## week 02

### **Activity Theory and HCI**

#### Implications for user interfaces

### **Lecture Outline**

- Historical development of HCI (from Dourish)
- Activity theory in a nutshell (from Kaptelinin & Nardi)
- Activity theory and design implications for HCI

### **Historical Development** of User Interfaces

From electrical to embodied interactions

"Our experience using computers reflects a tradeoff made more than 50 years ago. We are now in a position to reconsider the trade-off." From *Where the Action Is* (Dourish, 2001)

### **Historical Development of UI**



#### Historical Development of HCI Electrical



- Special purpose devices

   (e.g., automatic calculation
   of missile trajectories,
   patterns in coded
   messages)
- Held a sequence of instructions in its memory.
- To program the machine for different tasks, electrical circuits need to be changed
- Interacting with the system required a thorough understanding of the electronic design

The Small Scale Experimental Machine, AKA "Baby" built at Manchester University in 1948.

#### Historical Development of HCI Symbolic

(Excelse expression of a contract of a co

- Introduction of programming systems (e.g.,assemblers)
- Symbolic forms of interaction is not textual (e.g., punched cards)
- More regularized instructions available across a wider range of machines





IBM 29 card punch (circa 1950's)

#### Historical Development of HCI

#### **Textual**

<pre>NLSE Strees sendedigr strand g senistig T100/ANS1 SecAMPLA</pre>	SCREEN(1) SCREEN(1)		99:12   skate 15 zestato	(+pame)		
Stress - secondity: Askano y emalecja TUB0/ASSI SEXADALA SEXADALA SEXADALA SEXADA	94.7mi		99:12 99:12 Asis/9675529	Hares Py		
<pre>SELAMELA</pre>		screen - menedger ekranu z emulacją VT100/AMS1	99:12   ehe	ofLere		
<pre>strees : cocid teamsons is commentary: strees : field teamsons is commentary: strees : field teamsons is construction is the street is the stre</pre>	AND ADMITS		89117 Ref 1/6575876			
<pre>street : filed itterionil; street : filed i</pre>	100,000	screen (-spcig) (kamenda [arguments])	99:13   a la zacrumam luz sprzatac.	Aps With		
<pre>stream - * # imaginizing into interactive cases i cases they drain first contention into interactive interactive cases i cases they drain first contention into interactive interactive cases i cases interactive cases contention into interactive interactive cases i cases interactive cases contention interactive interactive cases i cases interactive cases interactive cases interactive cases i cases interactive cases contention of the interactive cases i cases interactive cases interactive cases interactive cases interactive cases interactive cases interactive ca</pre>		screet or [[aid-litta: heat]]	2011) TITLE FAIL ALL ALL A	Asse		
<pre>pris Screen jest pelanetranopys menderes alies, they divid jury of this first of the period of</pre>		screen of wingcicielises11/[[aid-]11s[-bost]]	P9:14 ofLara/8647675	144.0454		
<pre>Sizes: jest petrovekrancovy mendderem often. stary drilt file. City ferminal stary hilks processal (rayh interastyre interasting int</pre>	4034		02:14 05. 05:14	Kenne in		
<pre>Cov_statistic support kitsens processes: [Payth: interactivelying] providence: [Payth: interactive forming: [Payth: interacti</pre>		Screen jest petnoekranowym mehedberem oklen, który dzieli fizy.	09:14 ofLara/8647675	Maner (a		
<pre>Particle.components.componen</pre>		cony terminal migdzy kilkons processes (owyhle interaktywnymi	p9:14   a ja nie wiem, czy bede mogl przyjsc	Ratel, Ge		
<pre>criterion with mines the state of the s</pre>		powtokami). Kajdy z wirtustrych terminali daje funkcjanalnojc	P0:14	2449 (39		
2222 [vb, vitao/sunk link 1 solitop vital 2 station 2 maked Git A station vitao/sunk link 1 solitop vitals 2 maked erst witao/sunk vitao/sunk 1 solitop vitals 2 maked 2 maked protectional obstation vitability protectional obstation vitability solito 2 solitop vitability vitability vitability solitop vitability vitability solitop vitabili		sterujące ze standardów ISO 6492 (ECMA 48, AMSI X3.64) graz ISO	19114			
01. Kadego wirtwitego fermindle istelege befor grzwijski drzy wirtwite obszałw tekistw zajeży skaasi. W szeczie oby śrzeż jest wyrityway, tworzy pojedysze ska z płekaj lyk jest wiely i skawy wiely wiely wiely wiely i wiely i skawy skawy i skawy i skawy i skawy i skawy i skawy i skawy i z bekaj lyk jest wiely i skawy i skawy i skawy i skawy i skawy i rokaj i skawy i rokaj i skawy i skawy i skawy i skawy i skawy i skawy i rokaj i skawy i skawy i skawy i skawy i skawy i skawy i rokaj i skawy i skawy i skawy i skawy i skawy i rokaj i skawy i skawy i skawy i skawy i rokaj i skawy i skawy i skawy i skawy i rokaj i skawy i skawy i skawy i skawy i rokaj i skaw		2022 (rp. wstaw/usu6 linie i obstuge wielu zestawów znaków).	P9:14			
<pre>drag metchanis ( vg)(manis ( vg)(manis ( vg)) priesestemic obstants obstants ( vg)(manis ( vg)) y seesectice, ofy signed ( vg) ( vg)(vg) ( vg</pre>		Ola kazdego wirtualnego terminala istnieje bufor przewijanja	09:16 Asta/9675029			
<ul> <li>V sesencie, přy spířed vyvělyvany, kvířež poledynože skou</li> <li>Povětka (lub z počána kanemáj), a nastepské v dovánicej čhrůji, kvý najš dyvě (zme palinetizanove jiho z šintymi prigramani (řevětě z dodetlavymi povětanani), záhl čisiniej(te data), zobaczyć liste okizno, vląčzyć raportovanšé v dyvěné v dována pakter zobaczyć liste okizno, vląčzyć raportovanšé vyjícla, vklejać</li> <li>Ranul pape strevníli liseli</li> <li>Anze datažu Pokata Zanja Decja vzihan z pokately (zme palinetizanov ježe vzihately), kvě tše vsilečních j tak ladnici ( vlata)</li> <li>Anze datažu Pokate Zalazdova Jeneja vzihan z pokately (zme palinetizanov ježe vzihately)</li> <li>Pokately (zme palinetizanov vetezaje vzihately)</li> <li>Pokately do vakloslalatela</li> <li>Pokately do vakloslalatela</li> <li>Pokately do vakloslalatela</li> <li>Pokately vatrovice i lakažne</li> <li>Rakažné zakažne vetezaje tych pakistáv.</li> <li>Pokately vatrovice i lakažne</li> <li>Pokater se irc( 251 - 04)</li> <li>Pokate vatrovice i lakažne</li> <li>Pokate vatrovice vatrovice i lakažne</li> <li>Pokate vatrovice vatrovice vatrovice vatrovice</li> <li>Pokate vatrovice vatrovice i lakažne</li> <li>Pokate vatrovice vatrovice i lakažne</li> <li>Pokate vatrovice vatrovice vatrovice vatrovice</li> <li>Pokate vatrovice vatrovice vatrovice vatrovice vatrovice</li> <li>Pokate vatrovice vatrovice vatrovice vatrovice</li> <li>Pokate vatrovice vatrovice vatrovice</li> <li>Pokate vat</li></ul>		orgenetrenie obszarów tekstów miedzy oktami.	29116   # spytes/ 514., 29116			
<ul> <li>W essencia, off interposed of the second of t</li></ul>		freedomente entre	09:16 ofiara/8647675			
<pre>pouting (ub z podaną kowenieg), a matigapsież zolka / drogi, abej abej w archairy (podalawa), zakić sinigal programma (również z dwatkawymi podazaci, zakić sinigal dweje wyjącia, wkiejst // akie robazyć ling obietawij, zakić sinigal dweje wyjącia, wkiejst // akie // akie // akie// accessing circhilj line ] // akie // akie// accessing circhilj line ] // akie// accessic circhilj line ] // akie// accessing circhilj line</pre>		W momencle, pdy screen jest wywetywery, tworzy pojedyncze okno	99:16   ee			
<pre>wept breet of years from performed reaching the between of the second of the seco</pre>		z powioką (lub z podaną komendą), a następnie znika z drogi,	P9116			
<pre>Créwnise: 2 defaultevyeit poulexent). 2xhif isticlete anna Producty fiste state. Velopret are supported and Arres careal pour streen(1) line 1 Arres supported by this server Arres the server server Arres the server Arres the</pre>		models stworzyć nowe pelnoskranowe skna z istywi programami	99:16   wer sie unminchnij tak tadnig:)			
Dobszyc Listę okies, włączyć reportowanie wyjącie, wkiejsć         Benou post strenili ime 1         O         Benou post strenili zwajne strenili zwajne sprje wsiaki Pease CTF Mews 7 Pease strenili zwajne sprje wsiaki Pease CTF Mews 1 Pease strenili zwajne sprje wsiaki Pease CTF Mews 2 Pease strenili zwajne sprje wsiaki Pease Pease strene in Pease strene st		(rownie: 2 dodatkowymi powiekami), zabić istniejące okna,	P9116			
<ul> <li>And a set of the set</li></ul>		zobaczyć listę okien, włączyć raportowanie wyjścia, wklejać	(09:17) (ofiara/0647675) (wis/2(Asia)			
<pre>Pact Control Package Statements Statements Statement Package Pack</pre>	Planua -	t page screen(1) time 1	4516	_		
Lilly   Segret 9 retrymed Light Tr Cestered Nestgate And Lances	Destap	ene 3, Pomer g Zahogrz u zektusinij gi Instaluj/wend pekiet de 8.4 2 Dingendii: Zvoini sig 45540 na dysku Alety de valutusinienia we pakiety Instalmene pakiety Rzalmitalowine pakiety Rzalmitalowine pakiety Rzelnia Rety wirtusine dania ne są newsje wersje tych pakietów.	<ul> <li>MARIISSI-BEIILDÖ MARIAACCIS-4 CHAMTUPES-46 Inre supportents server</li> <li>CHARINET-AL, 56 CHAMWELLEN-50 CHAMTUPES-46. Inre supportents by Hist server</li> <li>INGAACON provide the list server</li> <li>INGAACON provide the lis</li></ul>	ex-1		
1 - 1 Eaters	1111/	] Support 9 patroyana	[Lag 17]	- E1111		
	1		1 hitchi			

- Takes advantage of the best-developed form of symbolic interaction: written language
- More like a "dialog"

#### Historical Development of HCI

Symbolic

### Graphical

🗳 File	Edit Vie	w Specia	al			1
	\$	ystem Too	ols 1			
4 items		665K in dis	k	115K avai	lable	<b>N</b>
=	System Folder	= Suctor	Utilities Folder	٢		System Tools 1
15 items		<u>= system</u> 665K	in disk		115K available	The Mac 512
System	Finder	MultiFinder :	Sor apbook File	Clipboard File	General	
r∰))) Sound	Mouse	C Handler	Key Layout	Monitors	Keyboard	
Color Color	Startup Device	Easy Access			ন্ট ন স	Trash

Turning interaction into twodimensional space rather than a one-dimensional stream of characters

Macintosh System 4.2, 1987

#### Historical Development of HCI

#### Graphical

🗳 File	Edit Vie	ew Speci	al			
	5	System Too	ols 1			
4 items		665K in dis	k	115K avail	able	N.
	System Folder	r	Utilities Folder	•		System Tools 1
		📕 Systen	n Folder 🗏		9 D	The Marson
15 items		665K	in disk		115K available	The Plac 512
System	Finder	MultiFinder	Sor apbook File	Clipboard File	General	
」))) Sound	Mouse	Č DA Handler	Key Layout	Monitors	Keyboard	
Color Color	Startup Device	Easy Access			<u>र</u> जन्म	Trash

- Peripheral Attention Primary space, secondary space (e.g., windows and dashboards)
- Pattern recognition and spatial reasoning Opportunities to arrange data spatially
- Information density
   A picture really can be worth
   a thousand words (e.g.,
   diagrams)
- Visual metaphors File cabinets, trashcans, desktop tools

Macintosh System 4.2, 1987

### **Embodied Interaction**



Embodied

## Historical Development of HCI Tangible Interaction



- Computation that moves beyond desktop
- Interaction is incorporated more richly in our daily experience of the physical world
- Trend 1: Distribute computation across a variety of devices
- Trend 2: Augment the everyday world with computational power

## Historical Development of HCI Social Computing

Textual





Spark (Vilhjálmsson, 2004)

 The application of sociological understanding to the design of interactive systems

Kismet (Breaseal, 2000)

### **Embodied Interaction**



### **"Computer reaching out"**

Interaction moves from being directly focused on the physical machine to incorporating more and more of the **user's world** and the **social setting** in which the user is embedded. The scope of human-computer interaction is expanding to include larger-scale, longer-term phenomena of computer use. (Dourish, 2004)

### **Activity Theory and HCI**

#### From human factors to human actors

Attempts to incorporate human activity in interaction design have led to ideas of "activity-based," "activity-centered," or "activity-centric" computing. How people actually use technology at work and play.

### **Activity Theory**

Aims to understand individual human beings, as well as the social entities they compose, in their natural everyday life circumstances, through an analysis of the genesis, structure, and processes of their activities.

## Activity Theory Brief Background



Behaviorist (circa 1930's) Observable behaviors

## Activity Theory Brief Background



Behaviorist (circa 1930's) Observable behaviors



Cognitivist (circa 1950's – 1990's) Mental models

## Activity Theory Brief Background



Theory and Practice of Tangible User Interfaces

## Activity Theory Unit of Analysis



People act as **subjects** in the world, constructing and instantiating their intentions and desires as **objects**.



People act as **subjects** in the world, constructing and instantiating their intentions and desires as **objects**.



People act as **subjects** in the world, constructing and instantiating their intentions and desires as **objects**.



Tools mediate between people and the world. Activity theory casts the relationship between people and tools as one of **mediation**.



Theory and Practice of Tangible User Interfaces

## Activity Theory Unit of Analysis



### Activity Theory Example 1

A software team programming a system for a client



### Activity Theory Example 2

#### Being a graduate student at UC Berkeley



### **Activity Theory Concepts**

- Hierarchical structure of activity
- Object-oriented
- Internalization and Externalization
- Tool mediation
- Development



#### Example 1

Activity	Building a house
Actions	Putting the roof up, transporting bricks by truck
Operations	Hammering, changing gears when driving

#### Example 2



#### Example 3





**Object** gives meaning to what people do. Objects separate one activity from another.





Can be physical thing or ideal object

www.boltonmuseums.org.uk





Intentions, desires, prospective outcomes that motivate and direct activity



Object is shaped by explicit and implicit rules, norms, and requirements existing in the local and the wider community.

www.boltonmuseums.org.uk





Intentions, desires, prospective outcomes that motivate and direct activity



The world provides **resistance** and **affordances** to our attempts to reach the object of our activities.

www.boltonmuseums.org.uk



#### Activity Theory Internal and External Activity

Internal activity: e.g., counting numbers in your head External activity: e.g., counting numbers with your fingers

## Activity Theory: Internalization / Externalization

Transformation of external activities into internal ones. Means for people to try potential interactions with reality without performing actual manipulation with real objects (mental simulations, imaginings, considering alternative plans, etc.).



#### Activity Theory: Internalization / Externalization **Externalization**

Transforms internal activities into external ones. It is important when a collaboration between several people requires their activities to be performed externally in order to be coordinated.



## Activity Theory Tools and Mediation

Tools shape the way human beings interact with reality. The shaping of external activities eventually results in the shaping of internal ones, and vice versa.



## Activity Theory Tools and Mediation

Use of tools is an accumulation and transmission of social knowledge.

Their experience is accumulated in the structural properties of tools, such as their shape or material, as well as in the knowledge of how the tool should be used.



## Activity Theory Development

Human activity unfolds over time in a historical frame.

The long view: we cannot understand activity if we do not watch it cycle, grow, change. It would be desirable to establish a practice of design in which the development of users – their ability to grow and change with technology.

### **Activity Theory: Summary**

- Hierarchical structure of activity
- Object-oriented
- Internalization and Externalization
- Tool mediation
- Development



# Why Should We Care about Activity Theory?



#### Designing Human Activities, Not Just Tools



### **Thanks!**