

Applying Cognitive Semiotics to User Interface Design

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Semiotics

- Study of creating and interpreting sign and symbols
- Signifier – visual or auditory “token”
- Signifies – concept being represented

Signs

- Signifier is a substitute for signified
- Language itself is made of signs
- Can be more abstract
- Icons – specific connections

Symbols

- Signifier substituted by signified
- Color is often used as a symbol

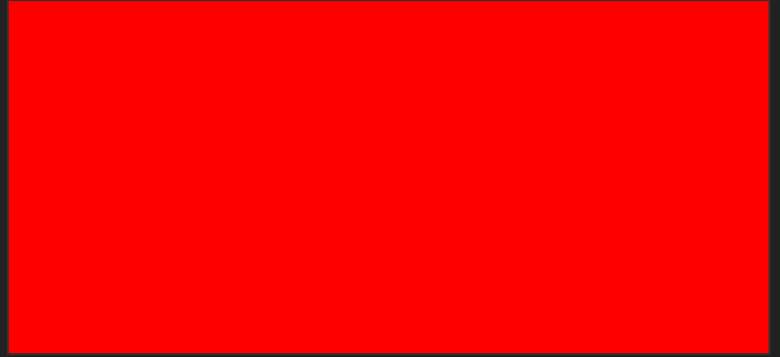


Figure 1: The color red can be a symbol for warnings in interfaces

Cognitive Semiotics

- Applying Psychological Theory to semiotics
- Perception
- Memory
- Judgement

Graphic User Interfaces

- Four Components – According to Yan (2020)
 - Window
 - Icons
 - Menu
 - Pointer

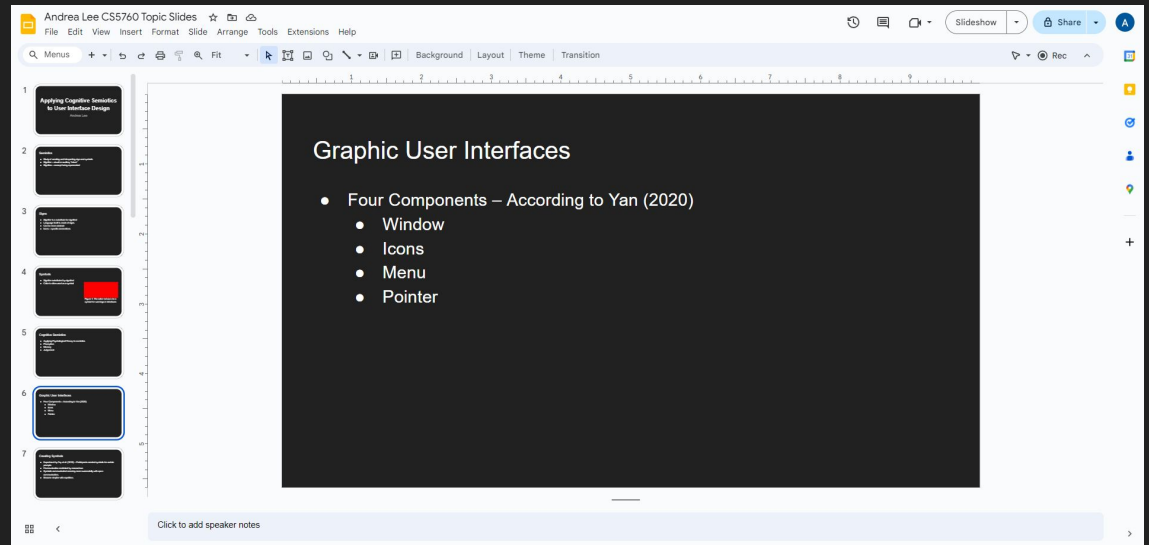


Figure 2: The graphic user interface of google slides

Creating Symbols

- Experiment by Fay et al. (2018) – Participants created symbols for certain prompts
- Communication restricted by researchers
- Symbols communicated meaning more successfully with open communication.
- Became simpler with repetition.

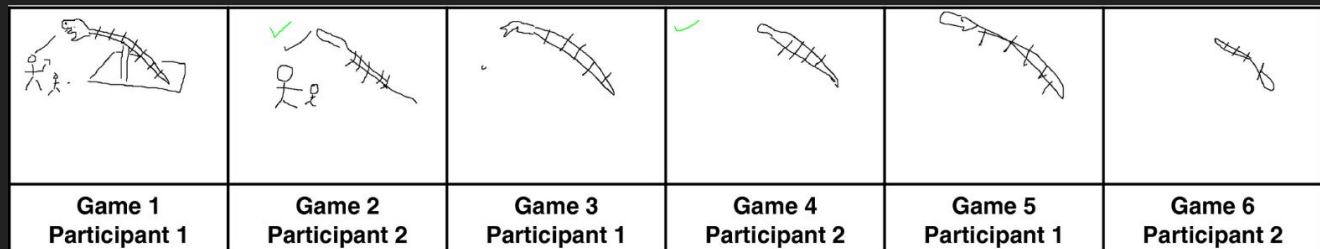


Figure 3: Symbols created for “museum” from “How to Create Shared Symbols” by Fay et al., 2018, *Cognitive science*, 42(S1). p. 244

<https://doi.org/10.1111/cogs.12600>

Applications

- Not every function will have an associated symbol
- Meaning will need to be communicated externally







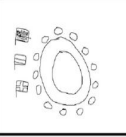
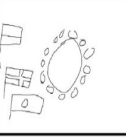
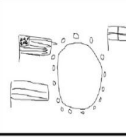
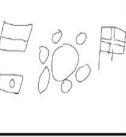






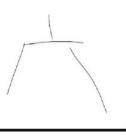


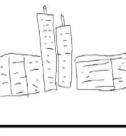

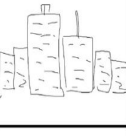
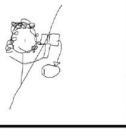

Allow Imitation, Allow Feedback						
Allow Imitation, No Feedback						
Forbid Imitation, Allow Feedback						
Forbid Imitation, No Feedback						
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6

Figure 4: Symbols created for “parlement” from “How to Create Shared Symbols” by Fay et al., 2018, *Cognitive science*, 42(S1). p. 258
<https://doi.org/10.1111/cogs.12600>

Decision Making and Memory

- Martidou (2020) – participants given choices between images
 - Did not remember every choice
- Users will not remember every decision they make
- May even hide suspected errors
 - Design time needs to show they are willing to admit to a flaw in design

<i>TYPE OF DETECTION</i>	<i>TYPE OF RESPONSE</i>	<i>NUMBER OF RESPONSES (%)</i>
<i>Clear</i>	Categorical	68 (21%)
	Conciliatory	37 (12%)
	Retrospective	2 (1%)
<i>Possible</i>	Uncertainty	46 (15%)
<i>None</i>	Ignorance	29 (9%)
	Indifference	25 (8%)
	Acceptance	109 (34%)

Figure 5: Recorded responses to being presented false choices from “Choice awareness and manipulation blindness: A cognitive semiotic exploration of choice-making” by Martidou, *Public Journal of Semiotics*, 9(1) p. 15

Layers of Design (Scolari 2009)

- Plastic
- Figurative
- Communicative
- Meta-Communicative

Plastic and Figurative

- Layout of interface – Colors and Shapes
- Shows general importance of different elements
- Give contrast to important elements
- What colors are being used and for what purpose?

Communicative and Meta-Communicative

- Communicative – Symbols and Icons
- Users need to understand what each symbol and icon means
- Meta communicative – communication between users through interface
 - Not part of all designs.

SIDE – Semiotic Interface Design Evaluation (Islam et al 2020)

- Syntactic
- Pragmatic
- Social
- Environmental
- Semantic

Syntactic Level

- Layout of interface – similar to plastic and figurative layers
- Emphasis on the users' level of control
 - What elements are interactable?

Pragmatic Level

- Symbols in relation to other symbols
 - Placement within layout
 - Differences in size
- “Internal logic” of interface



Figure 6: minimise, toggle full screen, and exit buttons from Google Chrome.

Social Level

- Cultural Meanings of Symbols
- Using symbols the user has already seen elsewhere

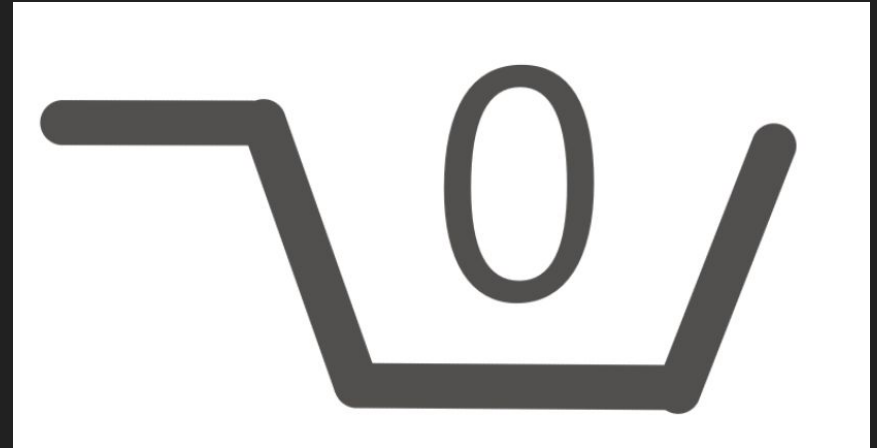


Figure 7: A simplified shopping cart is often used as an icon for a page containing users' potential purchases

Environmental Level

- Symbols from users' professional background
- Different programs in the same field may use the same symbols for the same functions

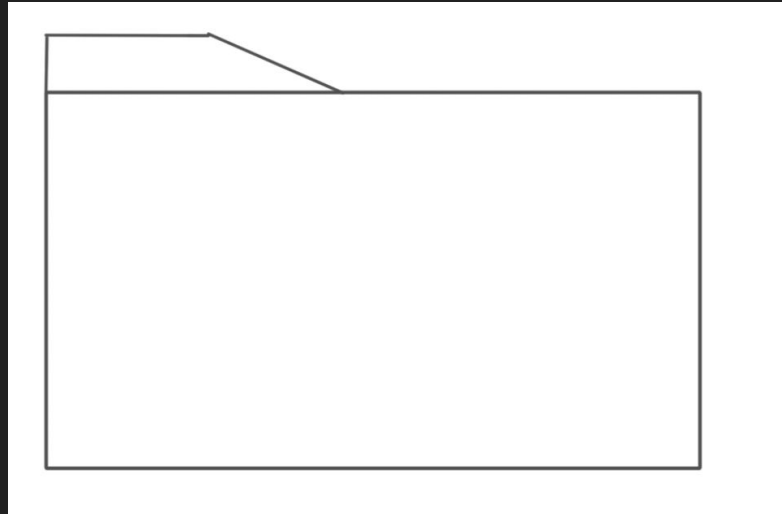


Figure 8: Open file functions are often represented with a folder icon

Semantic Level

- Users' interpretations of the designers' reasoning.
- If users can guess why a symbols was used, they can guess the function as well.
- Intentions should be clear from previous layers

Design Frameworks as Evaluations

- Islam et al. conducted an experiment which compared a standard heuristic analysis with an analysis based on the SIDE framework.
- Analyses were tested on both government websites and mobile applications.
- Semiotic evaluation and Heuristic evaluation both found issues the other overlooked.
- A combination of both evaluations could be useful.

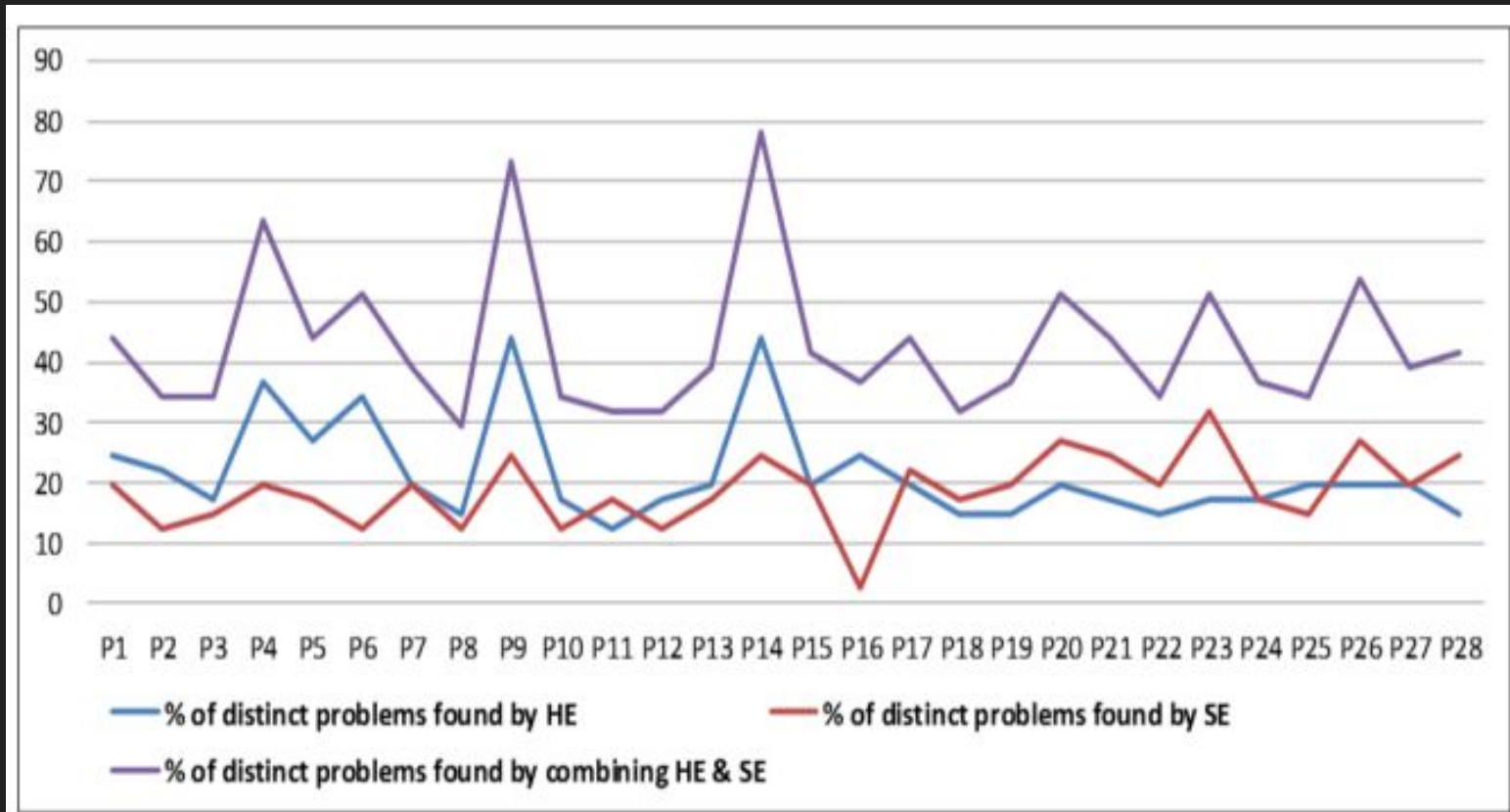


Figure 9: Percentages of issues discovered by Heuristic and Semiotic Evaluations from “Evaluating Web and Mobile User Interfaces With Semiotics: An Empirical Study” by Islam et al., *IEEE Access*, 8, p. 84408 doi: 10.1109/ACCESS.2020.2991840

Conclusion

- Promising results for evaluation techniques
- Frameworks for design should be based on user behavior
- More research is required

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