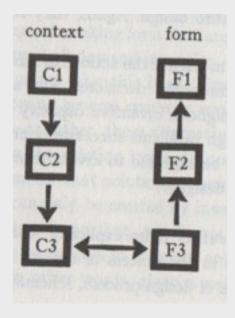








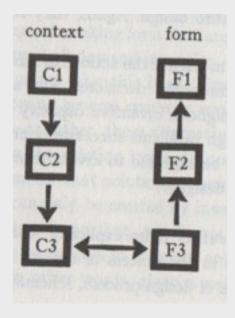










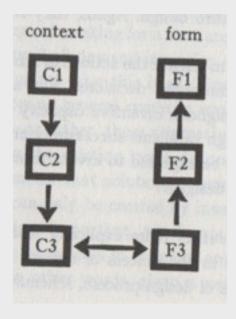
























IBM, 1981 Personal computer



Alfonso Bialetti, 1933 La Moka coffee maker



IBM, 1981 Personal computer



Alfonso Bialetti, 1933 La Moka coffee maker



Leica, 1953 M3 rangefinder camera



IBM, 1981 Personal computer



Alfonso Bialetti, 1933 La Moka coffee maker



Leica, 1953 M3 rangefinder camera



Dieter Rams, 1958 pocket transistor radio T3



IBM, 1981 Personal computer



Alfonso Bialetti, 1933 La Moka coffee maker



Leica, 1953 M3 rangefinder camera



Dieter Rams, 1958 pocket transistor radio T3



IBM, 1981 Personal computer



Jony Ive, 2002 Apple iPod



Alfonso Bialetti, 1933 La Moka coffee maker



Leica, 1953 M3 rangefinder camera



Dieter Rams, 1958 pocket transistor radio T3



IBM, 1981 Personal computer



Jony Ive, 2002 Apple iPod



Fred Bould (2011) Nest thermostat



Fred Bould (2011) Nest thermostat



Fred Bould (2011) Nest thermostat



Henry Dreyfuss (1953) Honeywell T68 thermostat



Fred Bould (2011) Nest thermostat



Henry Dreyfuss (1953) Honeywell T68 thermostat



```
Fuji (2013?)
Instax 90 film camera
```



Fred Bould (2011) Nest thermostat



Henry Dreyfuss (1953) Honeywell T68 thermostat



Fuji (2013?) Instax 90 film camera



iOS6 clock app



Fred Bould (2011) Nest thermostat



Henry Dreyfuss (1953) Honeywell T68 thermostat



Fuji (2013?) Instax 90 film camera



iOS6 clock app



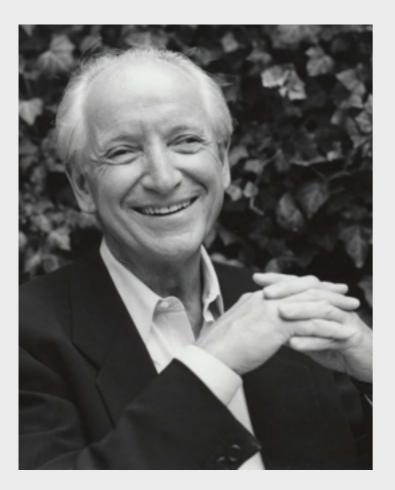
Swiss Federal Railways SBB clock

inclusive design

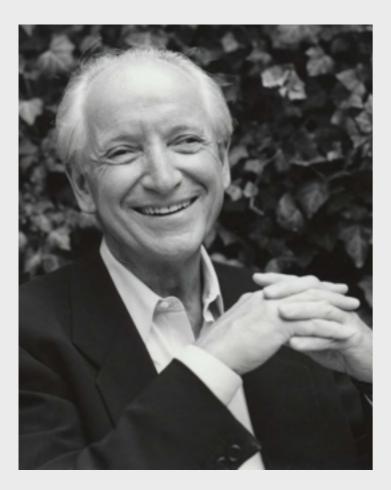
inclusive design



Bradley watch from Eone

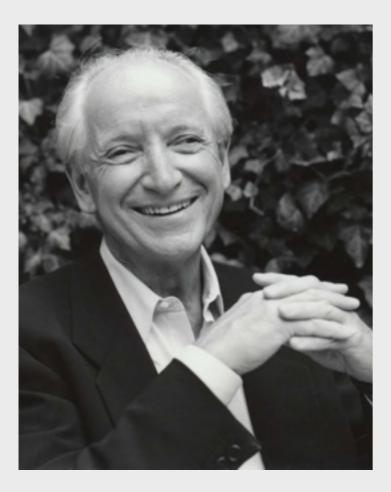


Michael Graves (1934-2015)



Michael Graves (1985) Alessi 9093 tea kettle

Michael Graves (1934-2015)





Michael Graves (1985) Alessi 9093 tea kettle



Michael Graves (1999) Target spinner whistle tea kettle

Michael Graves (1934-2015)

design consultancies

design consultancies

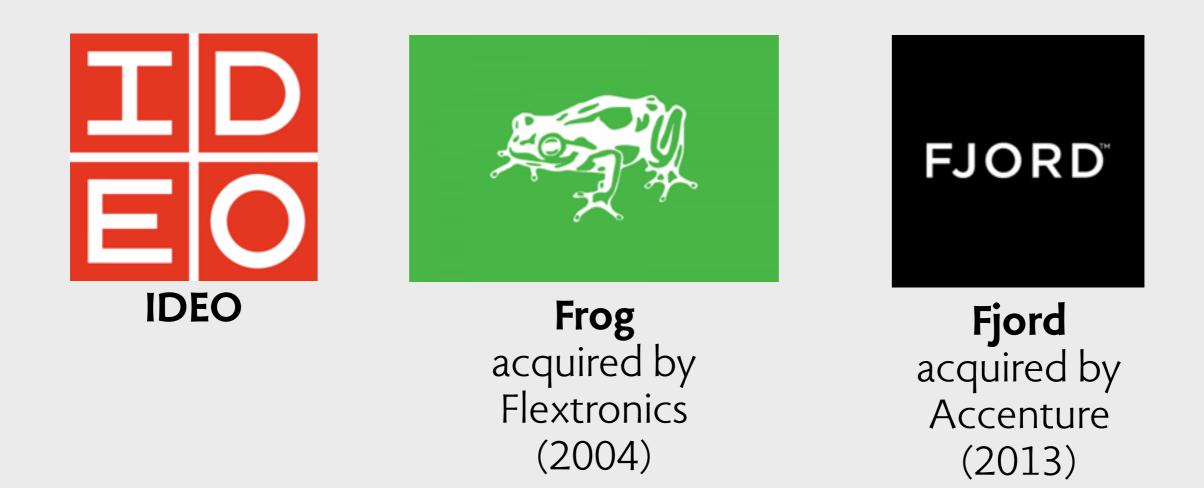




Frog acquired by Flextronics (2004) FJORD

Fjord acquired by Accenture (2013)

design consultancies



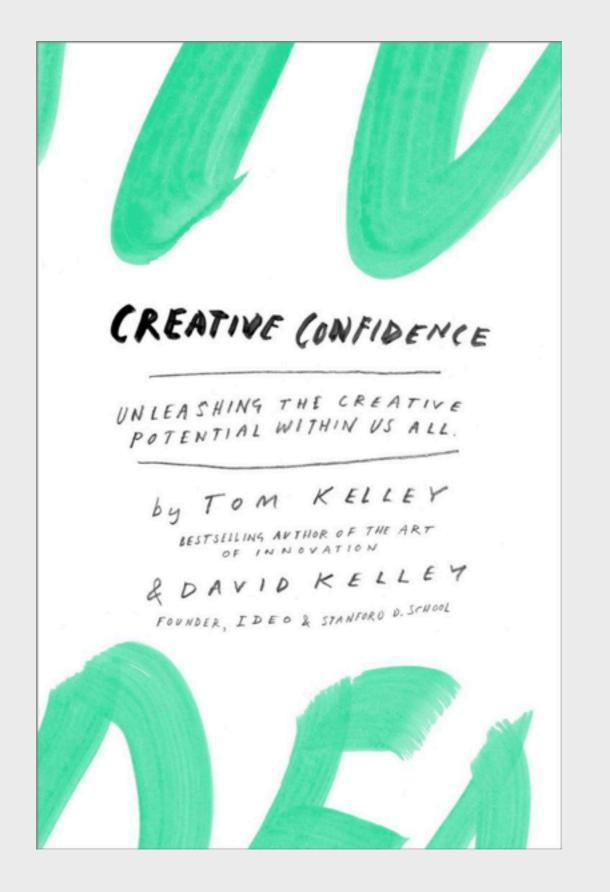
2011: GlobalLogic buys Method 2012: Google buys Mike and Maaike 2013: Facebook buys HotStudio

design schools & programs



Stanford D School founded 2004 by David Kelley and George Kembel

design thinking for business



coworking + maker spaces



a startup whose founders met at RISD

DME HOME

airbnb

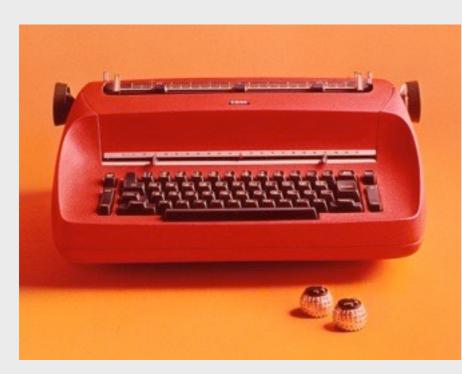
IBM (re)embraces design

IBM (re)embraces design



Eliot Noyes (1961) IBM Selectric Typewriter

IBM (re)embraces design



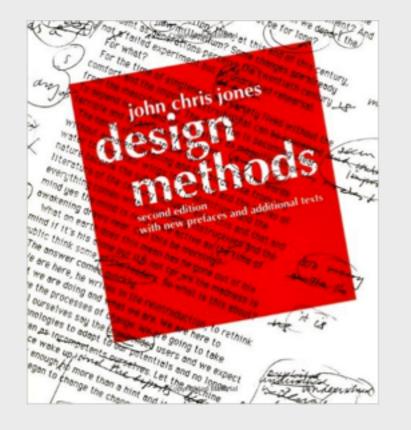
Eliot Noyes (1961) IBM Selectric Typewriter

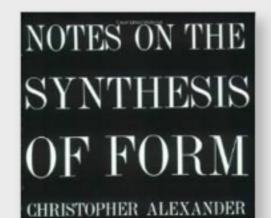


IBM's design studio in Austin, Texas

what is design thinking?

theories of design

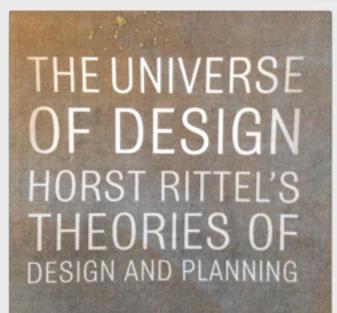




Designerly Ways of Knowing

Springer

Nigel Cross



what is design?

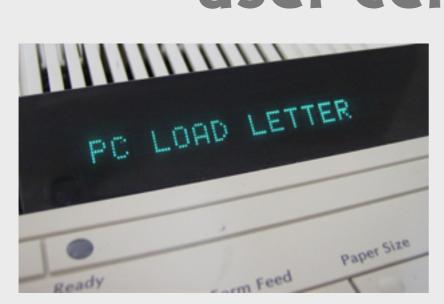
Nigel Cross (1982) Designerly Ways of Knowing excerpted from RCA report

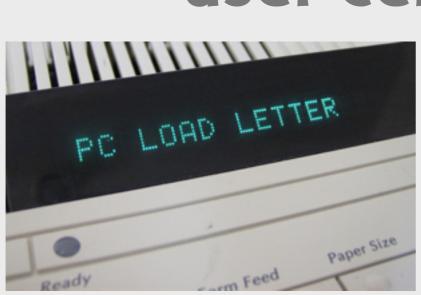
what is design?

The central concern of Design is the conception and realisation of new things. It encompasses the appreciation of material culture and the application of the arts of planning, inventing, making and doing. At its core is the language of modelling... equivalent to aptitudes in the language of the sciences (numeracy) and the language of humanities (literacy).

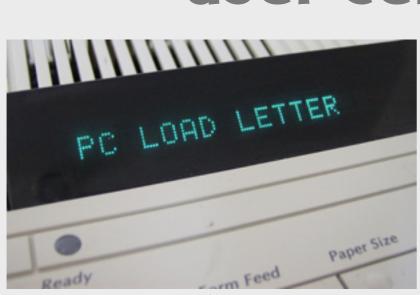
Design has its own distinct things to know, ways of knowing them, and ways of finding out about them.

> Nigel Cross (1982) Designerly Ways of Knowing excerpted from RCA report

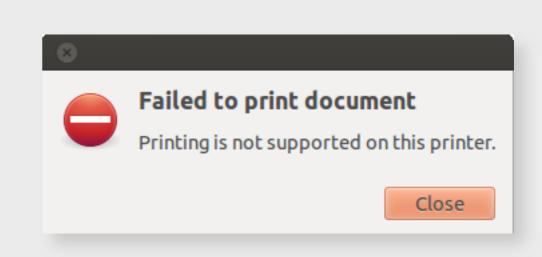


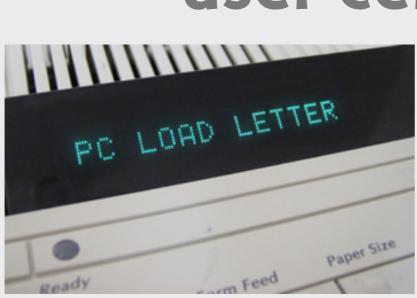


translation: "please load letter-sized paper into paper cassette"

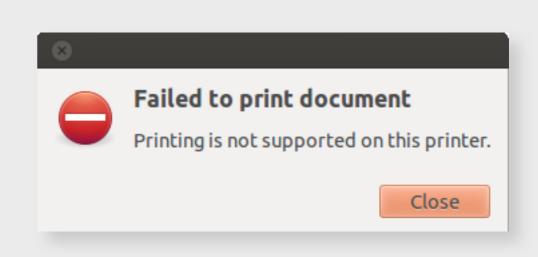


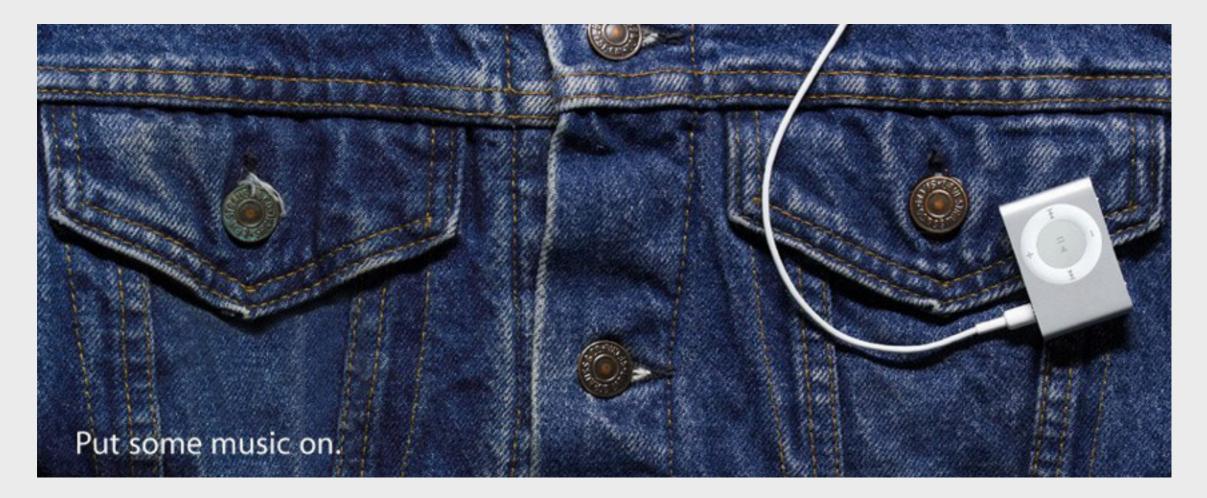
translation: "please load letter-sized paper into paper cassette"

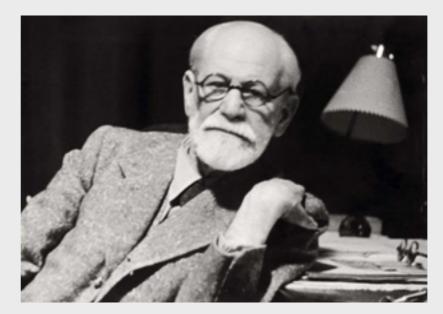




translation: "please load letter-sized paper into paper cassette"



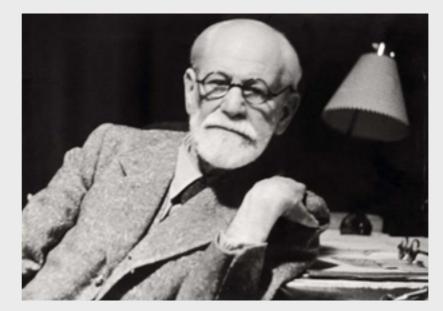




psychology



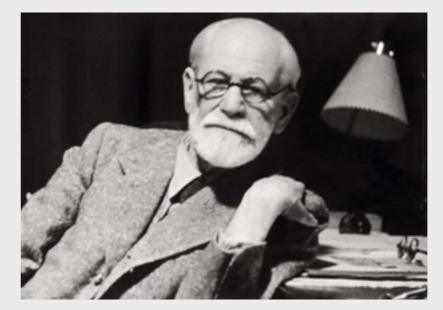
anthropology



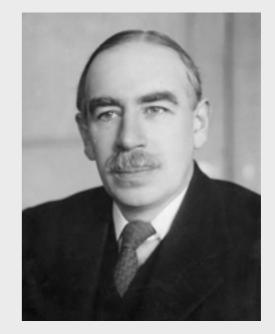
psychology



anthropology



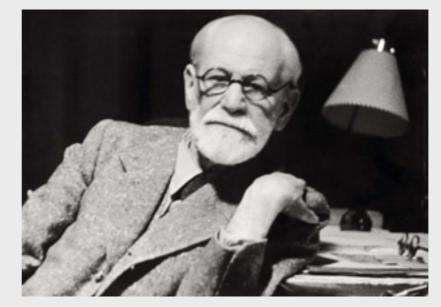
psychology



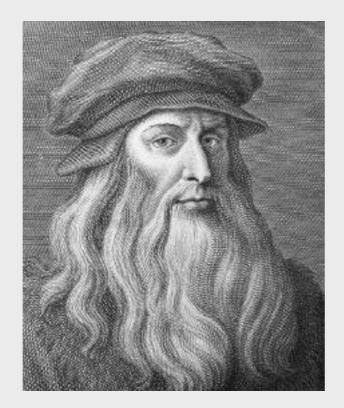
economics

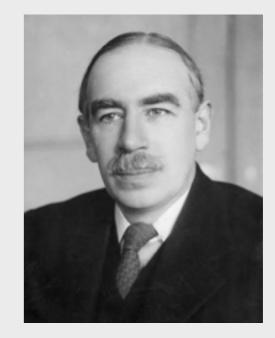


anthropology



psychology





economics

attention to detail





That's quite obsessive, isn't it? Jonathan Ive in "Objectified"

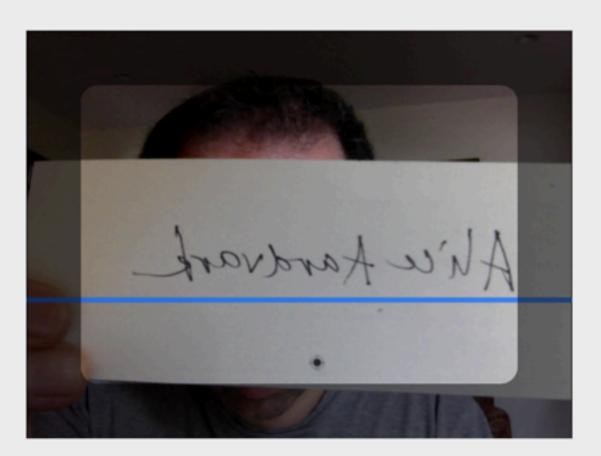
> The details are not the details. These make the design. attributed to Charles Eames by Garrett

example: signatures in Apple Preview

00	Signatures	
General Images PDF	Bookmarks Signatures	
You can add your handwritten signature to PDF documents. To start, use your Mac's camera to capture an image of your signature.		
To start, use ye	Create Signature	

example: signatures in Apple Preview

Signature Capture



000

Save this signature for use after Preview quits

Sign your name in black ink on a small piece of white paper.

Hold the paper up to your Mac's camera so your signature rests on the blue line.

Signature Preview

'u fardvark

Cancel

Accept

needfinding

The need itself is a perceived lack, something that is missing. Needfinding is thus a paradoxical activity—what is sought is a circumstance where something is missing. In order to find and articulate a need, this missing thing must be seen and recognized by someone.

Rolf A. Faste, Perceiving Needs (1987)

users don't know what they want

users don't know what they want



new recipe won blind taste tests

users don't know what they want



new recipe won blind taste tests



Aeron office chair low ratings in early tests

brainstorming

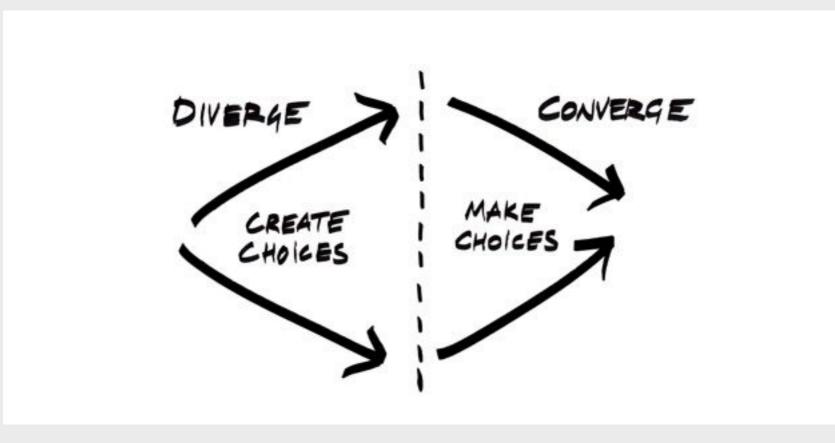


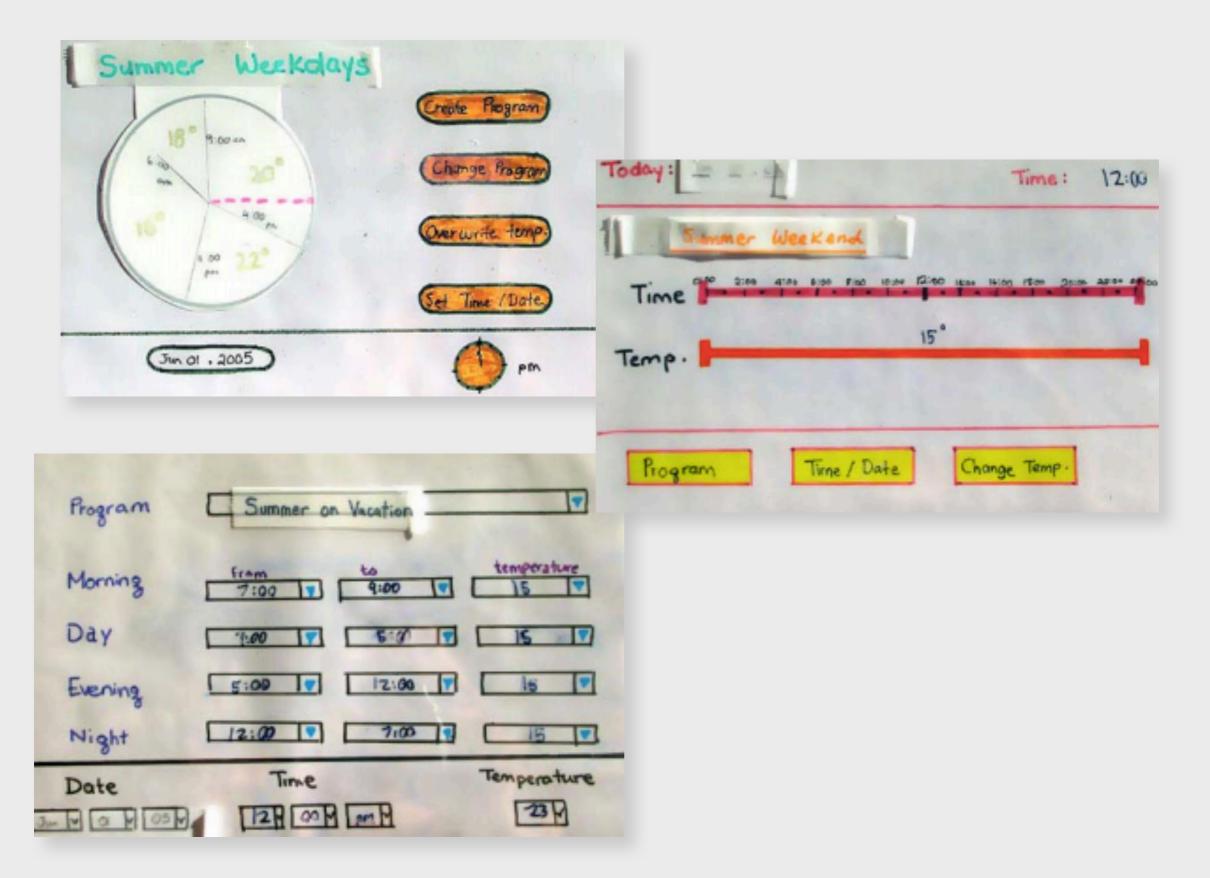
diagram from Tim Brown, IDEO

prototypes & user studies

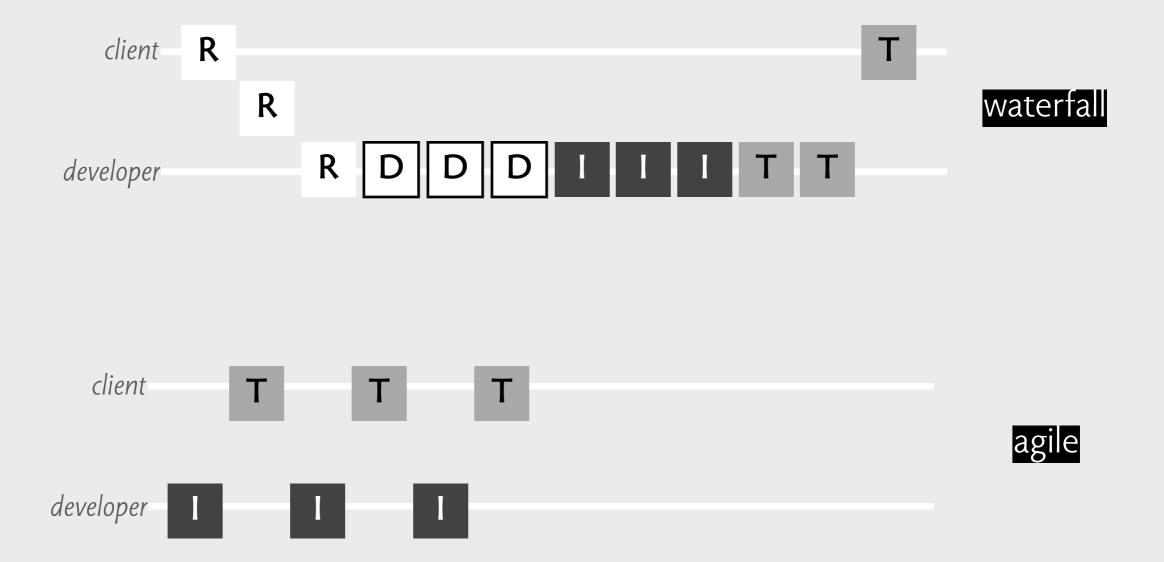
prototypes & user studies

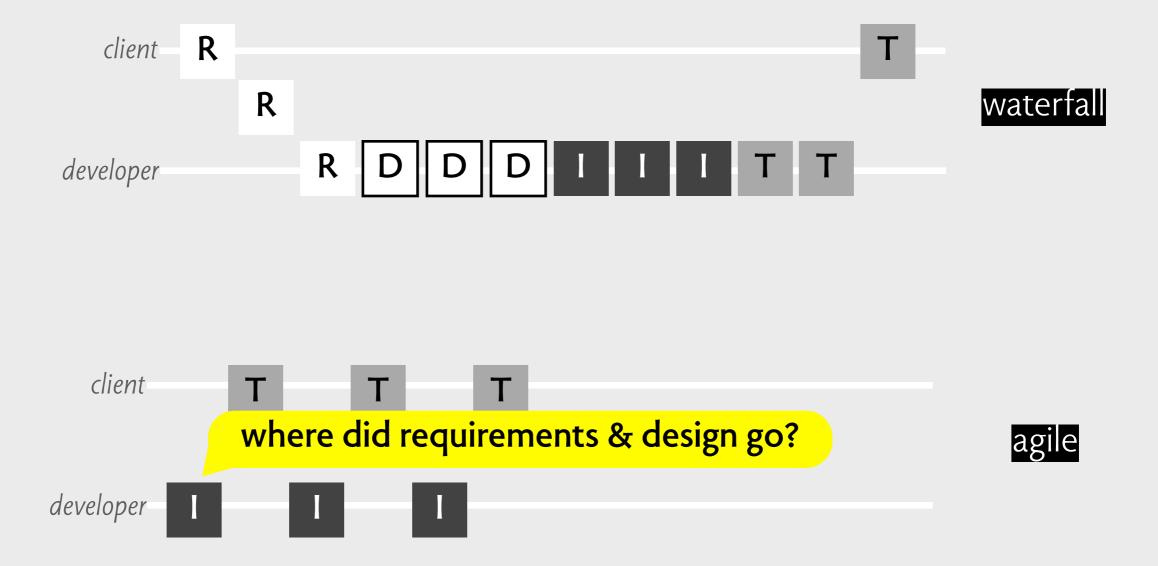


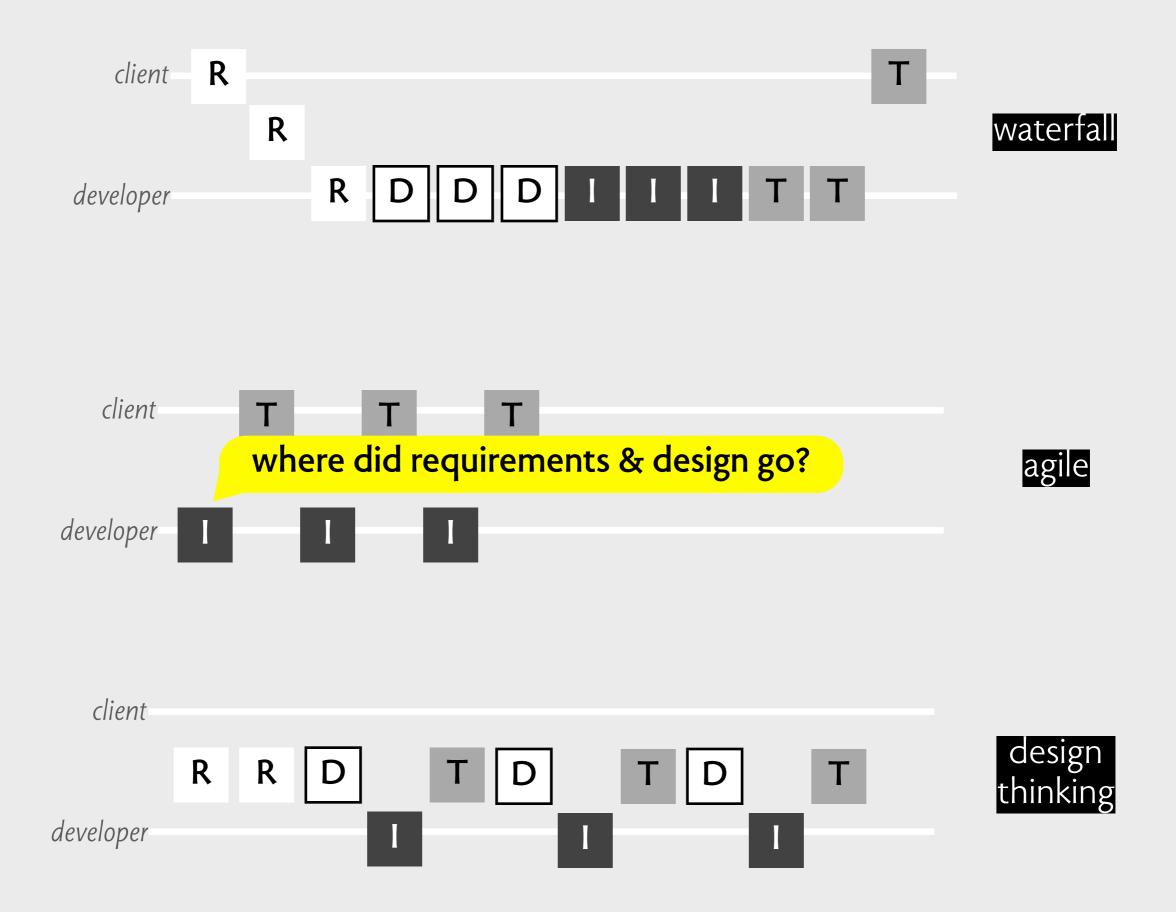
paper prototypes











so what is software design?

designers & engineers



designers & engineers

	designer	engineer
elements	door, window, wall	column, beam, truss
goals	comfortable, convenient, attractive	structural integrity, durable, sustainable

¢ File Edit	View Special		
5 items	232K in disk	167K available	System Disk
Empty Folder	System Folder	순 [] Disk Copy	Guided Tour
Font Mover	Fonts		
↓		<u> 나 빈</u>	
SysVersion	My Folder		

	designer	engineer
elements		function, object, type
goals		maintainable, correct, fast

	designer	engineer
elements		function, object, type
criteria		decoupling & localization
goals		maintainable, correct, fast

	designer	engineer
elements		function, object, type
criteria		decoupling & localization
goals	learnable, effective, tolerant	maintainable, correct, fast

	designer	engineer
elements	concepts	function, object, type
criteria		decoupling & localization
goals	learnable, effective, tolerant	maintainable, correct, fast

	designer	engineer
elements	concepts	function, object, type
criteria	concept/purpose correspondence	decoupling & localization
goals	learnable, effective, tolerant	maintainable, correct, fast

software design tools

concepts structuring functionality

concepts structuring functionality

modeling concepts focused data models concepts structuring functionality modeling concepts focused data models usability heuristics

well known principles



a common view of software design

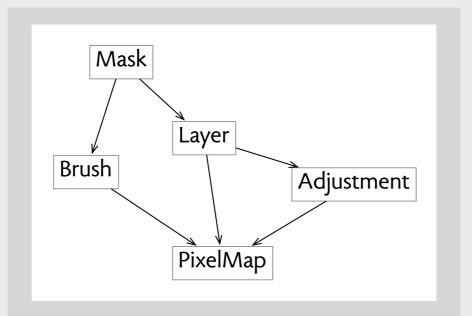
programming hard & technical about content

UI design

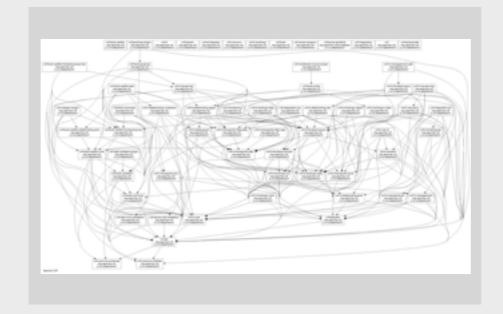
soft & human

about presentation

a better view of software design



conceptual design: essential concepts & behavior



representation design: organization & performance

what characterizes an app?

Apple Mail

			(a. (17 messa		1
		0 - (E) (A)	44.44	98 (A) (* + (A) (A)	
0 min (CTD and	- 10- 1	ent Flaggerd			
NAVE BOARD		Bart by Data +		This message contains unlike Load Images	
		Maria Rebello	100.094	K. Inclusion contrast makes	
1 th Floored	0	Re: Feet Your bill is now a	_		
To Drafts	õ	BERNAND LEVY	101 104	Control Control and and a series of the control of the Control Control Control of the Control of the Control Control of the Co	
of Sect	~	Congressmen Fingerhut (Sea		Taxat Reservation to DRLANDO INFL, PL on May 18 for	· I
II had	0	Cauda Barbach Fed Kidush of April 3	10.00	(and), (Alkilon	- 1
-	ω.	Michael Robert	10.074	Principal and Ann V Galacian	
ON BY BAC		for there and	04900		_
CONL MAP		fai form	1.17.04		
C Image		Re urgent hashed	1149(0)		- 1
in []] Admin		Judy Jackson	10.47 (84)		- 1
In C : Personal	60	Aut Jan	1.0	THE TRAVEL COLLABORATIVE	- 1
+ D Putterativ		Tehudah Wratty	10.00 AM	1400-070-FW00 gimy dar-last.com	- 1
+ C Professional		Re: great took!	149.00	Auto da con	- 1
P C Publications		part must	+ + + + + (1))		_
* C Armerte		Hamid Baghari /		VerbiligCase Astro-Cander Perline	
		Avrid Lagren y	847.48		-
* C Reviewing		CENT #	Tester Day		10
* 🗋 Students		Travel Reservation is (19), 454	0. 0.00	We are pleased to deliver your travel itnerary	Det 1
I C Teaching		Tim Network	Tester Day	through TripCaseIII, a free web and mobile solution for travellers.	
Y 🗋 Translent		(Suface Asstactors A.1.8)	N. 145	souton to raveers.	22
Cit Copies		Pameia Java	Testarily .	What does this mean to you? Bign up now to	10
Ci parte		Per call lowering	149(2)	start anjoying these benefits:	
Admissions		Angle Rg Direc Huang ?	21010	5. View your full literary directly in the	
El Cambianes			1000	 vew your full timerary dready in the confirmation annual. 	
Ci uson		Lote Lampson		2. Organize your business and islaure trips	
+ C1 TripAddurers		Neuronite, Ohris J	11010	in one place.	
+ 2 +-		alloy of amazon	10110	3. Access your the details everywhere via	

Microsoft Word



Twitter





Apple Mail

	intex (37 mess	
	8 + (B) (m m +	90 (a) (* • (a) (4)
Citika (CCC) Dealer (R. 16	ent Flaggerd	
P Faged ()	Rent by Date-* Maria Rebero Ren Rebero Ren Part Har tell is now a 34 48-000 BERMAND LENY NUM PAR	This message centers unlike Load Images deep concerning of the A financy (A), 2014 410 Fe/ This Deep Lances of the load
il Set Il Tach D	Congressmen Progeniul Geal 418 Claudia Barkesh 116 PM Peti Kabuh or April 1018 Michael Rubin 1019 PM	Taxed Reservation to DRANDO INFL, PL on May 18 for (ANR), addressin (Addressin, 2010) Sees 1. Sees 1.
IN NY RAC Soll, may In El Admin	No Parkynel U 45 25 Gel Konen Pro Park No ogert haked 114 25 Jack Jackson Station	
Personal Personal Personal Personal Personal	Automotivesy 000 mm Ne perform 1400 jan met 1000	THE TRAVEL COLLABORATIVE 1-60-070-100 gmy@bitul.com
Addications Accounts Accounts Accounts Soulants	No. postan 14522 Rental Regheri / Norman Josef (Appen 3474) Canada / Normanian Tanad Assessments to (MLMA), 4742	Vers in TripCase Add/to-Calendar Print Binarray We are pleased to deliver your have illinearray Drivugh TripCaseR, a then well and institute
Teaching Tornsient	Tim Network (1992) 1993 Tim Network (1992) 1993 States Anthropology (1993) Parrada Zana	solution for travellers. No.
Copien Junk Admission	Angle Ng Size Huang	start orjoying these benefits: 1. View your full threasy drectly in the
Conditions	Lois Lampson District RE menular show and dr. 14000 Newcombe, Onte J District Newcombe, Onte J District	 Cryperice your business and leave trips in one place. Access your this details avance/new via

Microsoft Word



Twitter



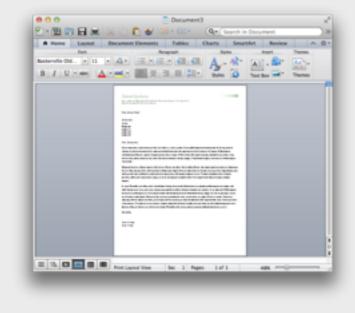


Apple Mail

	intex (07 mess	april d
	(8.9)(B)(A.(A.(+)	92 (d) (* + (D) (%
1 Hat (CT) Sub-12	tent Flagged	
P Paggel () Data () Solution () Solution () Solution ()	Terri In Delan Maria Rebato Re Fast Terri II anna a. 2140 BERNARD LEVY Compression Fragman dest. 448 Claudia Bartesh	This remarks unlike. Lind Images SMMT SOMM against Sec. A feature 91, 2014 420 Fe 10 Sector and sector and the sector of the Sector Sector and the Take Researce of the Sector Sector and the Sector Sector and the Sector Sect
Then O	Fed killun or April 1048 Michael Rubin 1010 Feb Re Rack and 1048 CB	14tectown 0.45 Sea 7 Selections
Coll. map → Coll Admin → Coll Personal COLL	Sal Koren 110 au Recogert hasked 1140(3) July Jackson 1100 Auf Jackson 1100	THE TRAVEL COLLABORATIVE
Polyapathy Polyapathy Polyapathy Polyapathy	Network Weeky 0.0.0 m Re: pred toold 0.40 (20)	1.405-075-FKC genry@crisit.com
* 🗋 Assarch * 🔄 Assleading	Hanid Bagheri / Servis Journe pager Silris	Venin TryCale Additio Calendar Peld Branary
* C Students * C Teaching * C Translent	Color / Vestmin Trans Reservation & (RLMC) _ 010 Test Nation Servation Antipology A118 Pt 110	We are pleased to deliver your have illnerary De brough NpCase®, a free web and nuble solution for insveters.
Capies Capies	Panels Jave Networks No. Laft Streeting 149-000 Angle Ng Dave Huang 7 210-00	What does this mean to you? Sign up now to be about or joying these benefits:
Cambdanes	The CYNE page to the State	 View your full literary deadly in the confirmation email. Organize your business and leave trips
> Ci TripsAndteens	Newcombs, Only / process alter at amount and the ID	in one place. 3. Access your His details everyofrem via

EmailAddress Message Folder or Label

Microsoft Word



Twitter



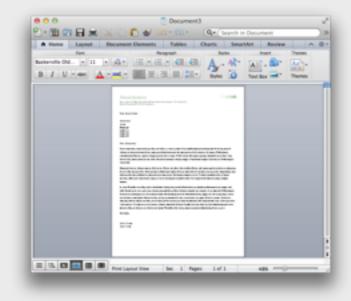


Apple Mail

	initia (17 mess	
	8 9 (8 4 4 4	10 D F + D Q
Direct CTD Inch IX	See Flagged	
L Inter	Real by Dates	this message contains unitsa Load images
P Report O	Re Fail Your bill a row a 31 48(2) BERMANG LENY 100 PM Compresents Frigenial Oracl	CART CORE option State A Training 24, 2014 ACE THE To: Daniel Science and State Lance
The O	Claudia Warkesh 111 PM Pw2 Kabuh or April 5 1018 Michael Rubin 1013 PM	(MNE), ADDON
Cont. mar	Re Hark you' 12 KB (2) Gal Karen 11 (2) KB (2) Re urgert hasked 11 40 (2)	
Admin Admin Admin Admin Admin Admin Admin Admin	Judy Jackson 1947 Mil Ruff Jack Tehudah Wireky 1942 Add	THE TRAVES, COLLABORATIVE 1-805-070-7400
Professional Publications	Ne peak took: E Kinggi Jah man Bart - Mar Ne peakter E Kinggi	production
Kenards Kenards Kenards Kenards	Hantid Baghart / Hustonia Jacobi paper 947-05 Galletti / Hustonia	Versis NyCase Additio Calendar Peter Bioritary We are pleased to deliver your havel litherary
* C Teaching * C Transient	Tease Reservation (100,000), 4748 Tea Netson Restriction (Suffware Asstractions 4.1.6) Pa., 148	Prough TripCaseR, a free web and mobile solution for insuriers. The What does this mean to you? Sign up now to the
Capies Capies Administra	Partiels Zone Number	start enjoying these benefits:
Candidates	Huan (2019) project (c., 101 KB) (3) Lote Lampson (2019) Hill memulien allow and dis., 1149 (3)	 View your full literary directly in the confirmation-arreat. Organize your business and leave https://doi.org/10.1016/j.jps
* C SipAdbers	Neucomba, Ohris d' annone anno 100	in one place. 3. Access your His details everywhere via

EmailAddress Message Folder or Label

Microsoft Word



Paragraph Format Style

Twitter



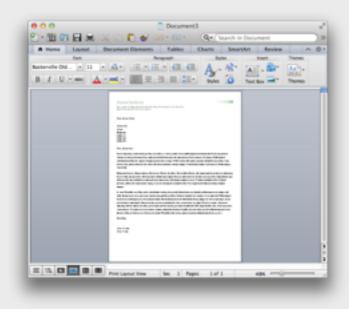


Apple Mail

	Index (07 mess	
	(814)(B)(*)(*)	
State Com Budy (2)	Sent Flagged	
evelations	Bart by Data +	This message contains units Load Images
	Maria Rebello Re: Fact Your bill is row as	No. of the second se
(* Flagged (C)	BETRUEND LEVY 100 PT	CONTROLMA - group from If Televary 24, 2214 ATE For
hints O	Compression Fright Seat. 418	To Daniel Jackson unclimitation Hele Details
of fant	Caula Batash 11174	Tread Reservation to DRLANDO INTL, 75, on May 18 for (anxie), an (anis) on
That C	Fed kittah or April 5 1018	
N NY MAC	Michael Rubin 1013 PM	Principante, 1973 New Y. Balanciante
Total man	Re hark your U Kings	
C Imae	Selfuren markei 114900	
+ Di Almin	Andra Jackson 1947 and	
C Arrowd (D)		THE TRAVEL COLLABORATIVE
+ D Personal (LL)	Tehubit Braky 1020-04	1-800-070-7400
	Re great took: 6 KB []]	grow @bricat.com
Professional	jut aut	
P Delications	Re positive # 40 []]	VerbiligCase Addr.Calenter Perlimenty
In Contraction	Hamid Bagheri / Scrib	ter i spear ser and ser and ser
Environment	GRAFT / Testering	We are pleased to deliver your havel itnerary
* 🛄 Students	Travel Reservation to ORLAND 1718	
* C Teaching	Tim Network Texturities	trough NpCaseR, a free web and mubile solution for travelers.
* 🗋 Tursleri	Schere Astronom A.1.8 Pt., 149	what does this mean to you? Sign up now to
Cit Copies	Parata Java 140.00	
Ci Junk	Angle Top Size Huang P 210100	abart enjoying these benefits:
Admissions 1	The CYTEL pract L. 121 KB(2)	1. View your full linesary directs in the
Cambidanes	Late Lampson proces	confirmation email.
C UROPS	No menufer allow and dr 140(22)	2. Organize your business and islaure trips
 TripAndivers 	Newcombs, Only of Prints	in one place.
- H - O-	ality at smacon 886 49 (22)	 Access your His details everywhere via

EmailAddress Message Folder or Label

Microsoft Word



Paragraph Format Style

Twitter



Photoshop



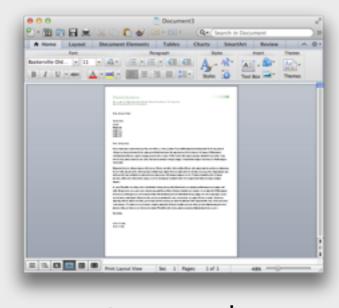
Tweet Hashtag Following

Apple Mail

	initia (17 mess	april d
	(8 (+)(B)(+)(+)	(98)(C)(*)(D)(4)
Direct CTT Dealer (B)	tent Flagged	
P Reprint () E Dates ()	Terri to Date- Maria Researce 132 (74) Re Fact that this rear a P 45(3) BERMAND LEVY Comparement Property Compared 14(1)	This message contains units Load images SAMP SOME spin-yhors I formary 20, 2010 4:10 fm To Senie Januar and Senies
Image Trank Image Image Trank Image Image Image Image <td< td=""><td>Cauda Nartash 115 Pu Test saturi ar April 1018 Michael Rubin 10 10 PV Richael Rubin 10 10 PV Richael Rubin 10 10 PV</td><td>Teach Reservation to (PLANEO INF), 7, on May 10 for (annet), addresion 7-Asservance, 11-15 Seat 11 Seat 12</td></td<>	Cauda Nartash 115 Pu Test saturi ar April 1018 Michael Rubin 10 10 PV Richael Rubin 10 10 PV Richael Rubin 10 10 PV	Teach Reservation to (PLANEO INF), 7, on May 10 for (annet), addresion 7-Asservance, 11-15 Seat 11 Seat 12
	Car Konen 1107 au Re organi hakad 1140(3) Ang Jackson 1140(3) Roman 1140 Naturalis Minety 1140(3) Na past look 1140(3) Jan Kat	THE TRAVEL COLLABORATIVE 1401/101/00 stratightud.com
Constants Constants Constants Constants Constants Constants Constants Constants	Per publice 04000 Persit Regheri / Venerity Jonni oper 04140 CAMOT / Technology 141 Technology 141 Techno	Versio NgCee All/InColordar Priod Revery We are pleased to deliver your travel Revery Prough TypCeerds, a free web and mobile solution for travelers.
Conjunt Conju	Panela Zoor Namita Na cal Insuring Debits Angle Ng Bare Hang P Debit Angle Ng Bare Hang P Debits Intel (20142) paget bar, 101451 Life Langeon Debits Namender debits and das 201411	What does this make to you? Bigs up now is start anyong these benefits: 1. View your full thready dractly in the conformation-anal. 2. Organization your business and letisure trips to one place. 3. Access your this defails exercisely new vie

EmailAddress Message Folder or Label

Microsoft Word



Paragraph Format Style

Twitter



Tweet Hashtag Following

Photoshop



PixelMap Layer/Mask Adjustment

the fundamental principle



the fundamental principle

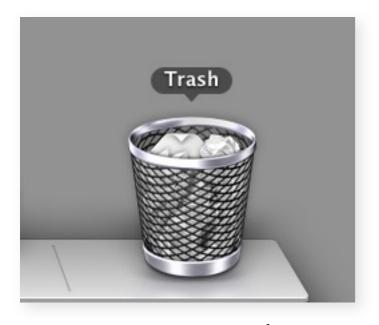
in a well-designed system



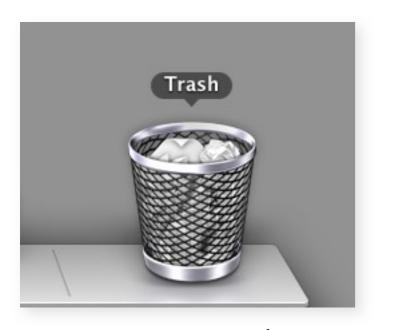
the fundamental principle

in a well-designed system each concept is motivated by one purpose



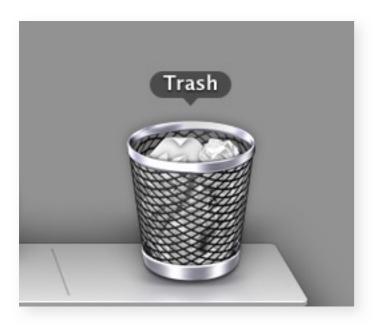


concept: trash



concept: trash

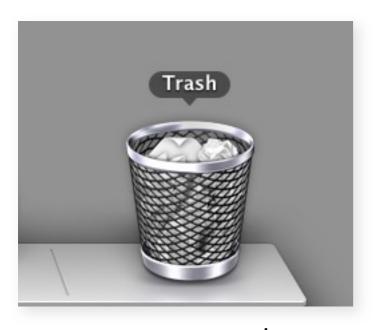
purpose: allow undo of deletions



concept: trash

purpose: allow undo of deletions

operational principle: if you delete a file, it moves to a special folder; you can restore from there, but emptying it removes contents for good (and makes space on disk)



concept: trash

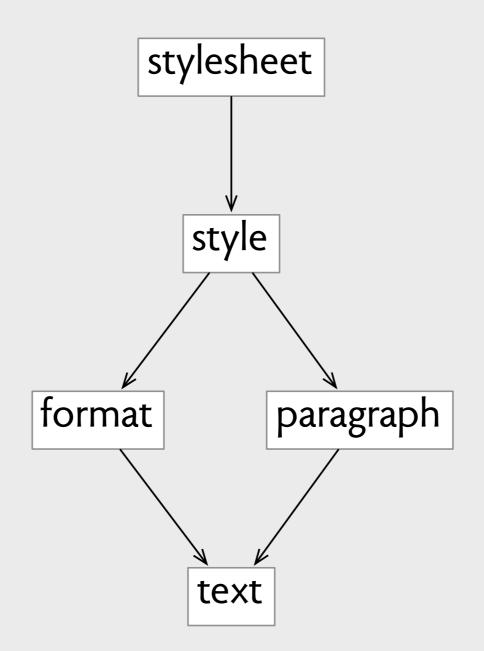
purpose: allow undo of deletions

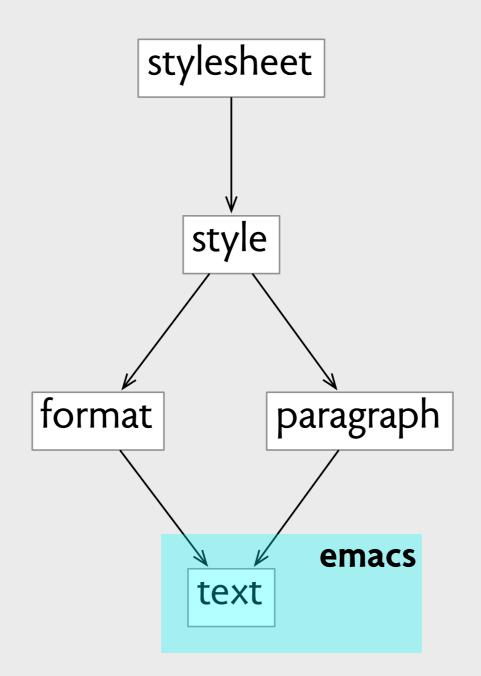
operational principle: if you delete a file, it moves to a special folder; you can restore from there, but emptying it removes contents for good (and makes space on disk)

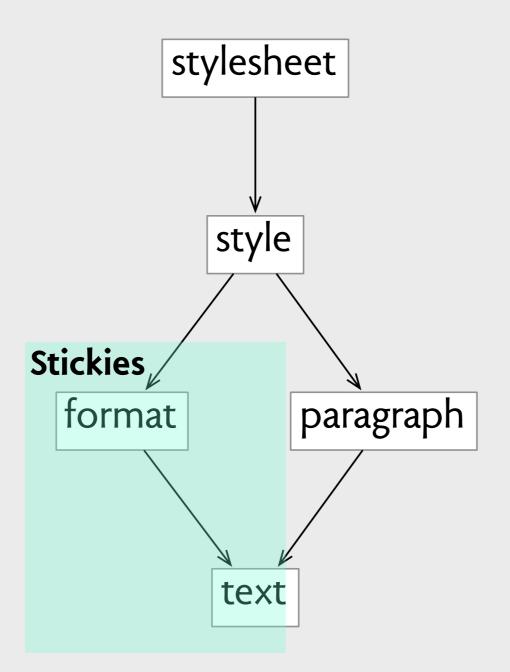
misfit: if you delete a file on an external drive, you cannot reclaim the space until you empty the trash, but then you'll lose the ability to restore files deleted from the main drive

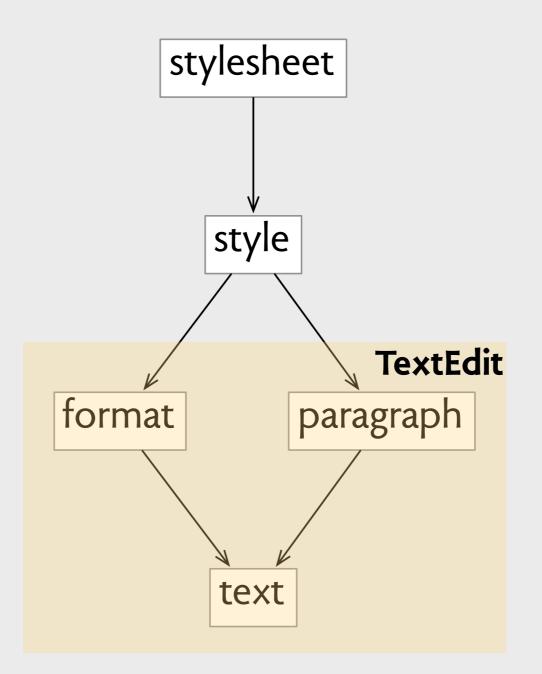
organizing concepts

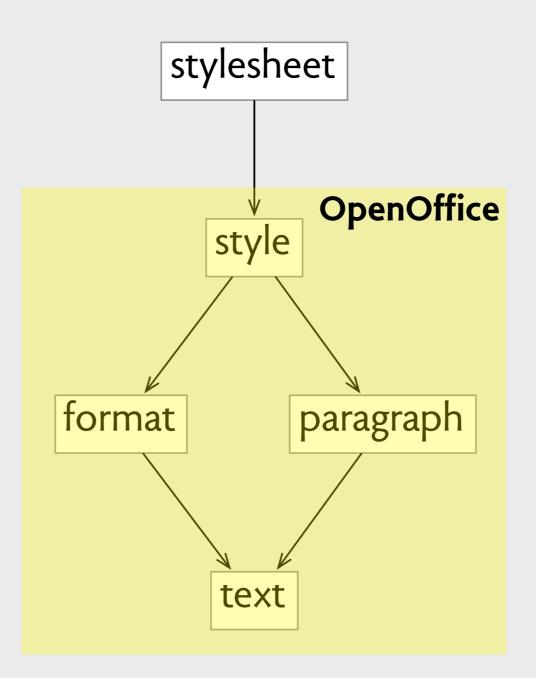
organizing concepts

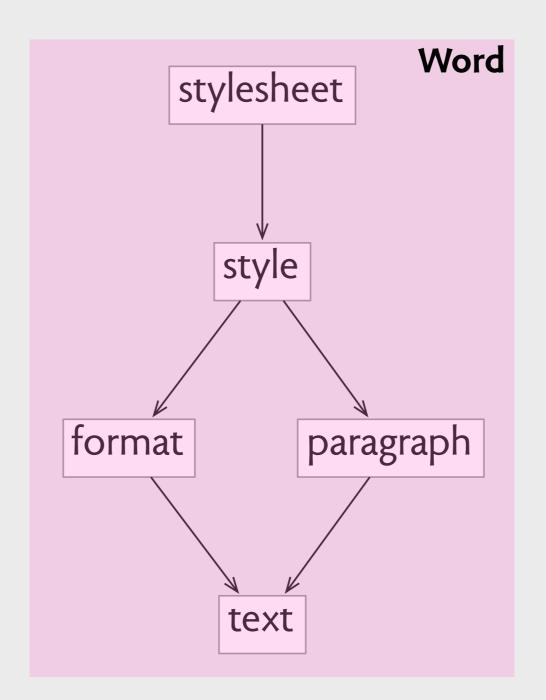














facebook 🥵 🖉 🚱 Search for people, places and things

Q

🔙 Daniel Jackson Home 🔐 🛠

Who Is in These Photos?

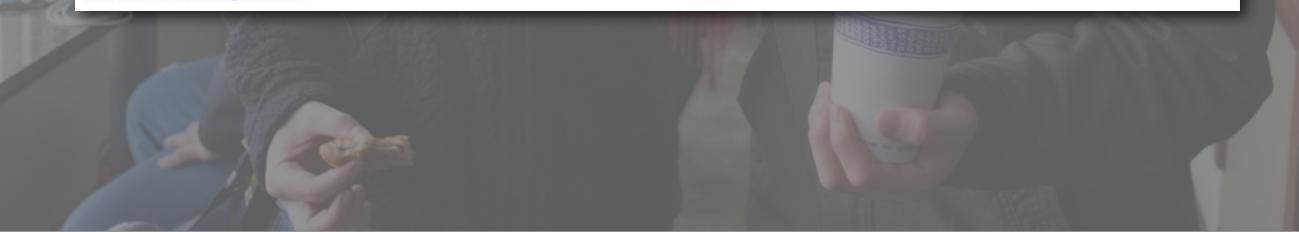
To tag your friends, review the suggested names and click Save Tags at the bottom of this page. If a name is missing or incorrect, list a new name and press Enter.

Remember: If someone doesn't like a photo, they can untag themselves or ask you to take it down.

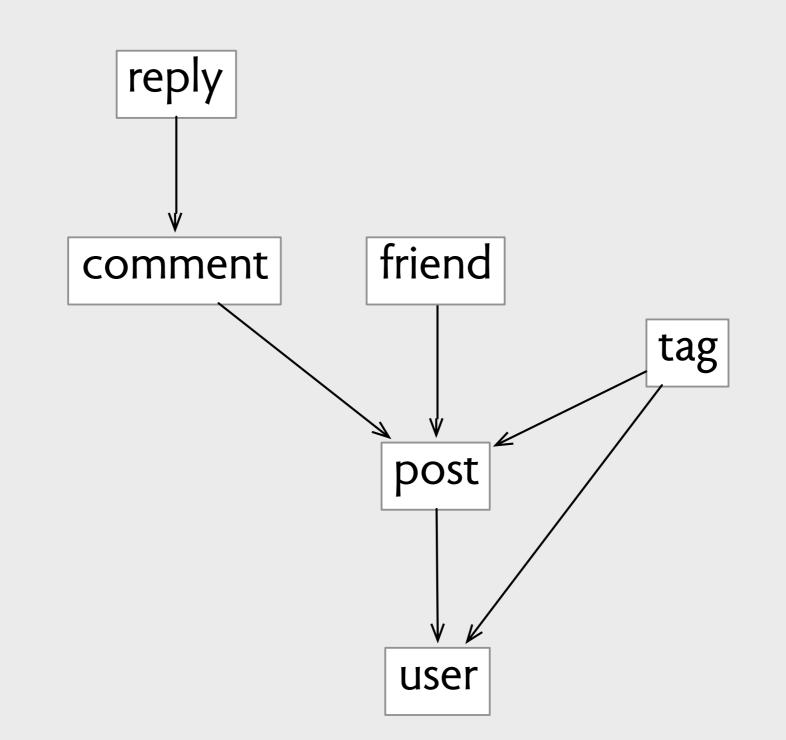
14	1		
	11		
s this?			
i	is this?	is this?	is this?

Create an Ad Create a Page Developers Careers Privacy Cookies Terms Help About

Facebook © 2013 · English (US)



facebook concepts





purpose: share photo with people who appear in it

purpose: share photo with people who appear in it

operational principle: if you tag a photo, then it becomes visible to the person tagged, and to their friends (in addition to your friends)

purpose: share photo with people who appear in it

operational principle: if you tag a photo, then it becomes visible to the person tagged, and to their friends (in addition to your friends)

misfit: suppose I get drunk at a party with strangers and one of them tags me. if my boss is my friend, she will now see the photo.

real purpose: increase connectivity of friend graph?

purpose: share photo with people who appear in it

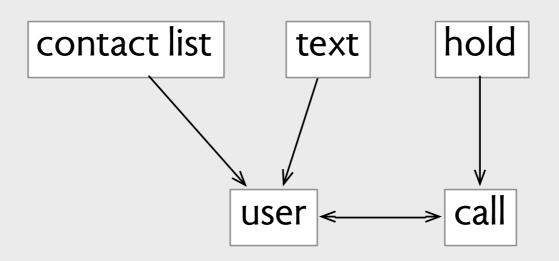
operational principle: if you tag a photo, then it becomes visible to the person tagged, and to their friends (in addition to your friends)

misfit: suppose I get drunk at a party with strangers and one of them tags me. if my boss is my friend, she will now see the photo.

skype concepts



skype concepts



purpose: make it possible to multiplex calls

purpose: make it possible to multiplex calls

operational principle: if you put a call on hold, you can answer another call, and then switch back to the first one by putting that on hold (or ending it) and resuming the first.

why not just allow concurrent calls?

purpose: make it possible to multiplex calls

operational principle: if you put a call on hold, you can answer another call, and then switch back to the first one by putting that on hold (or ending it) and resuming the first.

modeling

the core of design

Nigel Cross (1982) Designerly Ways of Knowing excerpted from RCA report

the core of design

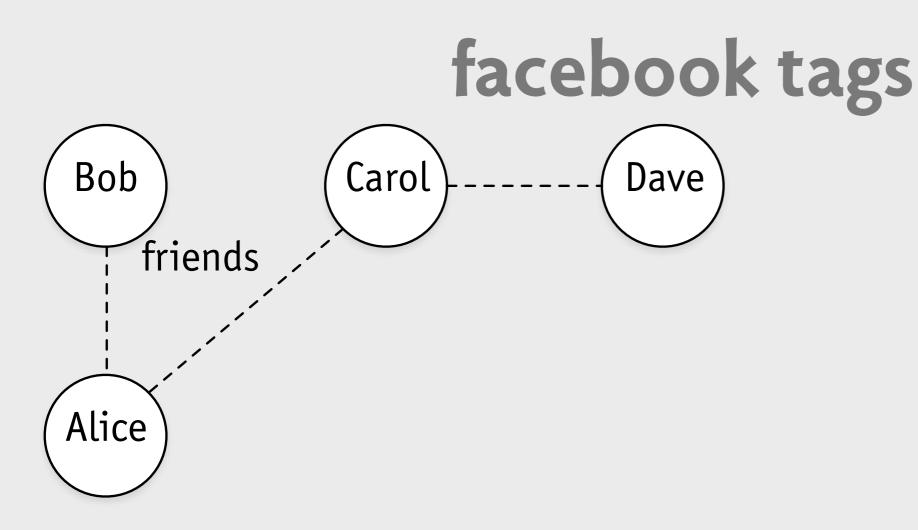
The central concern of Design is the conception and realisation of new things. It encompasses the appreciation of material culture and the application of the arts of planning, inventing, making and doing.

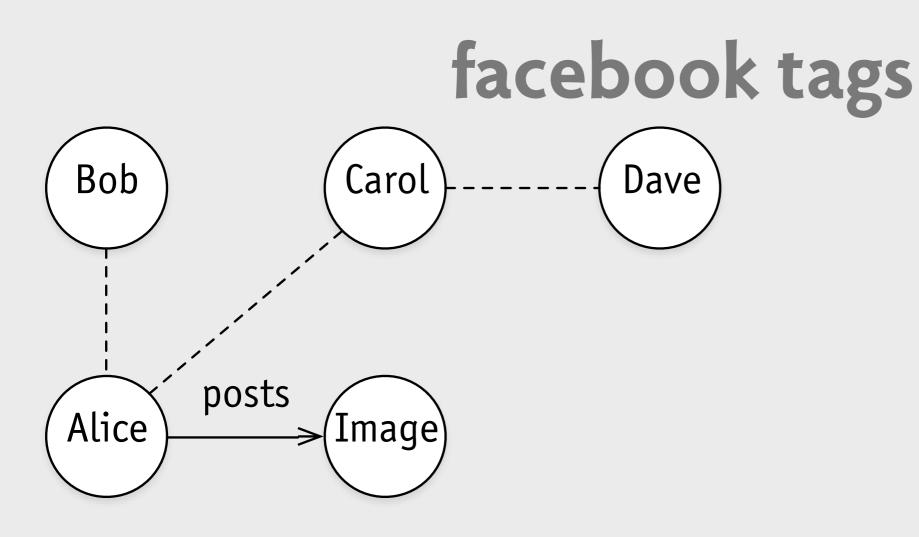
At its core is the language of modelling... equivalent to aptitudes in the language of the sciences (numeracy) and the language of humanities (literacy).

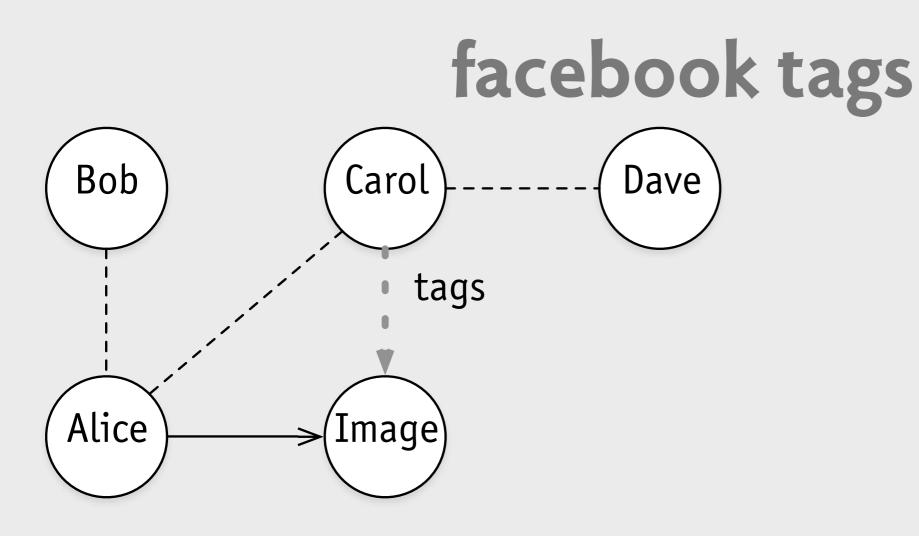
Design has its own distinct things to know, ways of knowing them, and ways of finding out about them.

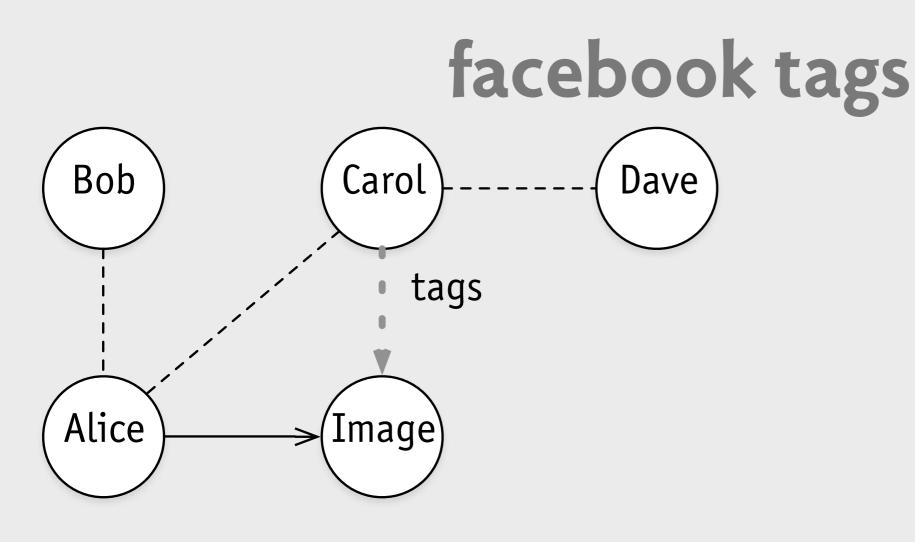
> Nigel Cross (1982) Designerly Ways of Knowing excerpted from RCA report

facebook tags

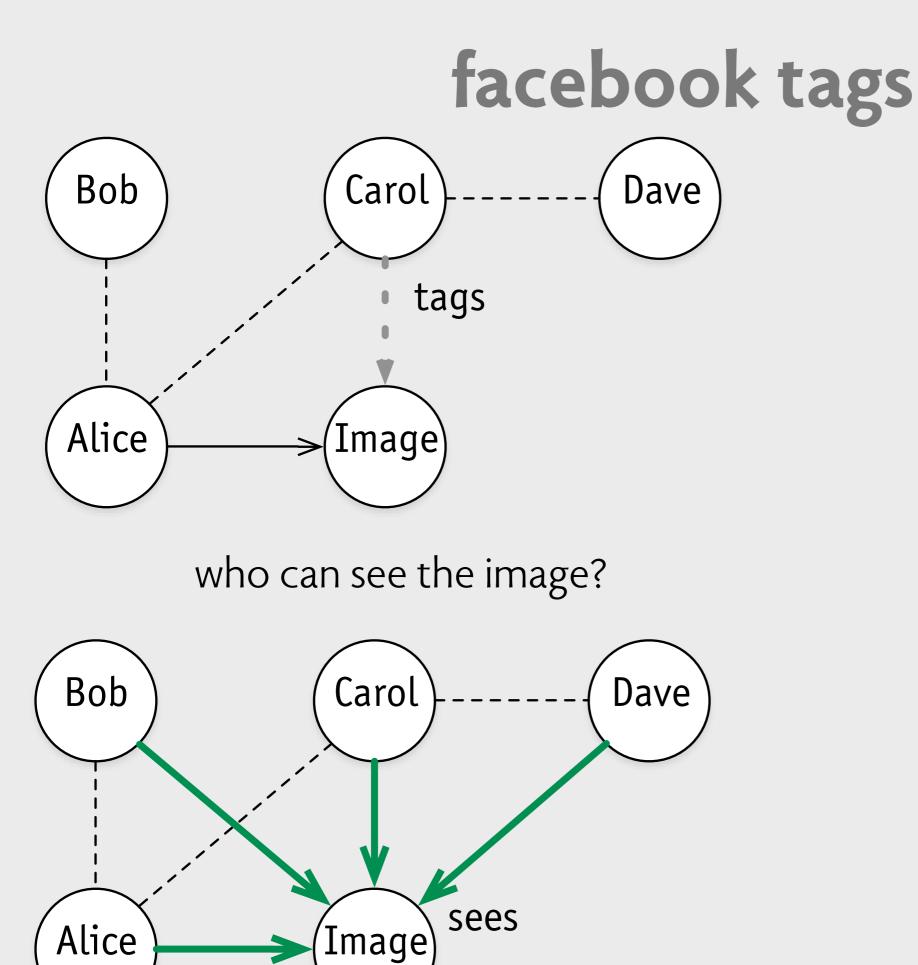


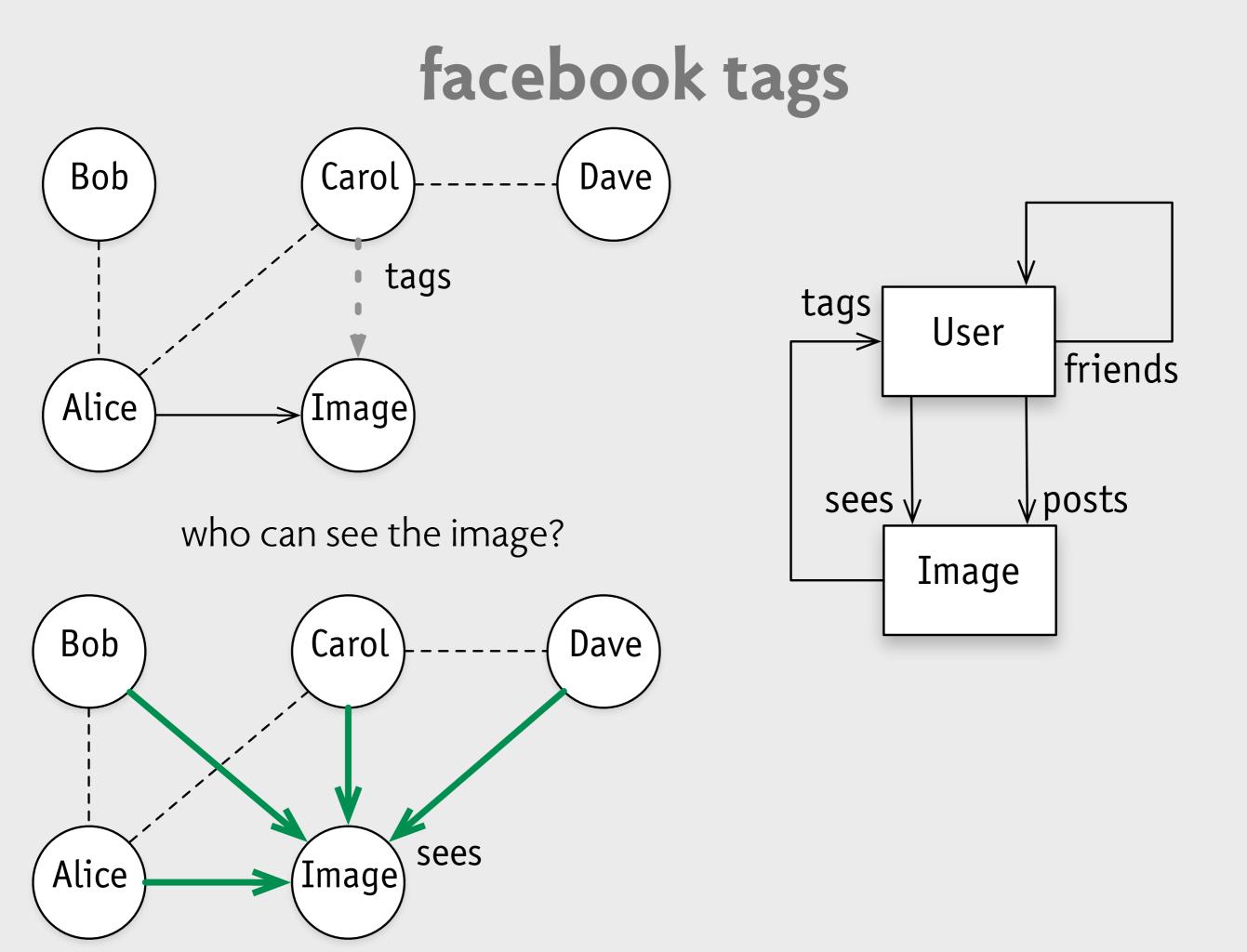


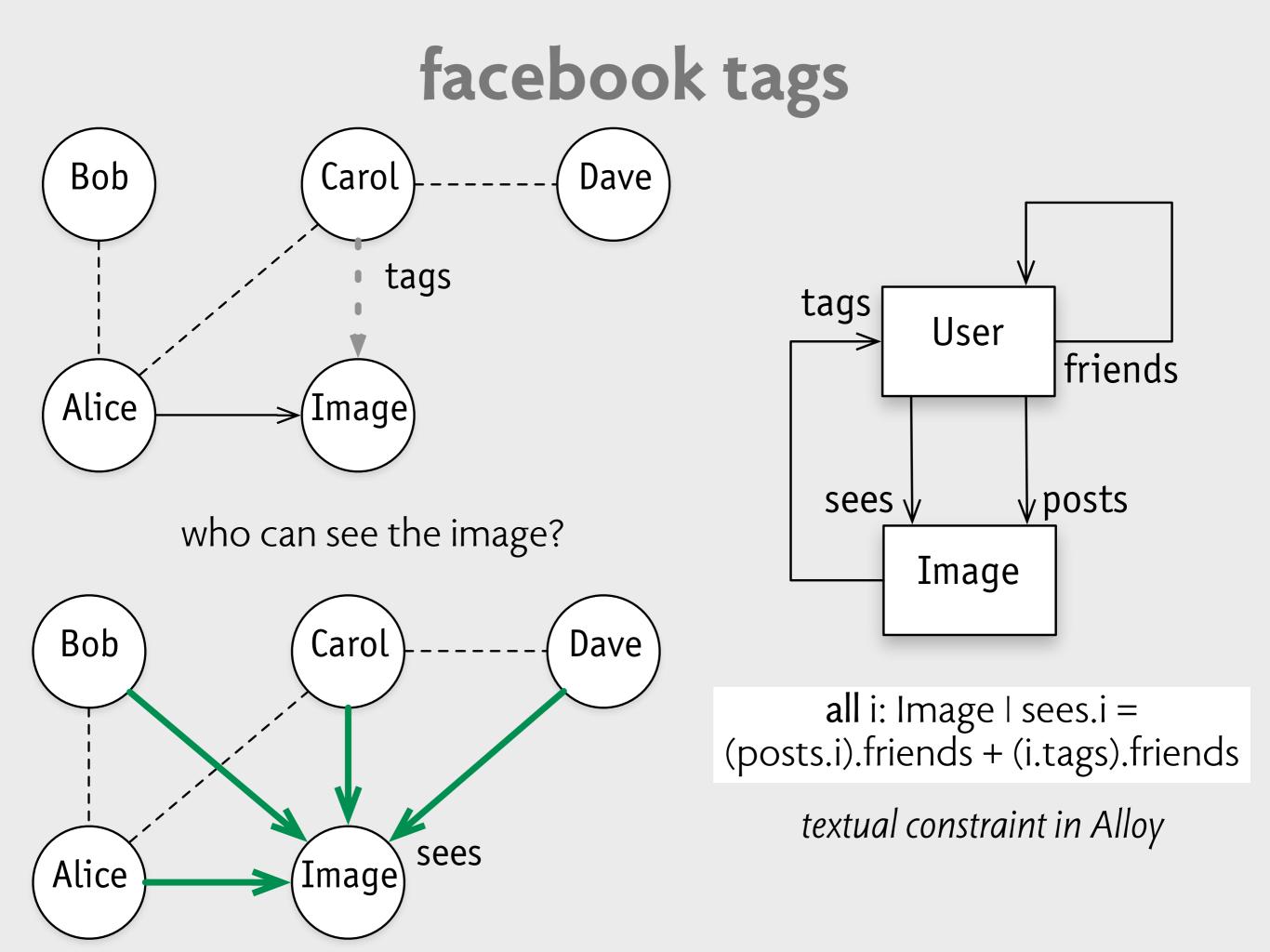




who can see the image?

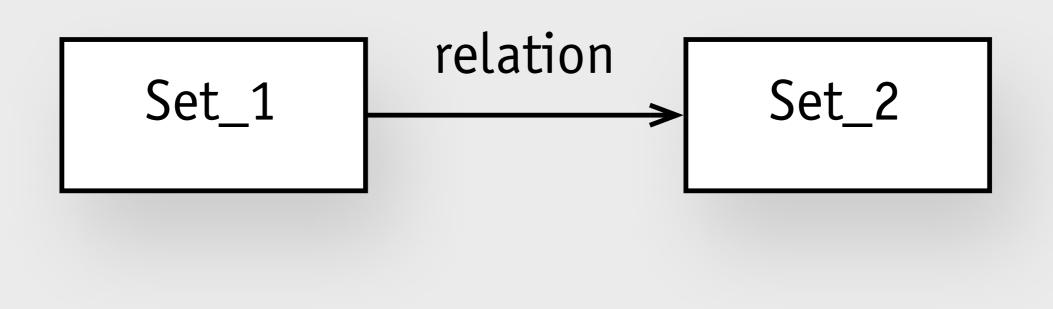




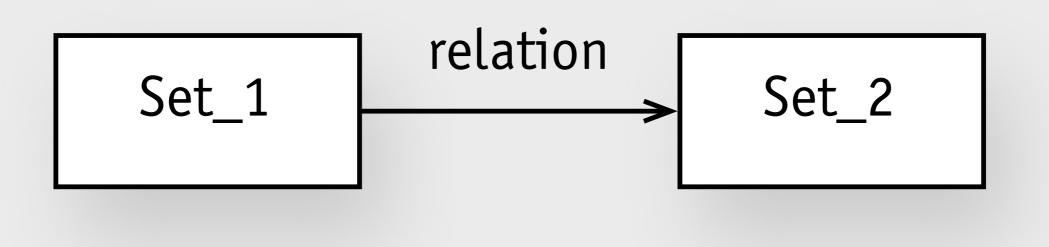


modeling data (ie, state)

modeling data (ie, state)

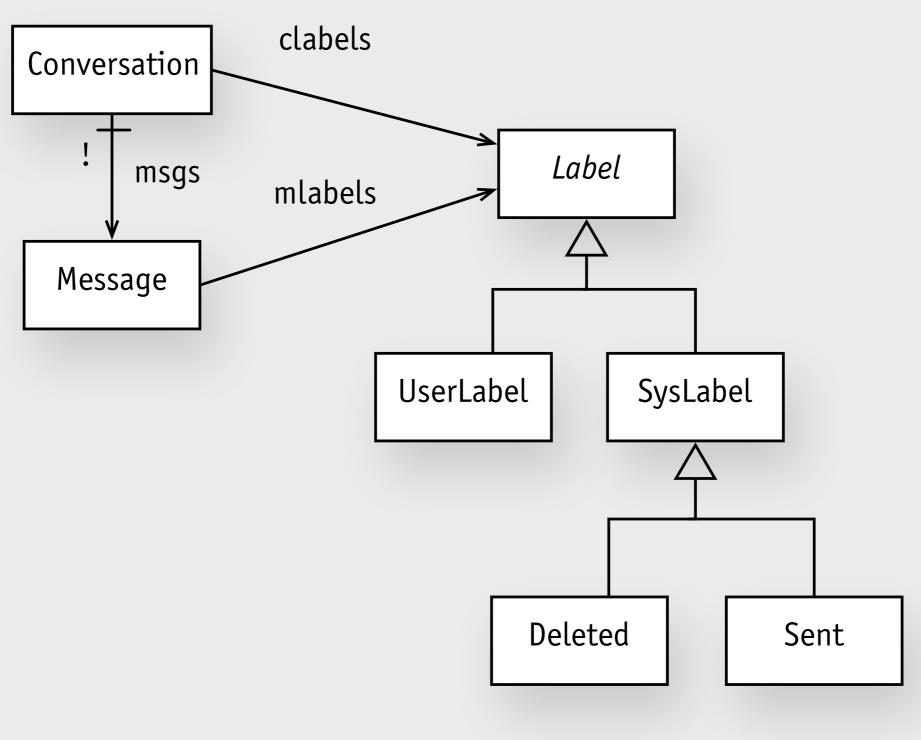


modeling data (ie, state)

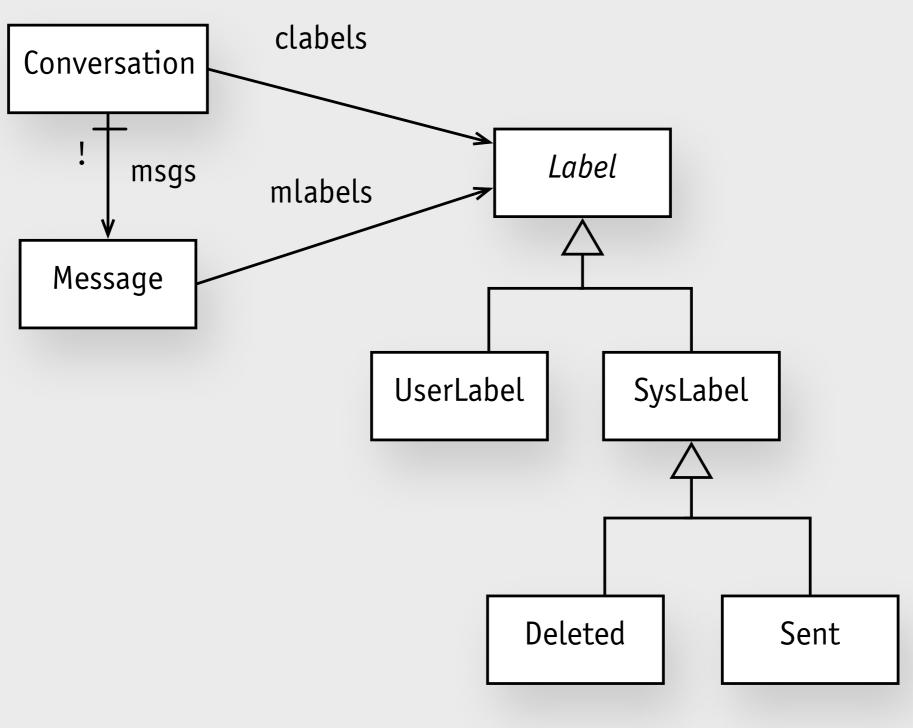


means that: the state includes two sets Set1 and Set2 and a relation that associates elements of Set1 with elements of Set2

gmail labels



gmail labels



constraint that explains conversation labels:

all c: Conversation | c.clabels = c.msgs.mlabels

strange consequences

strange consequences

search for unlabelled messages

in conversation view, shows conversations any conversation that contains an unlabelled message but this conversation may appear to be labelled

strange consequences

search for unlabelled messages

in conversation view, shows conversations any conversation that contains an unlabelled message but this conversation may appear to be labelled

no ops?

deleting then adding a label adding then deleting a label both can modify a conversation

strange consequences

search for unlabelled messages

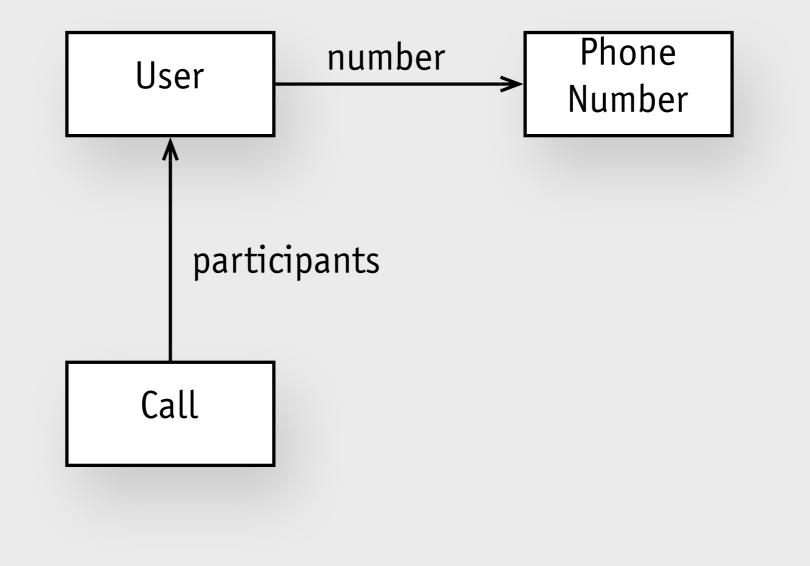
in conversation view, shows conversations any conversation that contains an unlabelled message but this conversation may appear to be labelled

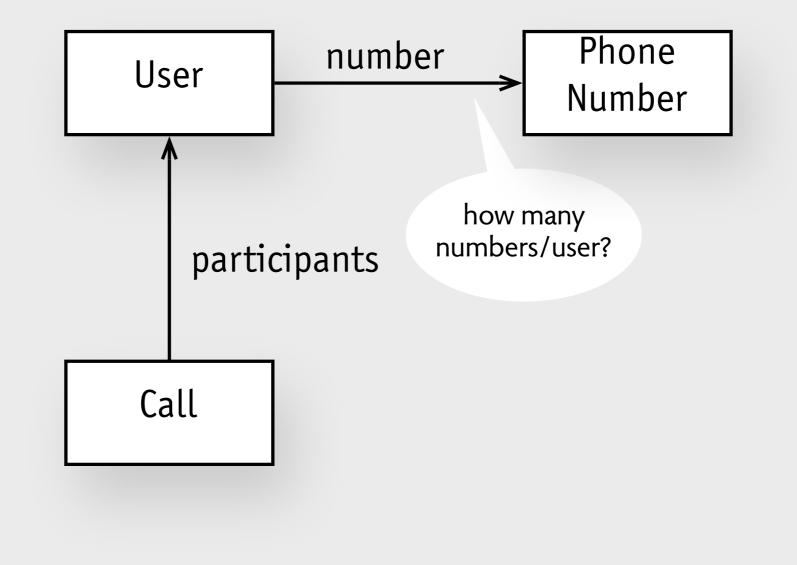
no ops?

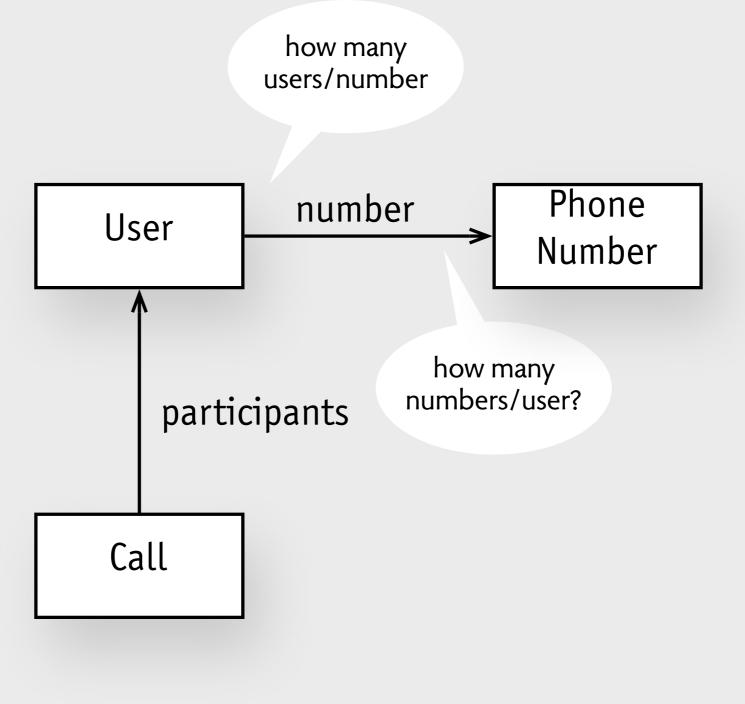
deleting then adding a label adding then deleting a label both can modify a conversation

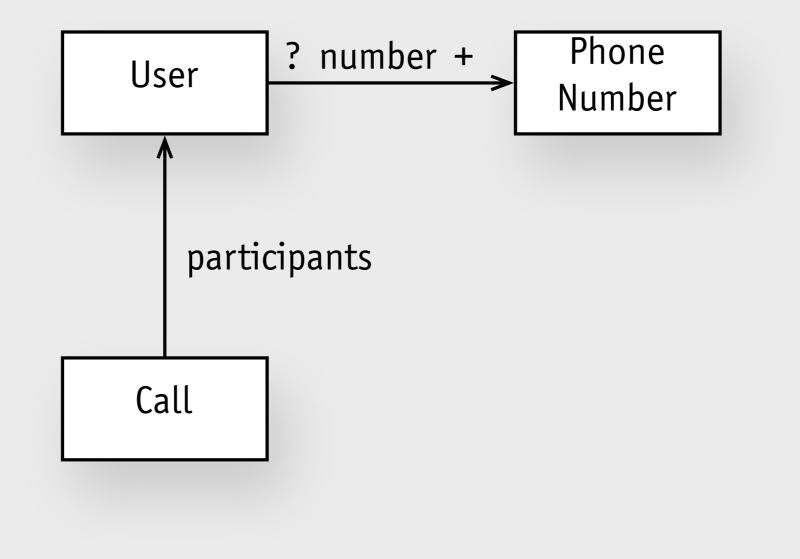
a puzzle

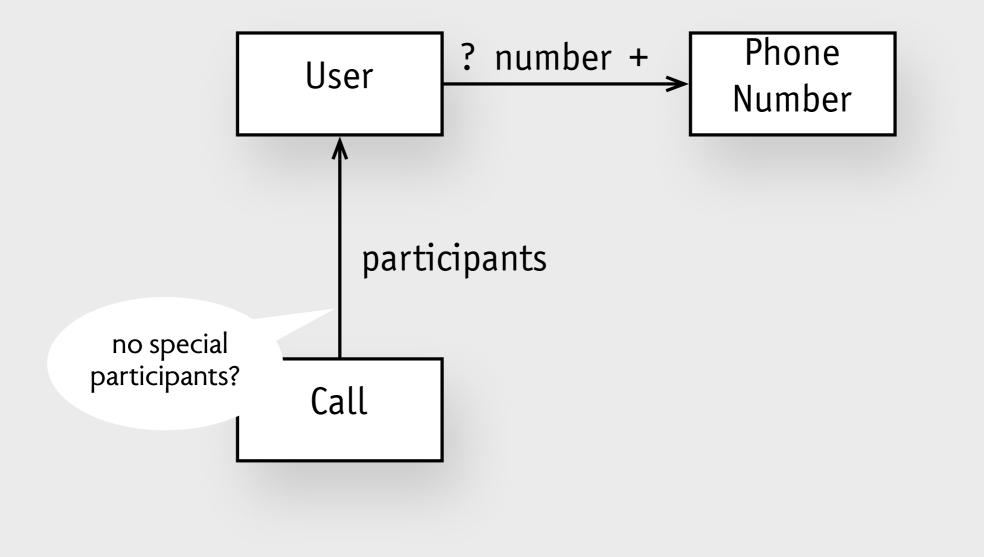
can a conversation have a Sent label?

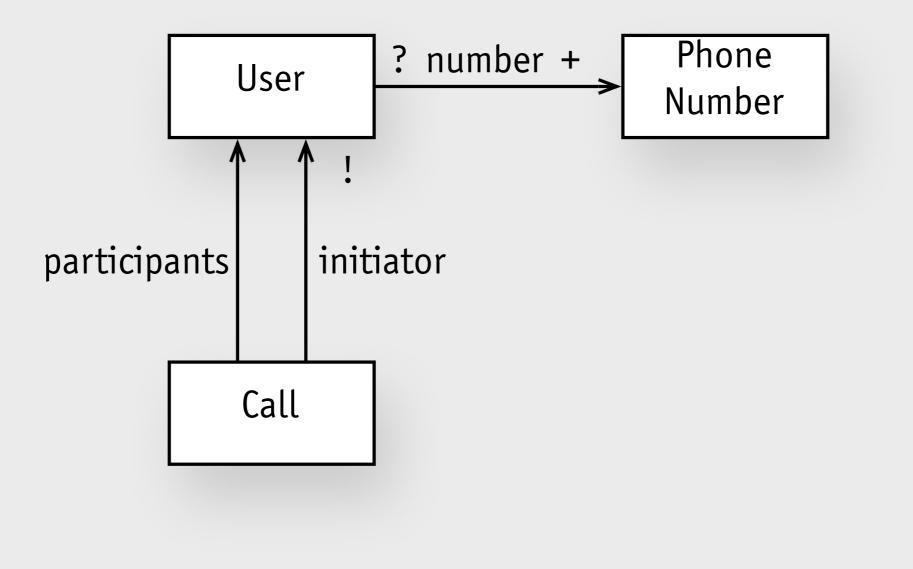


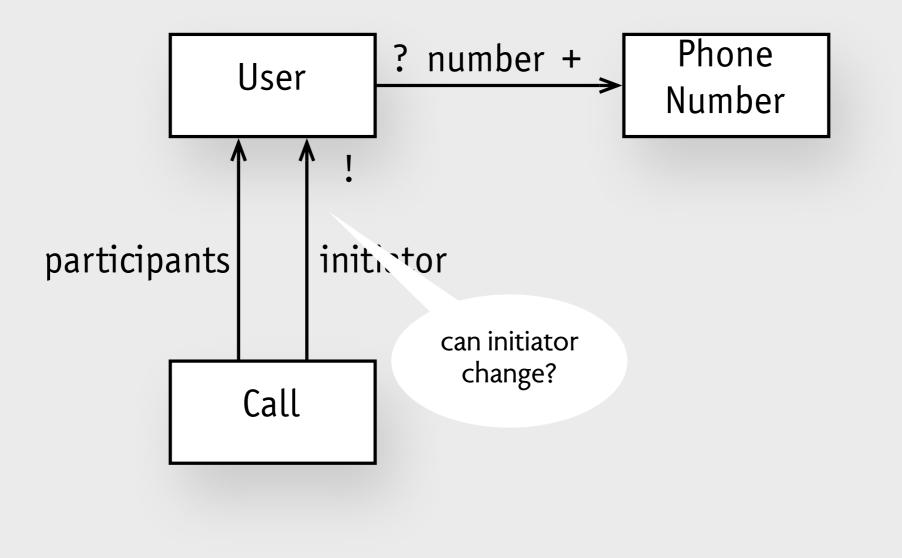


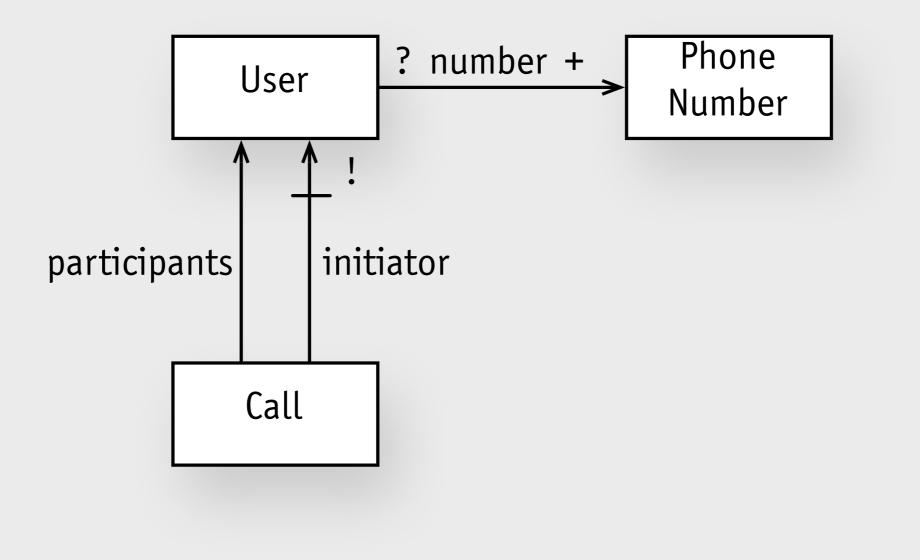


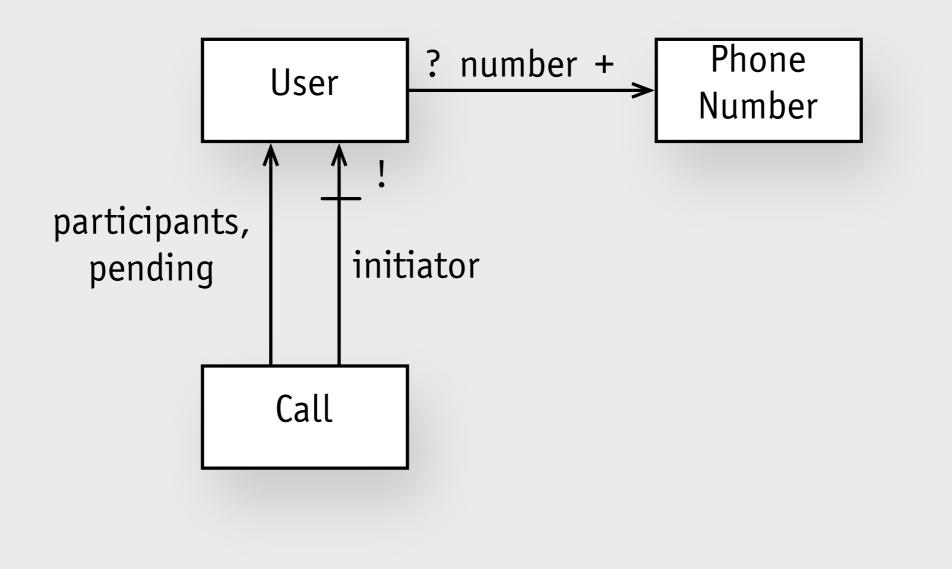


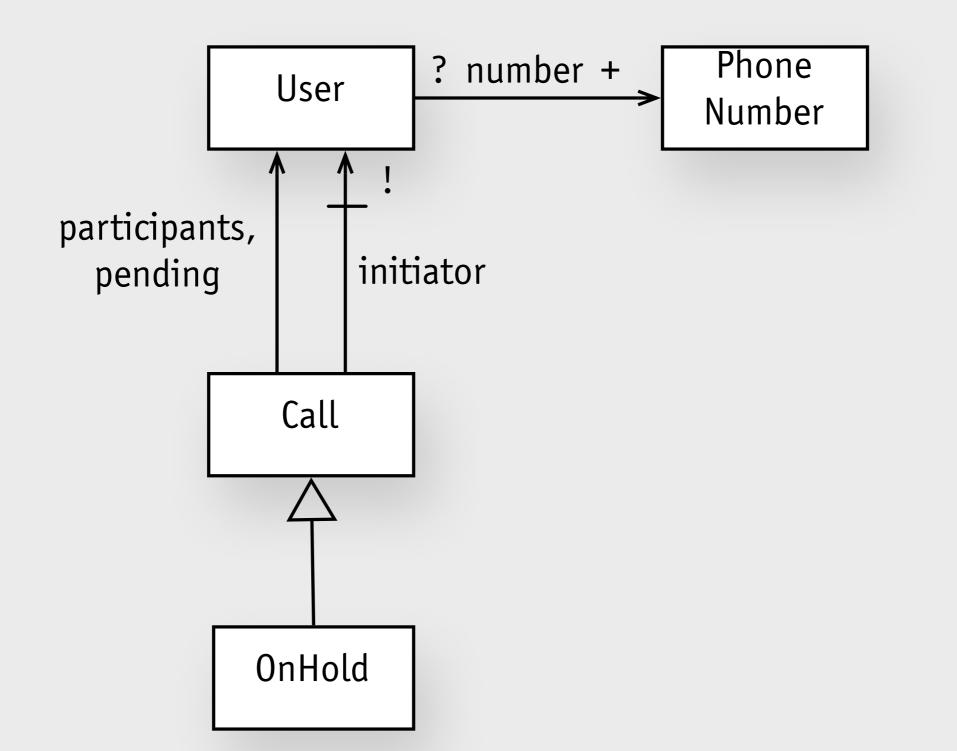


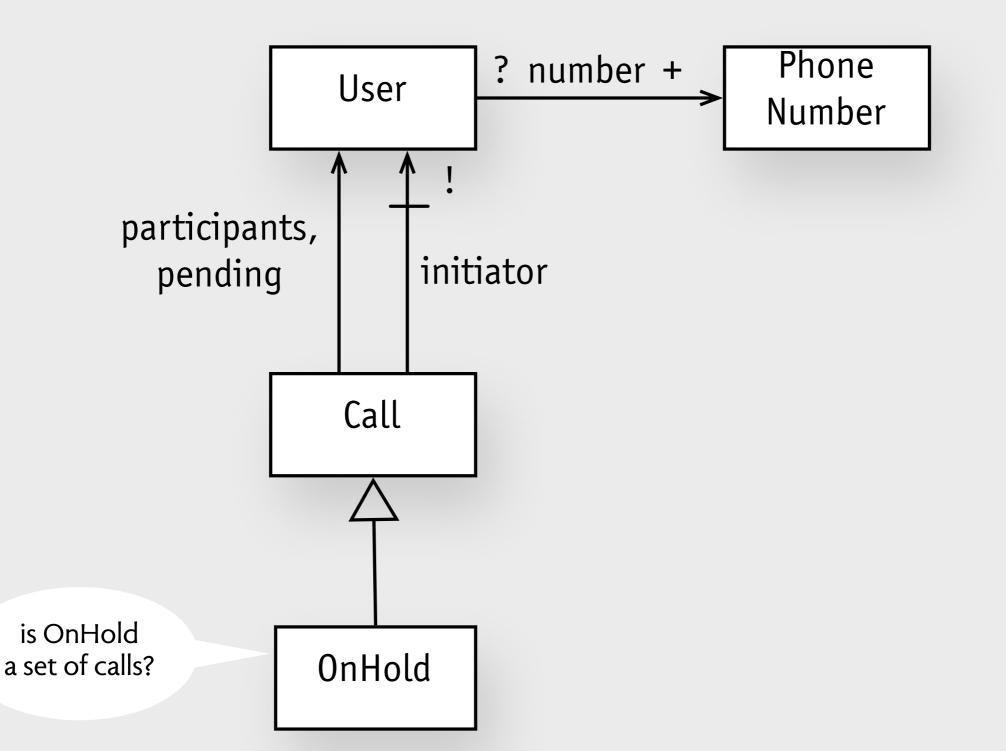


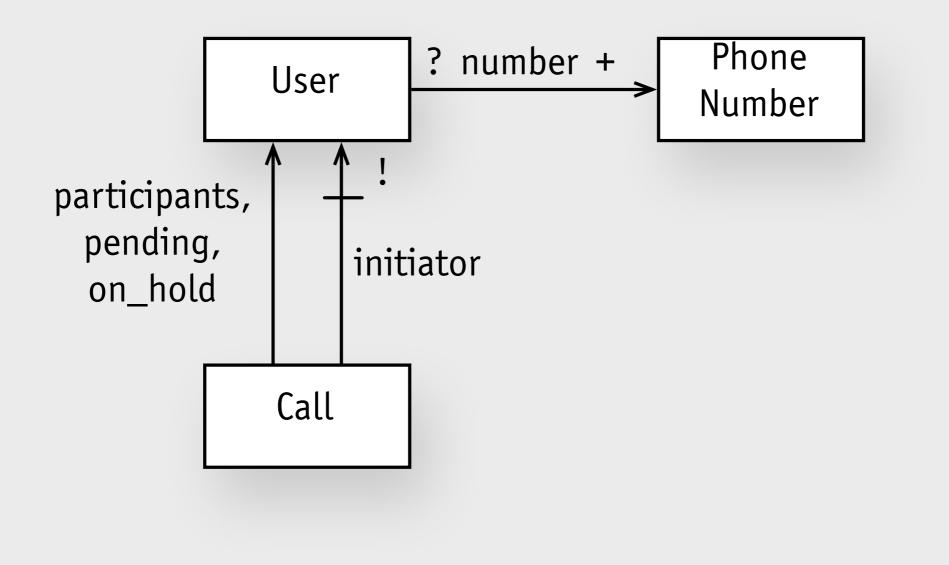


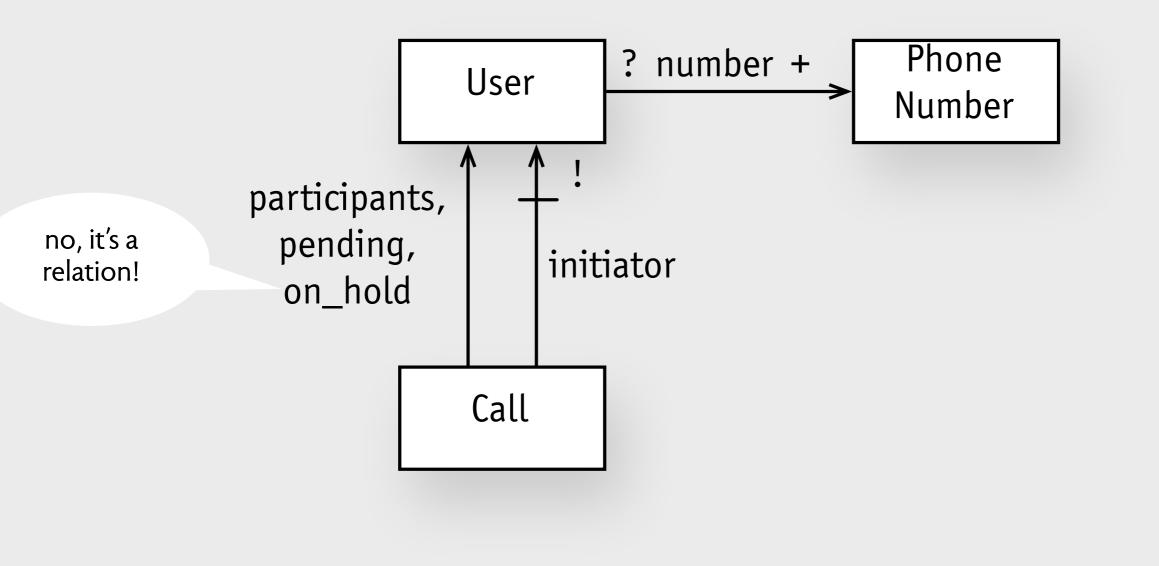












heuristics

sources of heuristics







Jakob Nielsen 10 Usability Heuristics



Ben Shneiderman 8 Golden Rules

Don Norman Design of Everyday Things

Bruce Tognazzini First Principles of Interaction Design

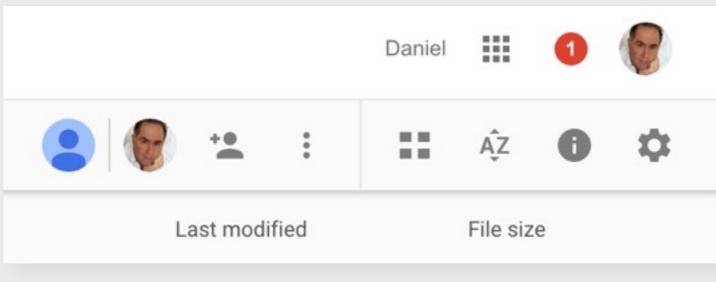
consensus heuristics

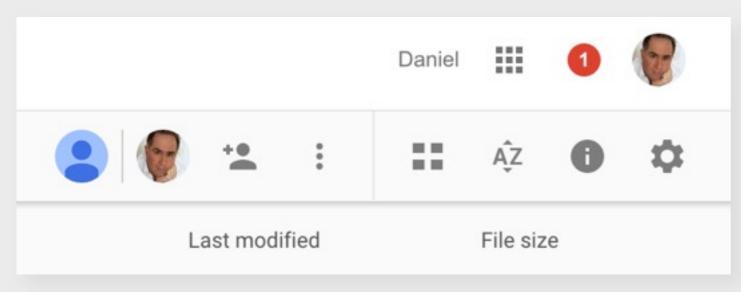
visibility of functions, state, feedback

Consistency within app, platform, domain, culture

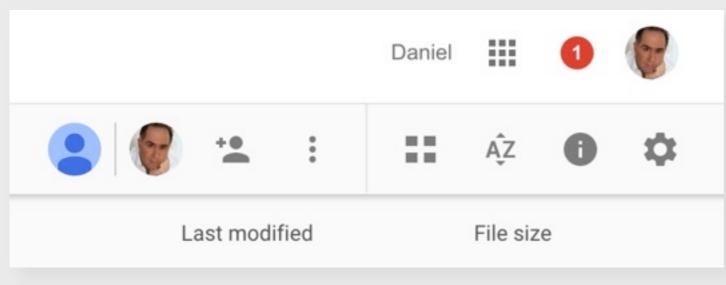


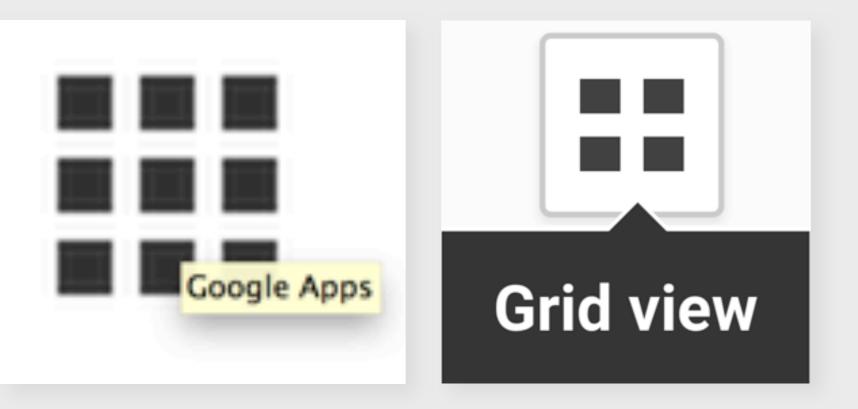
prevent errors

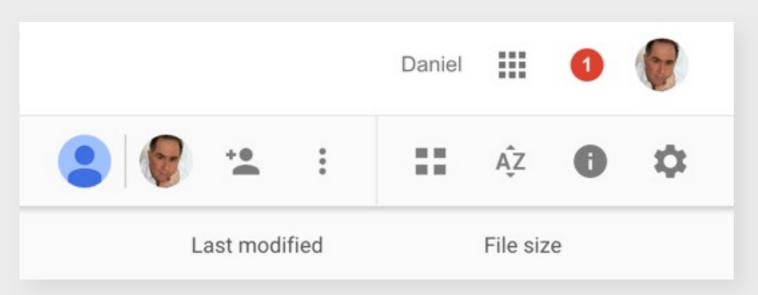




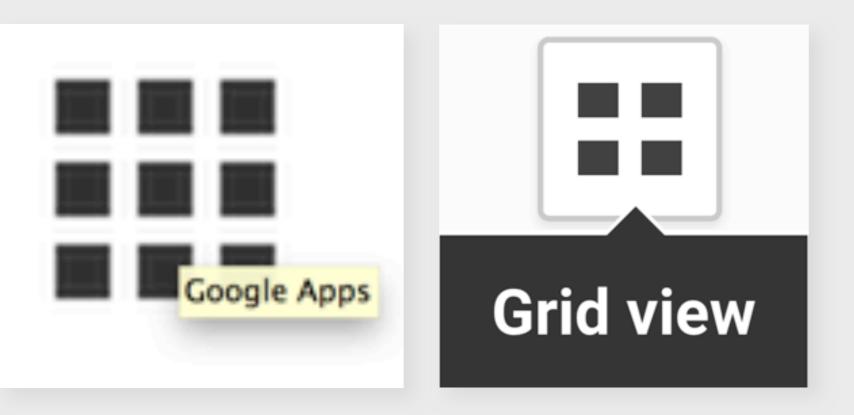




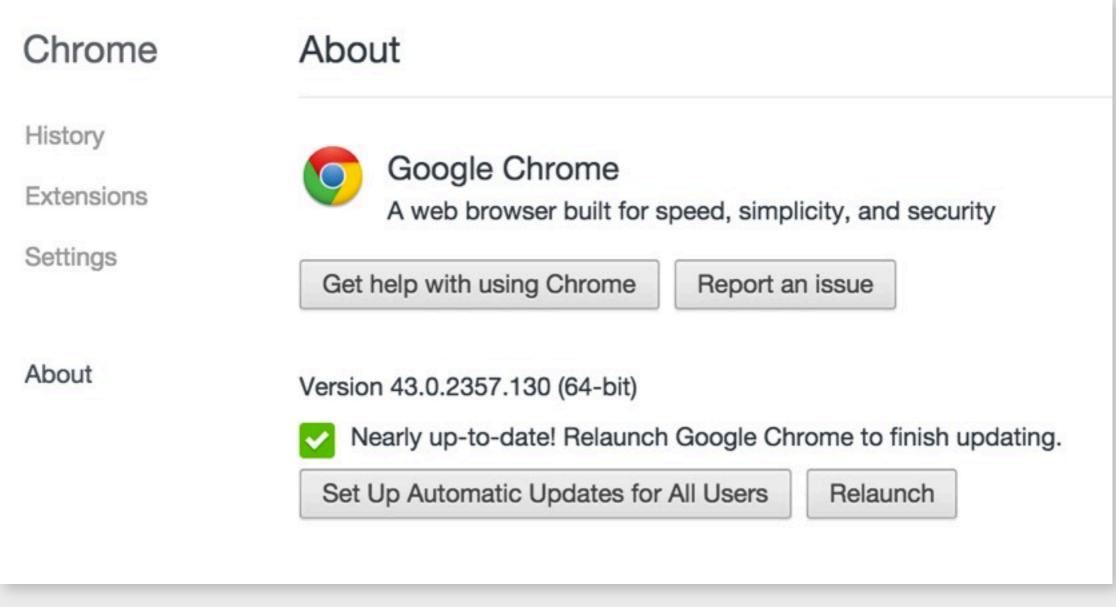




design lesson: make sure same name or symbol used for a function or feature throughout



cultural consistency



why is 'History' greyed out?

heuristic: information scent

Award Winners

Caldecott Medal (107) Man Booker Prize (54) National Book Award (49) Newbery Medal (84) The Pulitzer Prize (46) Hugo & Nebula Awards (25) Eisner Award (39)

Packaging Option

Frustration-Free Packaging (9)

Promotion

Bargain Books (142,908)

Avg. Customer Review

*** **	& Up (2,903,157)
***	& Up (3,274,714)
***	& Up (3,378,179)
*****	& Up (3,481,555)

amazon.com

books

what's new new releases pre-orders NY Times bestsellers Target Club Picks Only at Target

featured categories

book deals Rosetta Stone John Green Dr. Seuss signed books

kids' books baby-3 years 4-8 years 9-12 years teen Common Core State Standards all kids' books

ToysRUs.com

heuristic: information scent

Award Winners

Caldecott Medal (107) Man Booker Prize (54) National Book Award (49) Newbery Medal (84) The Pulitzer Prize (46) Hugo & Nebula Awards (25) Eisner Award (39)

Packaging Option

Frustration-Free Packaging (9)

Promotion

Bargain Books (142,908)

Avg. Customer Review

*** **	& Up (2,903,157)
***	& Up (3,274,714)
***	& Up (3,378,179)
አስራስሳጵ	& Up (3,481,555)

amazon.com

books

what's new new releases pre-orders NY Times bestsellers Target Club Picks Only at Target

featured categories book deals Rosetta Stone John Green Dr. Seuss signed books

kids' books baby-3 years 4-8 years 9-12 years teen Common Core State Standards all kids' books

ToysRUs.com

design lesson: give good scent to aid information 'foraging'

design thinking will change software development

design thinking will change software development brings good ideas user-centeredness incrementality prototypes

design thinking will change software development brings good ideas user-centeredness incrementality prototypes applied to software focused data models usability heuristics concepts & purposes