

# W E L C O M E

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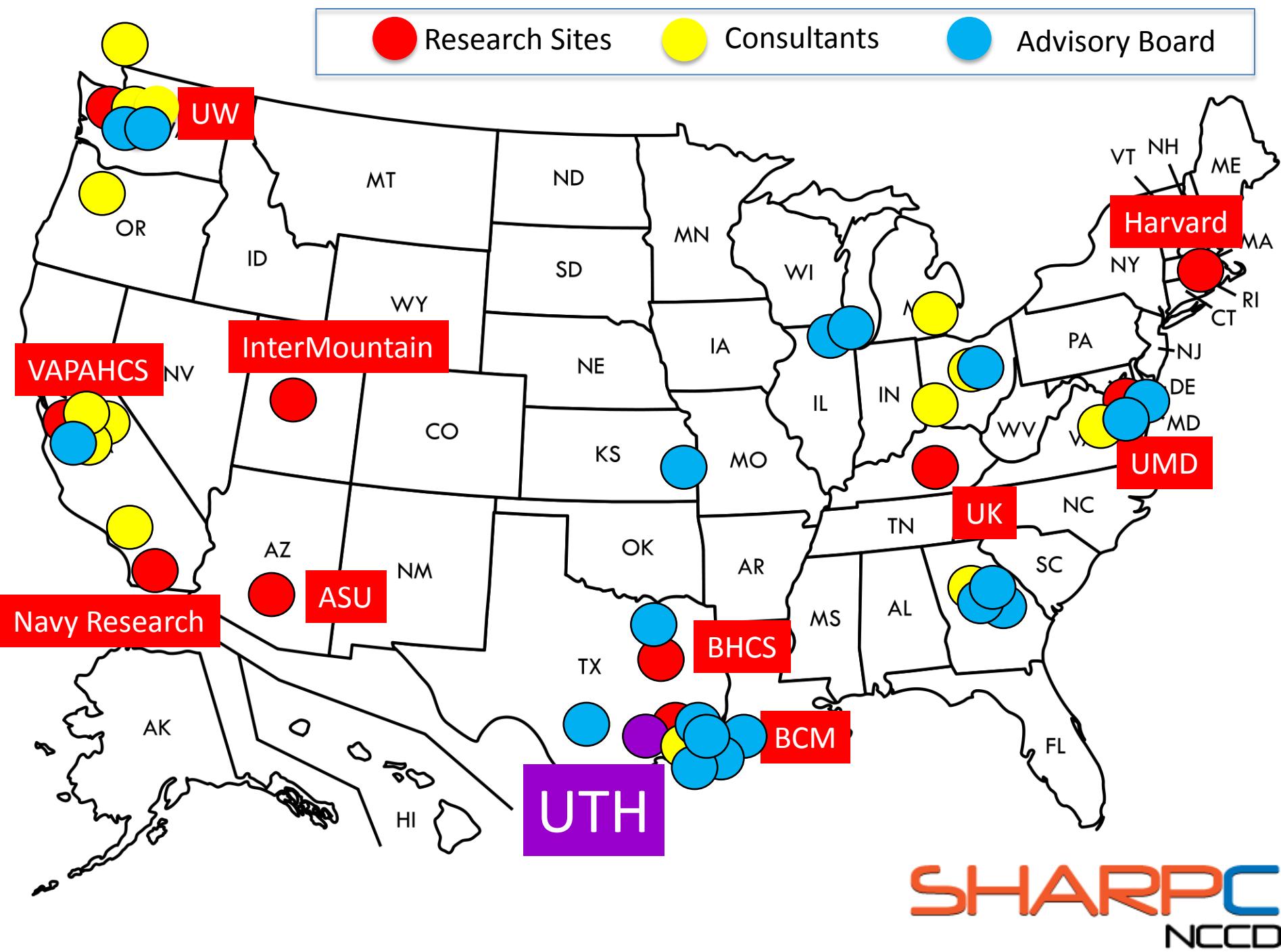
## EHR Usability: Present & Future

Organizer: SHARPC

Co-Sponsors: ONC, AMIA, HIMSS

# SHARPC

- One of four ONC funded SHARP projects
- Focus on Patient-Centered Cognitive Support
- Operate under National Center for Cognitive Informatics and Decision Making in Healthcare (NCCD)

 Research Sites Consultants Advisory Board

# Meaningful Use of EHR

through

## Meaningful Practice of Usability

Jiajie Zhang

Director

National Center for Cognitive Informatics & Decision Making  
in Healthcare



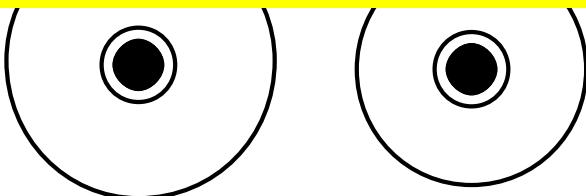
# What is Usability?

- The heart of usability is Representation Effect:
  - Different representations of a common structure can generate
    - dramatically different
      - efficiencies
      - complexities
      - outcomes

# Stove Tops

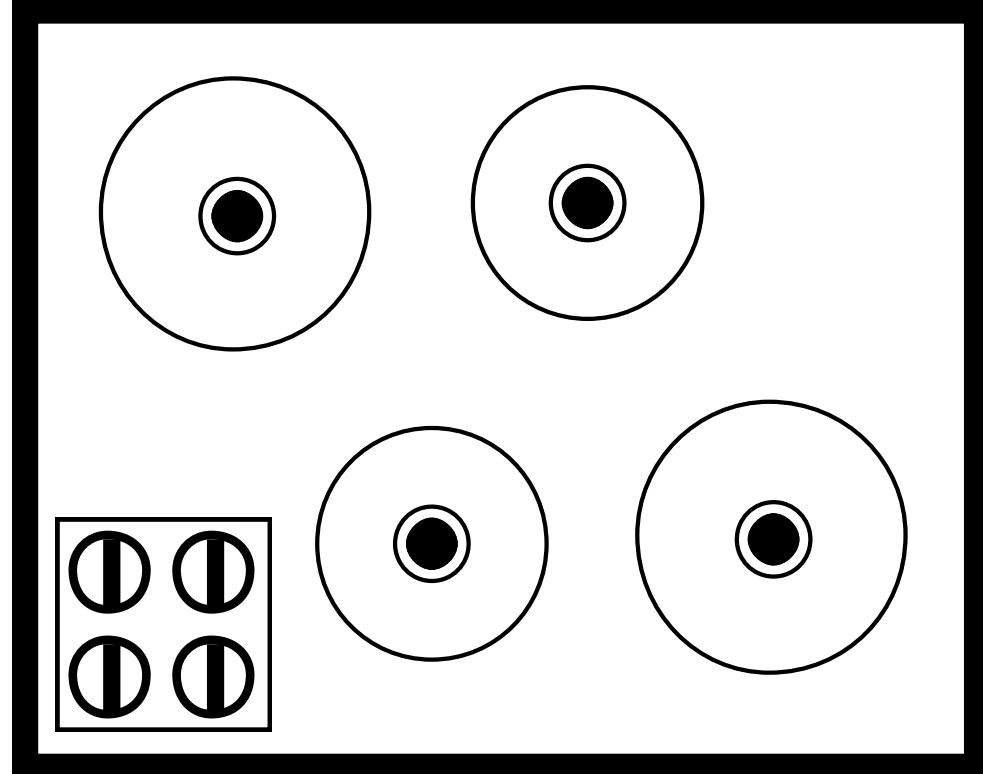
## Different Designs -> Different Consequences

- Harder to use
- Never memorize
- More errors



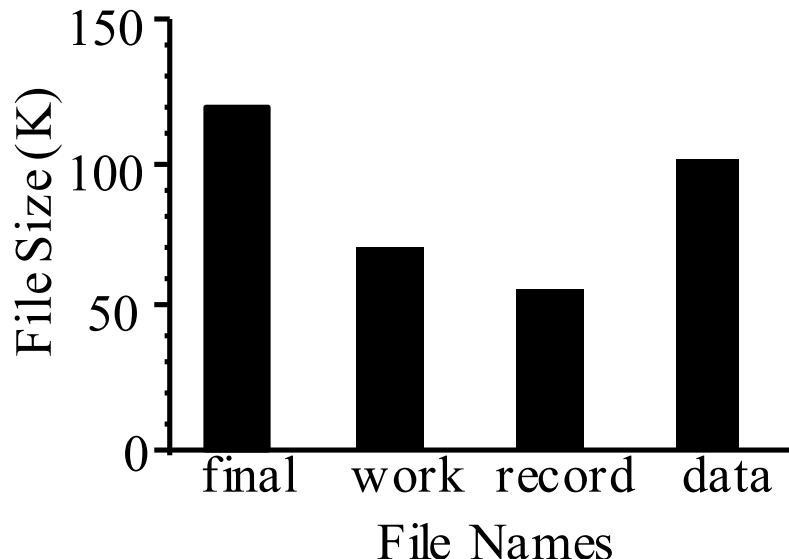
Back Right    Front Left    Back Left    Front Right

(A)

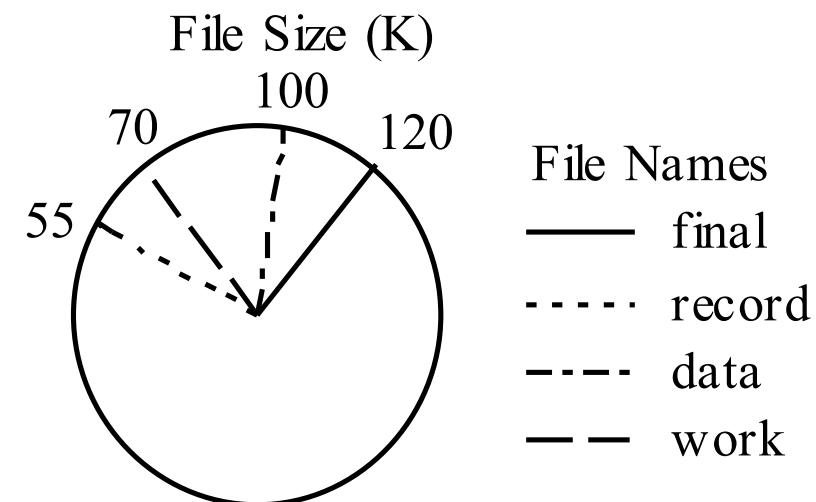


(B)

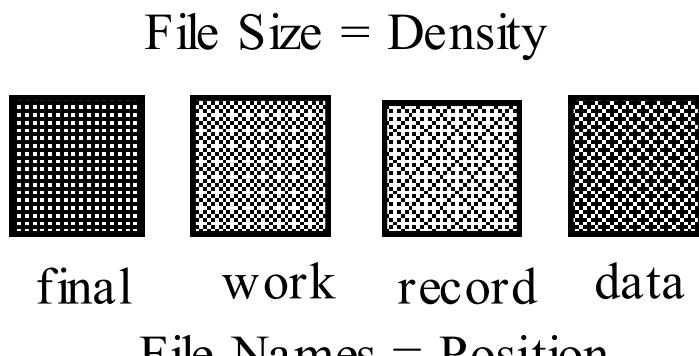
# Same Variables <-> Different Designs



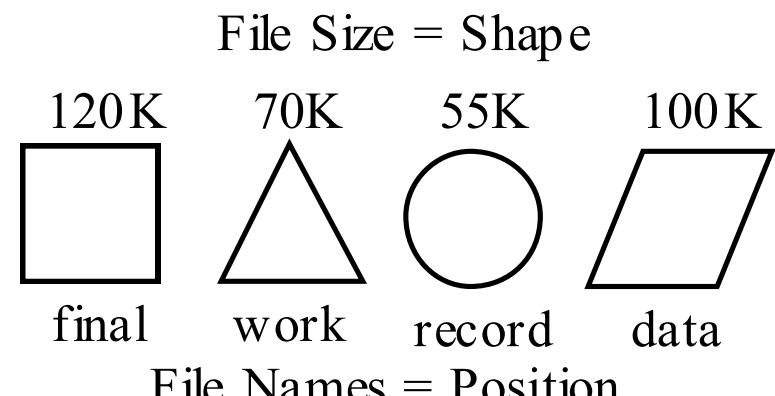
(A)



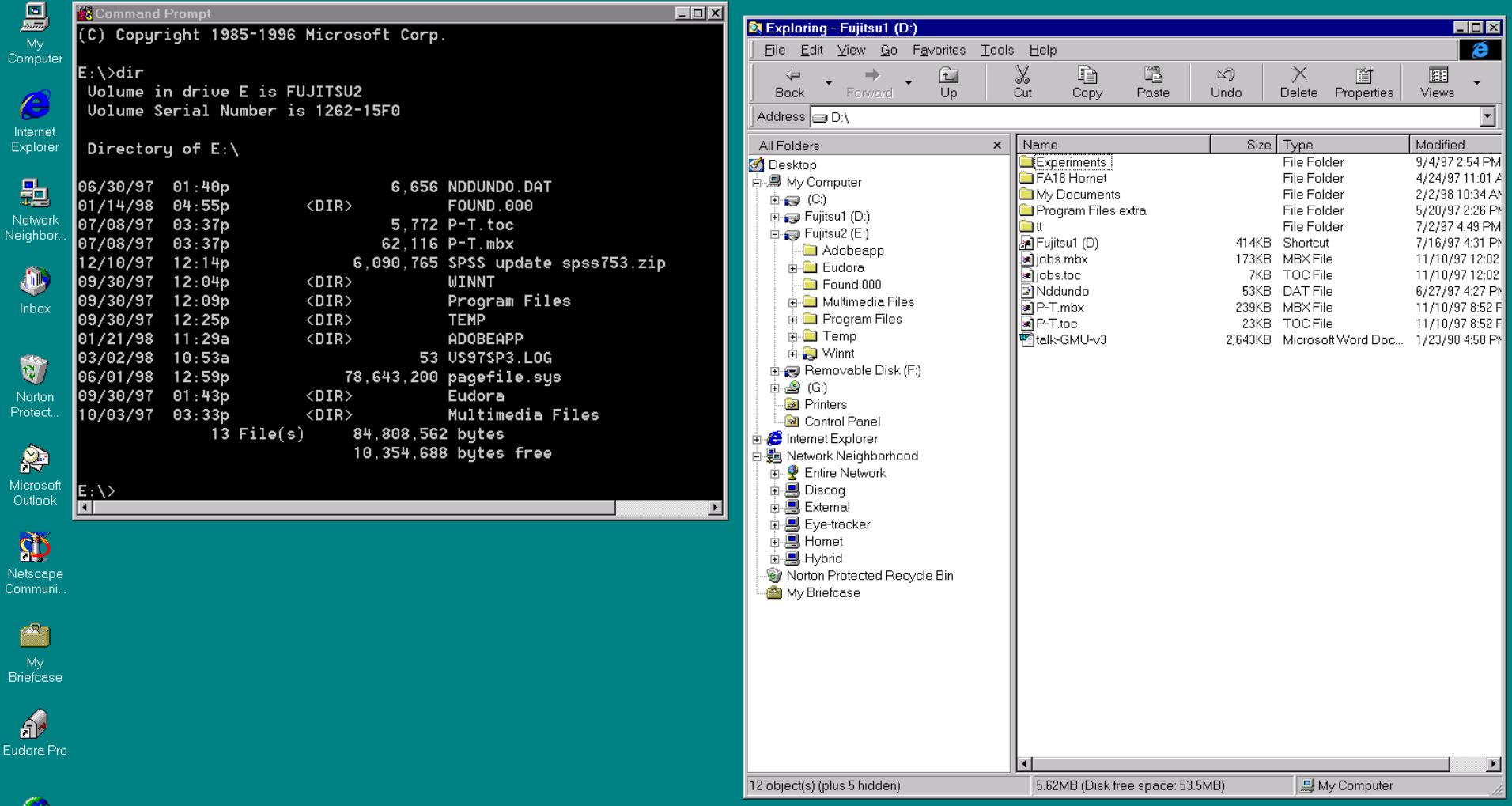
(B)



(C)



(D)



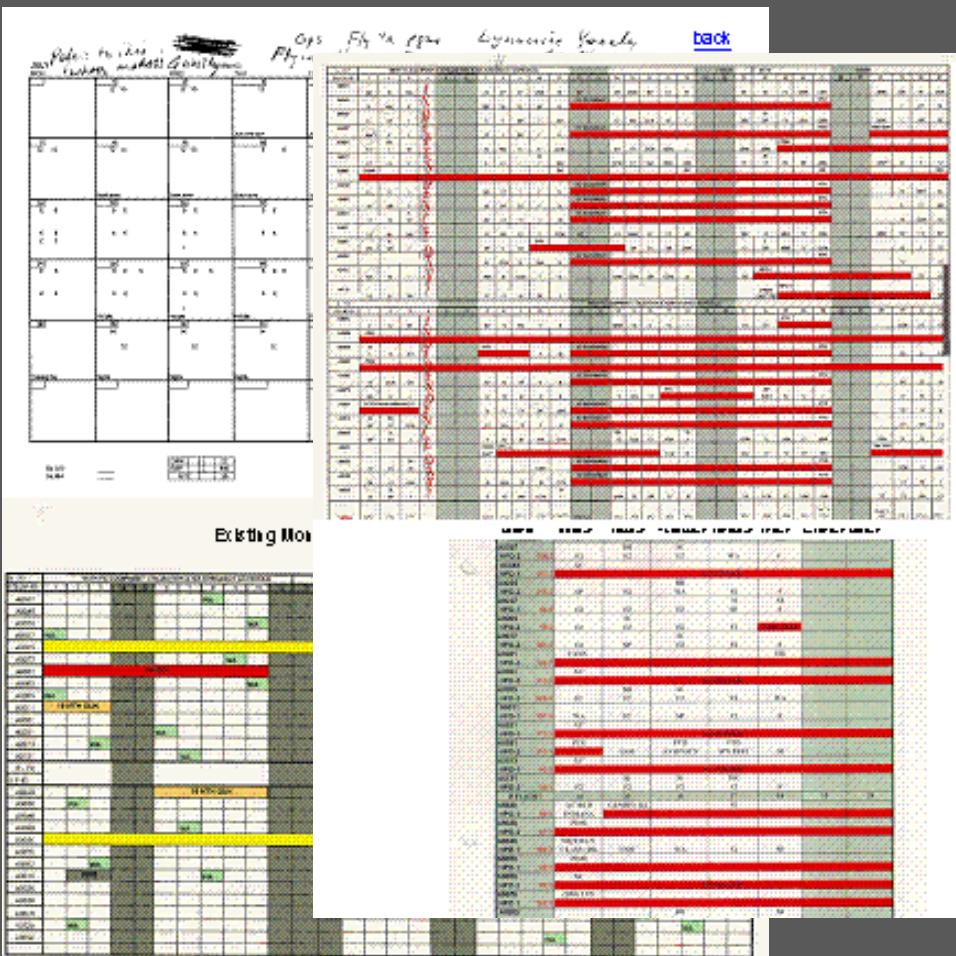
# DOS vs. Windows

# Same Numbers -> Different Systems

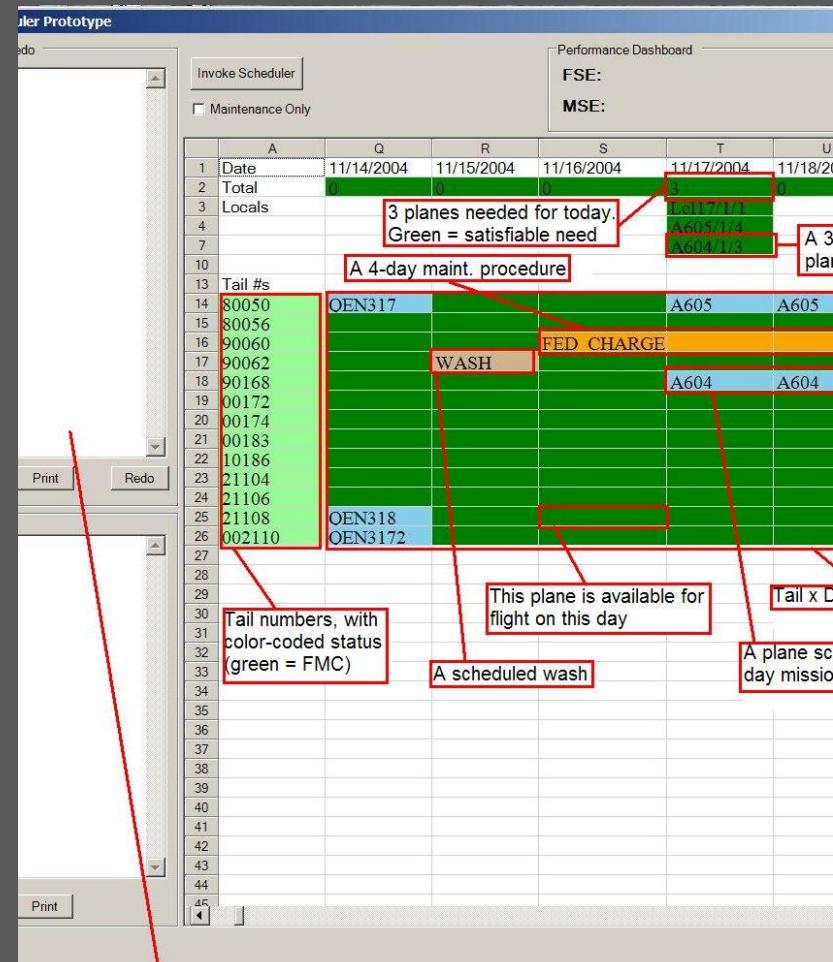
Arabic	Egyptian	Babylonian	Greek	Roman	Chinese	Aztec	Cretan	Maya
1		▽	α	I	一	•	‘	•
2		▽▽	β	II	二	..	“	..
3		▽▽▽	γ	III	三	...	”	...
4		▽▽▽▽	δ	IV	四	....	””	....
5		▽▽▽▽▽	ε	V	五	.....	”””	—
6		▽▽▽▽▽	Ϛ	VI	六	....•	”””	—
7		▽▽▽▽▽	Ϛ	VII	七	....••	”””	—
8		▽▽▽▽▽	η	VIII	八	....•••	”””	—
9		▽▽▽▽▽	θ	IX	九	....•••	””””	—
10	□	△	ι	X	一十	.....	●	==
20	□□	△△	κ	XX	二十	□	●●	•
100	፩	▽△△△	ϙ	C	一百	████████	/	—
200	፩፩	▽▽▽△△	ϙ	CC	二百	████████ ████████	//	==

# Aircraft Operation & Maintenance Scheduling

3 people x 3 days

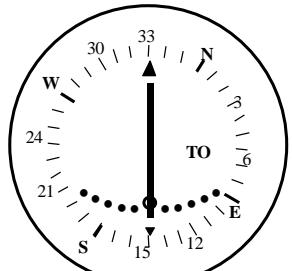


1 person x 11 min

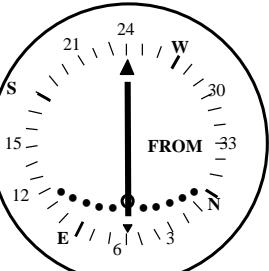


(From Butler, Zhang, Esposito, Bahrami, Hebron, & Kieras, 2007)

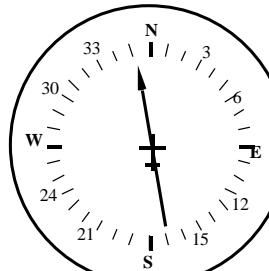
# Navigation Instruments for Airplanes



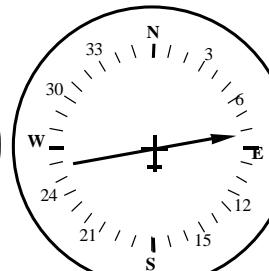
Left VOR Indicator



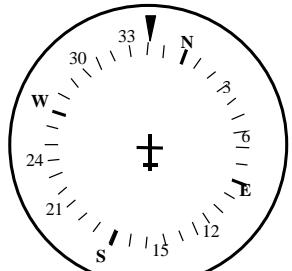
Right VOR Indicator



Left ADF Indicator



Right ADF Indicator



Heading Indicator

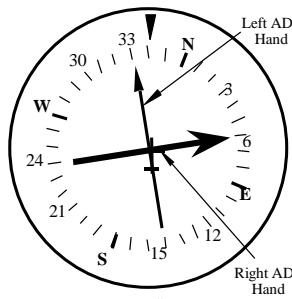
120.5 NM 100 KT 72 MIN

Left DME Indicator

175.5 NM 100 KT 105 MIN

Right DME Indicator

(A) VOR



RMI Indicator

120.5 NM 100 KT 72 MIN

Left DME Indicator

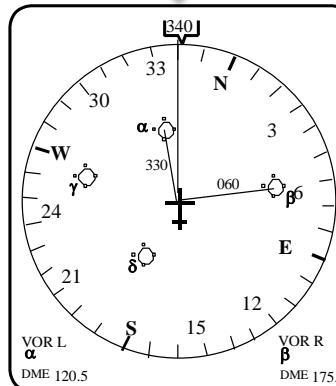
175.5 NM 100 KT 105 MIN

Right DME Indicator

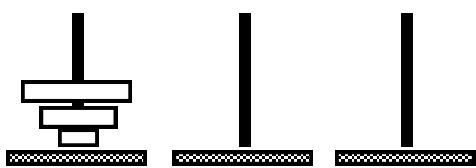
(C) RMI

This type of designs contributed to the increased safety of aviation

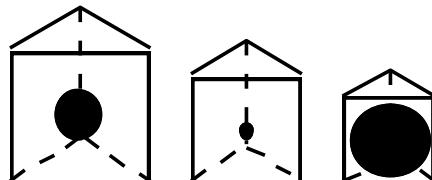
(B) A



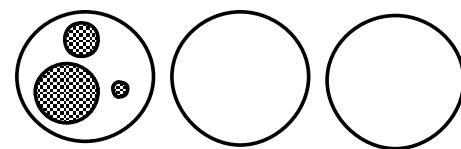
(D) 747/FA-18



(A) Tower of Hanoi

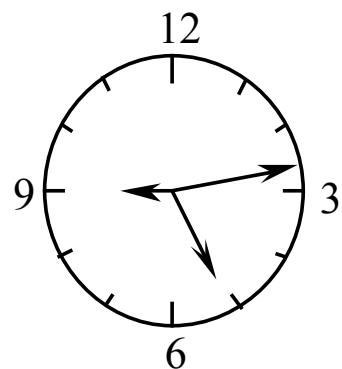


(B) Cylinders

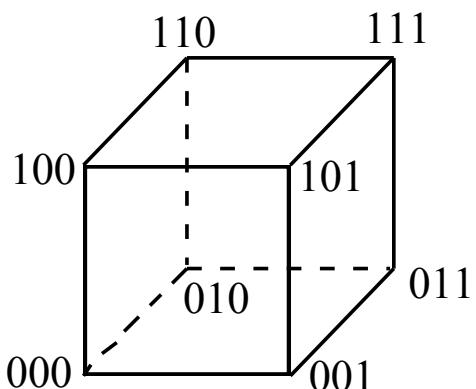


(C) Balls

75 seconds to solve



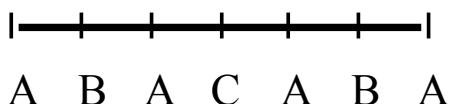
(D) Analog Clock



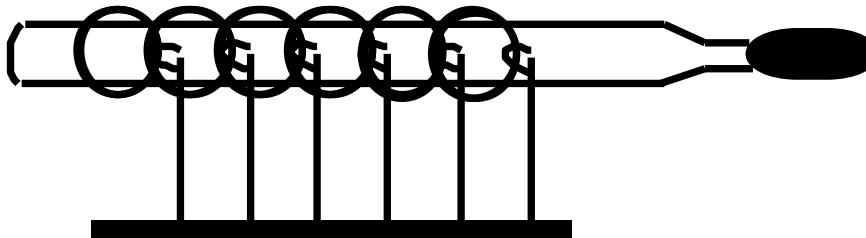
(E) Hamilton Problem

1	--	000
2	--	001
3	--	011
4	--	010
5	--	110
6	--	111
7	--	101
8	--	100

(F) Grey Code

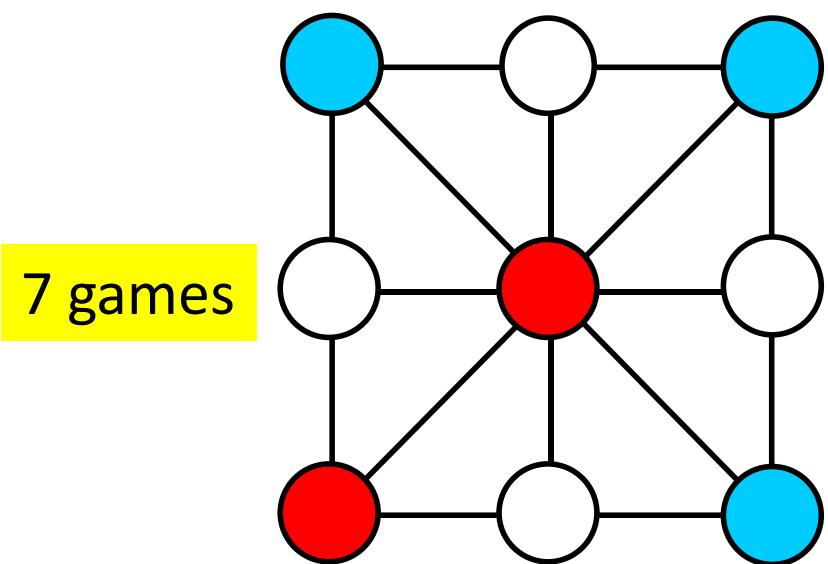


(G) Ruler

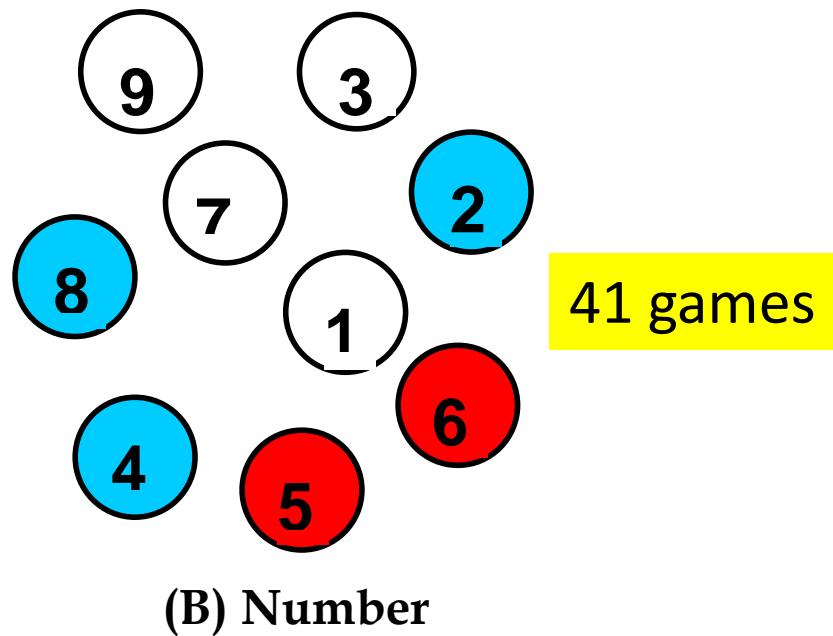


(H) Chinese Ring

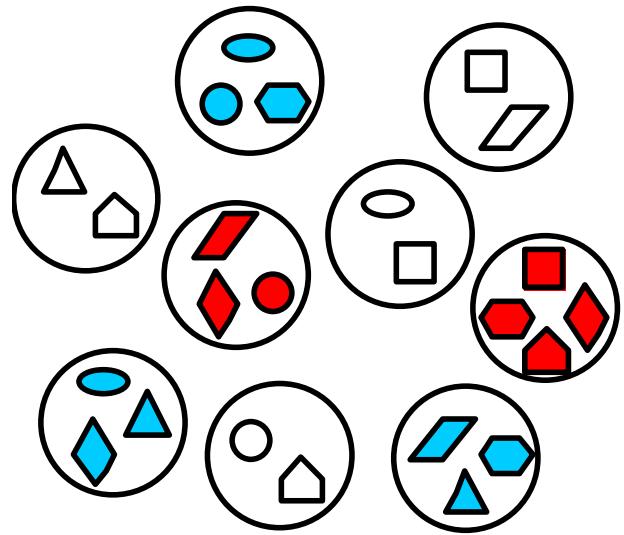
None solved it within 2hours



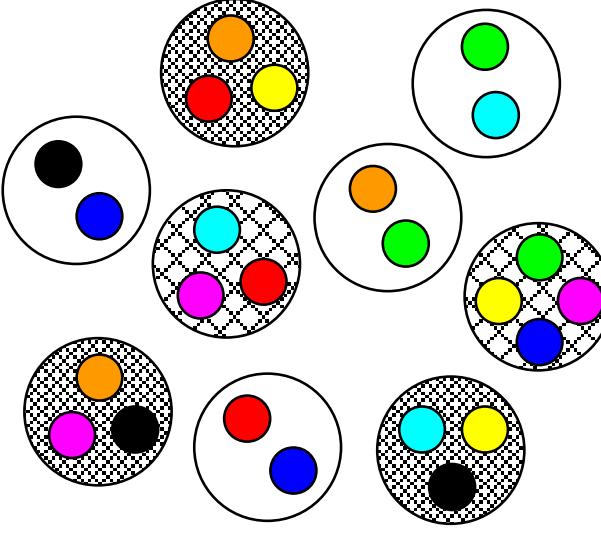
(A) Line



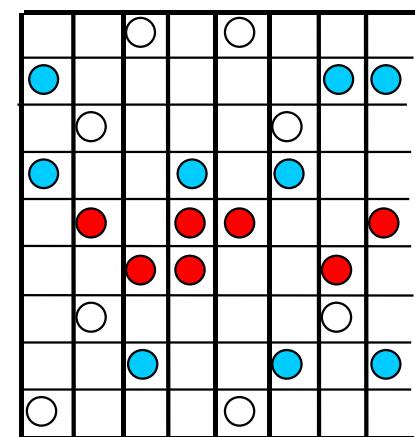
(B) Number



(C) Shape

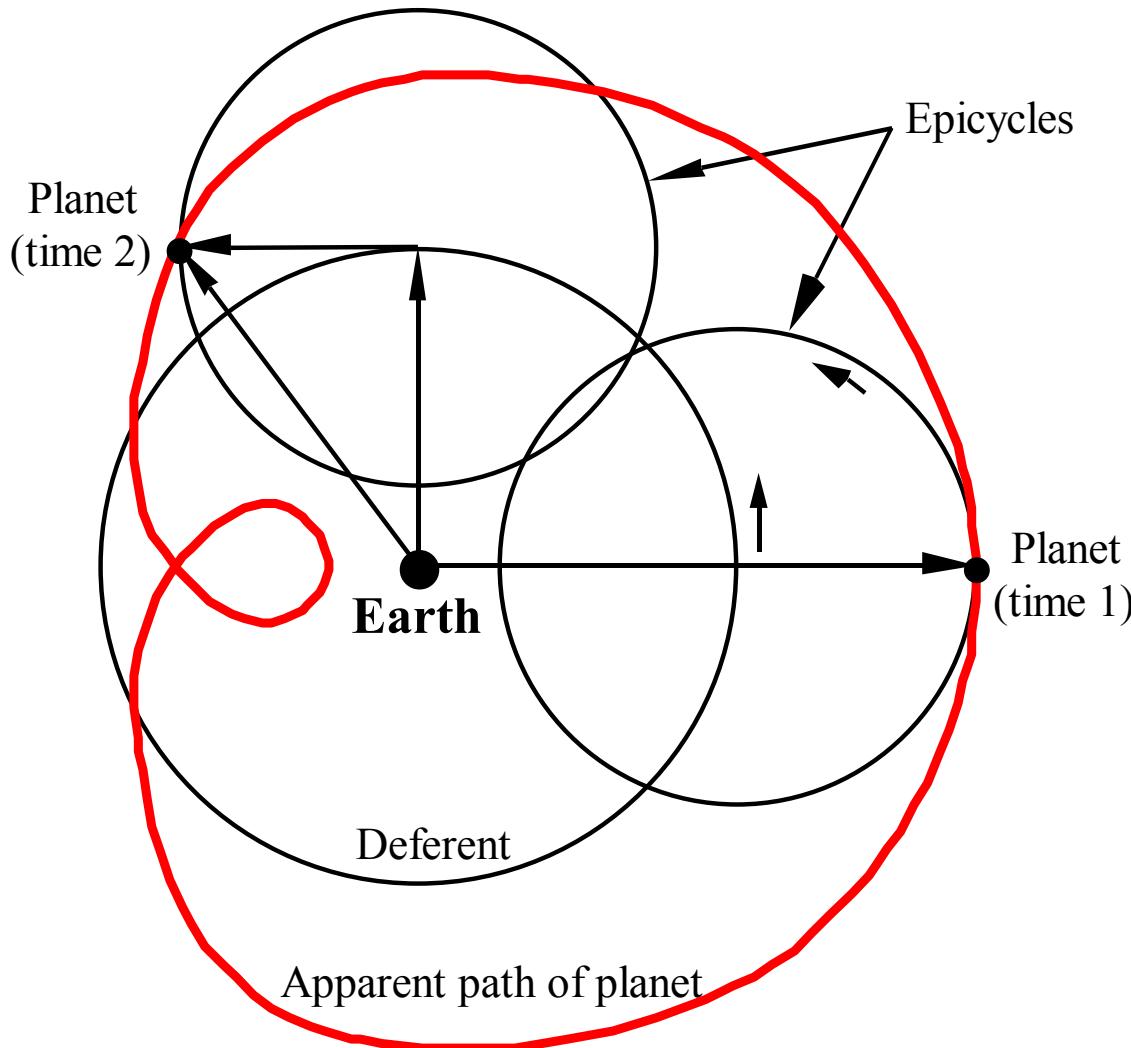


(D) Color



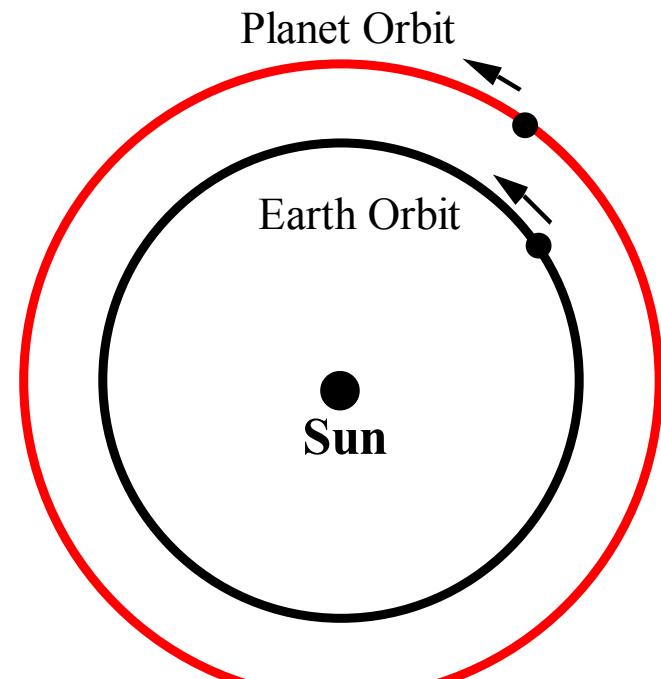
(E) Position

# Representation of Solar System



(A) Ptolemy

Modern Science



Kepler's Laws

Newtonian Physics

(B) Copernicus

# Evidence and Theories for Representation Effect

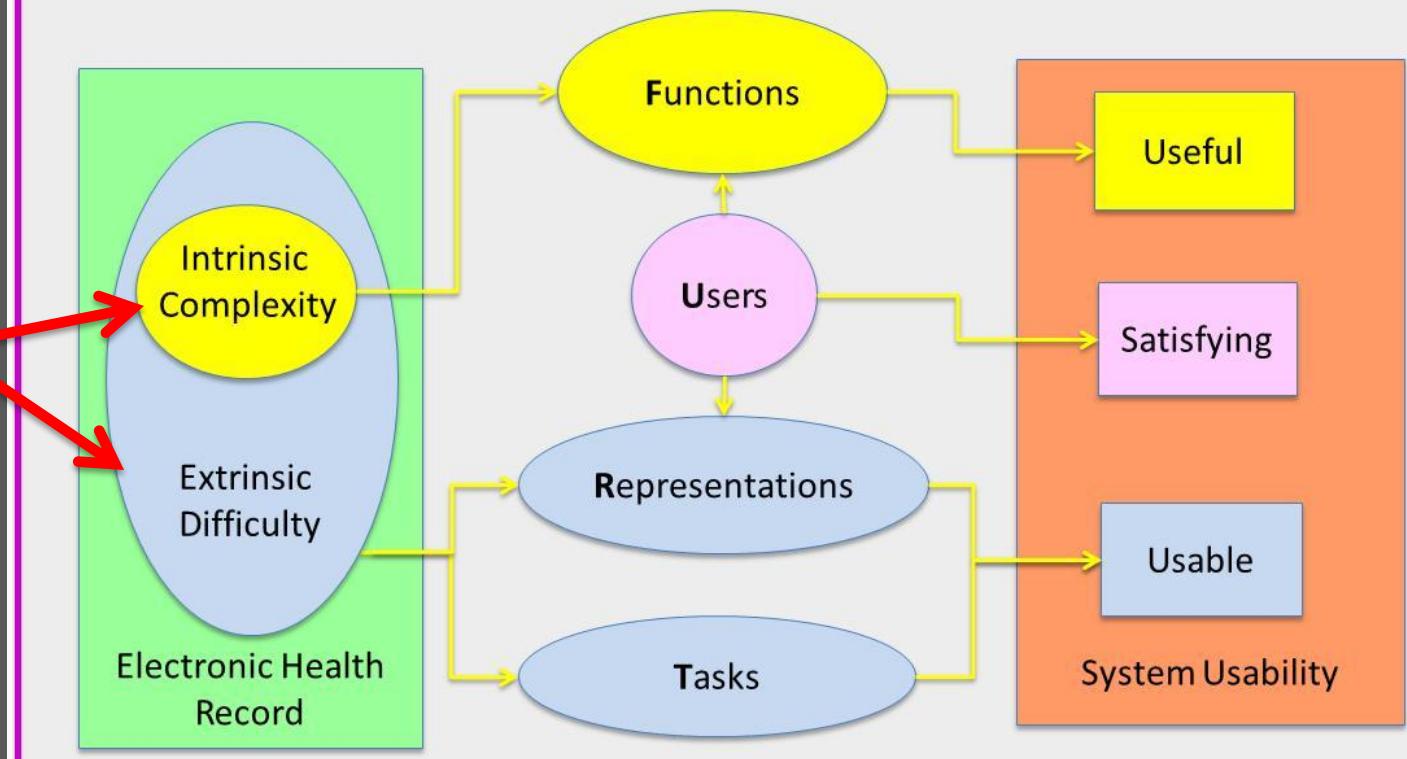
- Kotovsky, K. & Simon, H. A. (1990). What makes some problems really hard: explorations in the problem space of difficulty. *Cognitive Psychology*, 22, 143-183
- Zhang, J. & Norman, D. A. (1994). Representations in distributed cognitive tasks. *Cognitive Science*, 18, 87-122.
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- Zhang, J. (1996). A representational analysis of relational information displays. *International Journal of Human-Computer Studies*, 45, 59-74.
- Zhang, J. (1997). The nature of external representations in problem solving. *Cognitive Science*, 21(2), 179-217.
- Zhang, J. (1997). Distributed representation as a principle for the analysis of cockpit information displays. *International Journal of Aviation Psychology*, 7(2), 105-121.
- Butler, K., Zhang, J., Esposito, C., Bahrami, A, Hebron, R., & Kieras, D. (2007) Work-centered design: A case study of a mixed initiative scheduler (pp. 747-756 ). *Proceedings of CHI 2007*.

# Representation Effect for EHR?

- This afternoon: TURF
- Monday, 1030-noon: Panel S14
- Wednesday: 830-1000: Paper S85
- Monday-Tuesday: Posters by SHARPC
- Review Paper:
  - Zhang, J., & Walji, M. (2011, in press). TURF: Toward a unified framework of EHR usability. *Journal of Biomedical Informatics*, 00, 000-000.

# TURF Framework for EHR Usability

Representation  
Effect



sharpc.org