

Medical Technology UX/HF Meetup



PEP Talks

(Practical Exercises for UX Practitioners)

New PEP Talk Format

- 5:45 – 6:00 Arrive & socialize
- 6:00 - 6:30 Topic Introduction by speaker
- 6:30 - 7:00 Small group exercise
- 7:00 - 7:30 Large group discussion, Q&A

- ✓ Please help fund our food and beverages
- ✓ Please fill out our survey before you leave



Juggling Hats



Conducting a Heuristic Evaluation of Medical Technology

Shannon Halgren, PhD



SAGE RESEARCH & DESIGN



Heuristic Evaluation

“Heuristic evaluation involves having a small set of evaluators examine the interface and judge its compliance with recognized usability principles (the ‘heuristics’).” – Jakob Nielsen



When is a HE appropriate?

Mid to late design phase (formative)



Prior to usability testing (find low hanging fruit)



When you need feedback fast



When budget is a factor



As part of your documented UE process



When is a HE NOT appropriate?

As a substitute for user testing



When designers are struggling with a design problem



HE Method Steps

1 Define

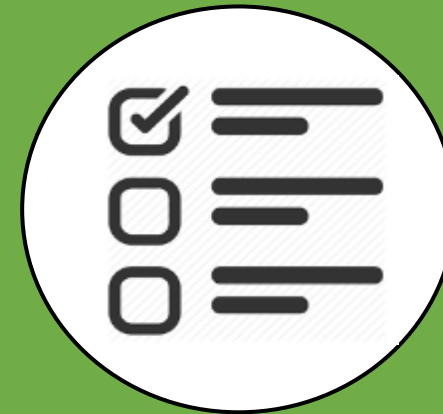
Users



Tasks



Heuristics



Evaluators



HE Method Steps

1 Define

Users



- Job Title
- Experience
- Responsibilities
- Motivators
- Skills
- Age



HE Method Steps

1 Define

Tasks



- From task analysis or use scenarios
- Mapped to user type
- Primary and secondary
- Consider
 - Workflow
 - Frequency
 - Inputs & outputs
 - Work Environment



HE Method Steps

1 Define

Heuristics



Nielson, 1989

- Visibility of system status
- Match b/n system and real world
- User control & freedom
- Consistency & standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency
- Aesthetic & minimalist design
- Error recognition & recovery
- Help & documentation

Zhang et. al, 2003

- Consistency & standards
- Visibility of system state
- Match b/n system and real world
- Minimalist
- Minimize memory load
- Informative feedback
- Flexibility & efficiency
- Good error messages
- Error Prevention
- Clear closure
- Reversible actions
- Use users' language
- Give users control
- Help & documentation



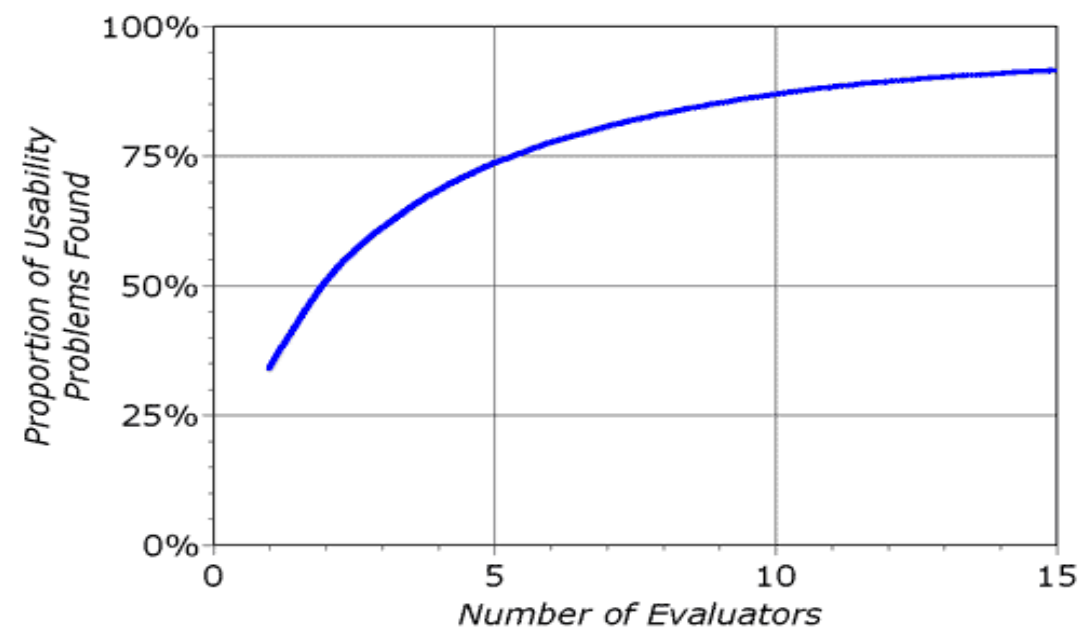
HE Method Steps

1 Define

Evaluators



- 3-5 (more if usability critical)



Nielsen, J. & Mack, R. L., Eds. (1994). *Usability Inspection Methods*. John Wiley & Sons.



HE Method Steps

1 Define

Evaluators



- FDA guidance specifies evaluators should be HF experts

	UX Expert	Domain Expert	Issues Found
Domain Expert		✓	22%
UX Expert	✓		41%
Double Expert	✓	✓	60%

Nielsen, J. & Mack, R. L., Eds. (1994). *Usability Inspection Methods*. John Wiley & Sons.



HE Method Steps

2 Evaluate



User

- Walkthrough tasks
- Play the part
- Consider each user group independently



HE Method Steps

2 Evaluate



User

- Walkthrough tasks
- Play the part
- Consider each user group independently



UX Expert

- Walkthrough UI multiple times
- Consider each heuristic independently



HE Method Steps

2 Evaluate

Heuristic Violations

Severity Rating Definition

0 = Not a usability problem at all

1 = Cosmetic problem only. Need not be fixed unless extra time is available.

2 = Minor usability problem. Fixing this should be given low priority.

3 = Major usability problem. Important to fix. Should be given high priority.

4 = Usability catastrophe. Imperative to fix this before product can be released.

Place of Occurrence	Usability Problem Description / Questions	Heuristics Violated (if applicable)	Severity Rating (if applicable)
General			
Screen/Product Name 1			
Screen/Product Name 2			



HE Method Steps

2 Evaluate

Rating

(1-10 scale)	Rating	Comments
Consistency		
Visibility of system state		
Match		
Minimalist		
Memory		
Feedback		
Flexibility		
Message		
Error		
Closure		
Undo		
Language		
Control		
Document		
Overall Usability		



HE Method Steps

3 Report

(1=poor compliance, 10=excellent compliance)	Average Rating	Reviewer 1 Comments	Reviewer 2 Comments	Reviewer 3 Comments
3. Match between system and world	8.0	<ul style="list-style-type: none"> Light indicators are effective: <ul style="list-style-type: none"> Good use of color to indicate state & relative urgency of any alerts. Good to have separate state indicator lights for Water quality and Analyzer Light shapes are intuitive. Effective display and icon for idle mode. 	<ul style="list-style-type: none"> The 'timer' on the UI does not provide adequate labeling for the purpose [<i>maybe a prototype issue since it didn't dynamically move to indicate the intent</i>] Since this is a new 'feature' for this monitoring (e.g., test strips) there is little correlation to make against the users' expectations and the current system design. However use of icons (droplet) seems to match users' knowledge of the system capabilities. 	<ul style="list-style-type: none"> Users will expect a touchscreen and try to use the GUI in this way initially. The term "notifications" may not accurately represent the severity of some conditions (e.g., high chlorine). If there are multiple notifications present, it's not clear if the SI and analyzer display the highest priority color (e.g., if there is a red and a yellow notification, red should be displayed). The SI icon meaning is not immediately obvious
4. Minimalist	9.7	<ul style="list-style-type: none"> Light indicators are effective: <ul style="list-style-type: none"> Good use of color to indicate state & relative urgency of any alerts. Good to have separate state indicator lights for quality and temperature Light shapes are intuitive. Effective display and icon for idle mode. 	<ul style="list-style-type: none"> Messaging and icon usage is clear and effective. Good use of space. The biggest challenge will be to adjust from being tempted to touch the screen vs. using the control panel 	A beautiful, clean, simple design!



HE Method Steps

3 Report

Place of Occurrence	Usability Problem Description / Questions	Heuristics Violated (if applicable)	Severity Rating (if applicable)	Reviewer	Design Change Indicated?	New Requirement Indicated?
General						
01 All	No clear source of "Help." Maybe planning to provide a hard copy "Quick Reference" guide to be kept with machine. If so, embedded help could wait until version 2.0.	Document	2.5	1		
Product 1						
02 Home Screen	The expectation is that this is a touchscreen. Even after it's well understood that all interactions are controlled by the push buttons below, it's still instinctual to attempt to touch the buttons directly on the screen, especially the Continue buttons and selecting options within the Menu.	Match	2	3		
03 Home Screen	The meaning of the dynamic circle with the percent value is not clear or explained.	Visibility, Document	3	3		
05 Idle Screen	Novices could benefit from a single-line instruction of how to take machine <u>out</u> of Idle.	Flexibility; Document	2	1		
06 Idle Screen	Is there a need for a Cancel button on the Idle mode screen? It doesn't take you anywhere. The <Cancel> button in both Enter idle mode and Exit Idle mode didn't navigate to anywhere – is this intentional?	Feedback	2	2		



HE Method Steps

3 Report



Debrief

- Evaluators + product team
- Review findings
- Discuss design changes
- Make notes for user testing



The Heuristics

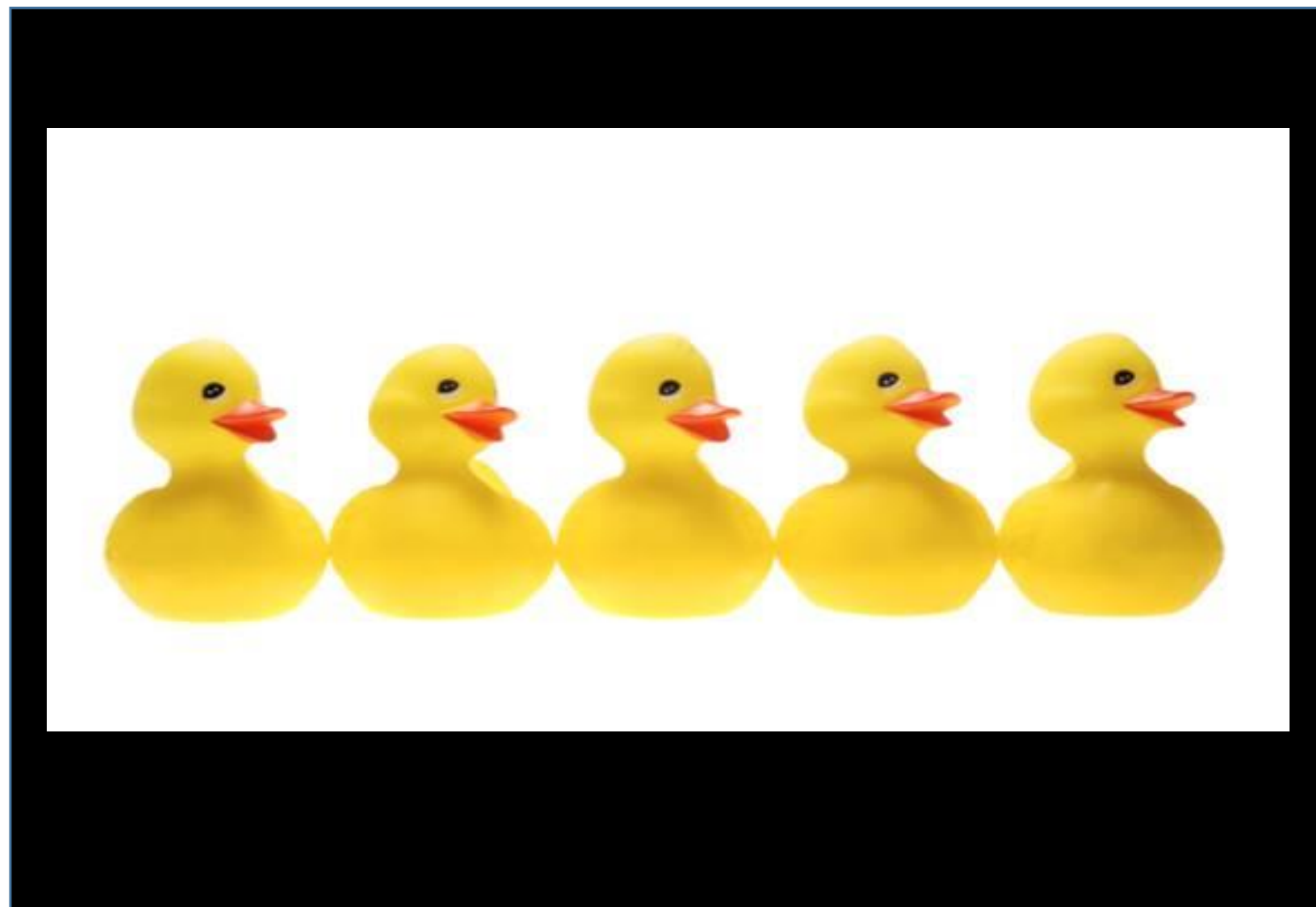
Zhang, J. et al. (2003)

ZHANG, J., et al. (2003) *Using usability heuristics to evaluate patient safety of medical devices*, J of Biom Info (36)1:23-30



Consistency

Users should not have to wonder whether different words, situations, or actions mean the same thing. Standards and conventions in product design should be followed.

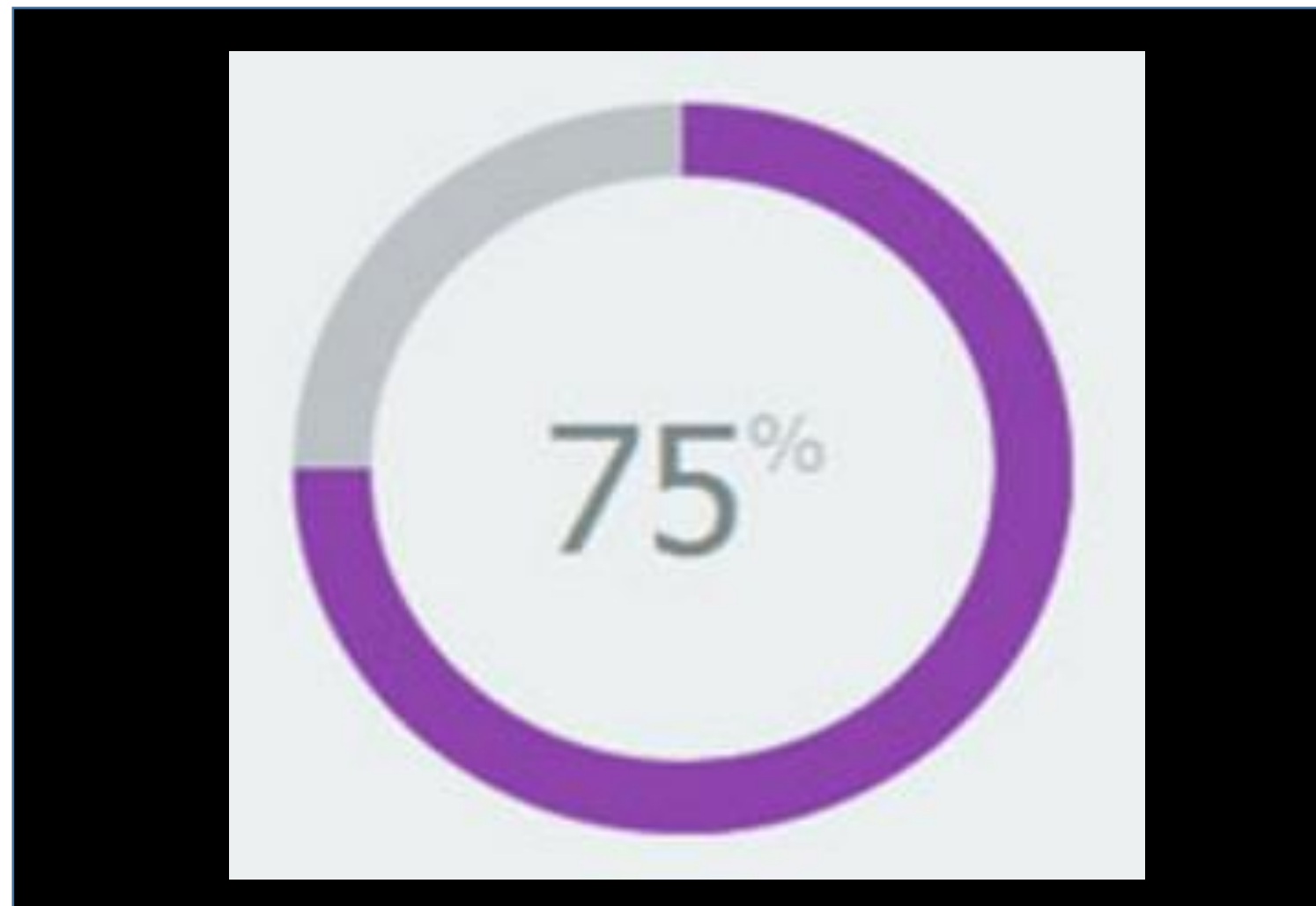


- Sequences of actions (skill acquisition).
- Color (categorization).
- Layout and position (spatial consistency).
- Font, capitalization (levels of organization).
- Terminology and language (words, phrases).
- Standards (e.g., blue underlined text for unvisited hyperlinks).



Visibility of System State

Users should always be informed what is going on with the system through appropriate feedback and display of information.



- What is the current state of the system?
- What can be done at current state?
- Where can users go?
- What change is made after an action?



Match between System & Real World

The image of the system perceived by users should match the model the users have about the system



- User model matches system image.
- Actions provided by the system should match actions performed by users.
- Objects on the system should match objects of the task.

Minimalist

Any extraneous information is a distraction and a slow-down.



- Less is more.
- Simple is not equivalent to abstract and general.
- Simple is efficient.
- Progressive levels of detail.



Minimize Memory Load

Users should not be required to memorize a lot of information to carry out tasks. Memory load reduces users' capacity to carry out the main tasks.

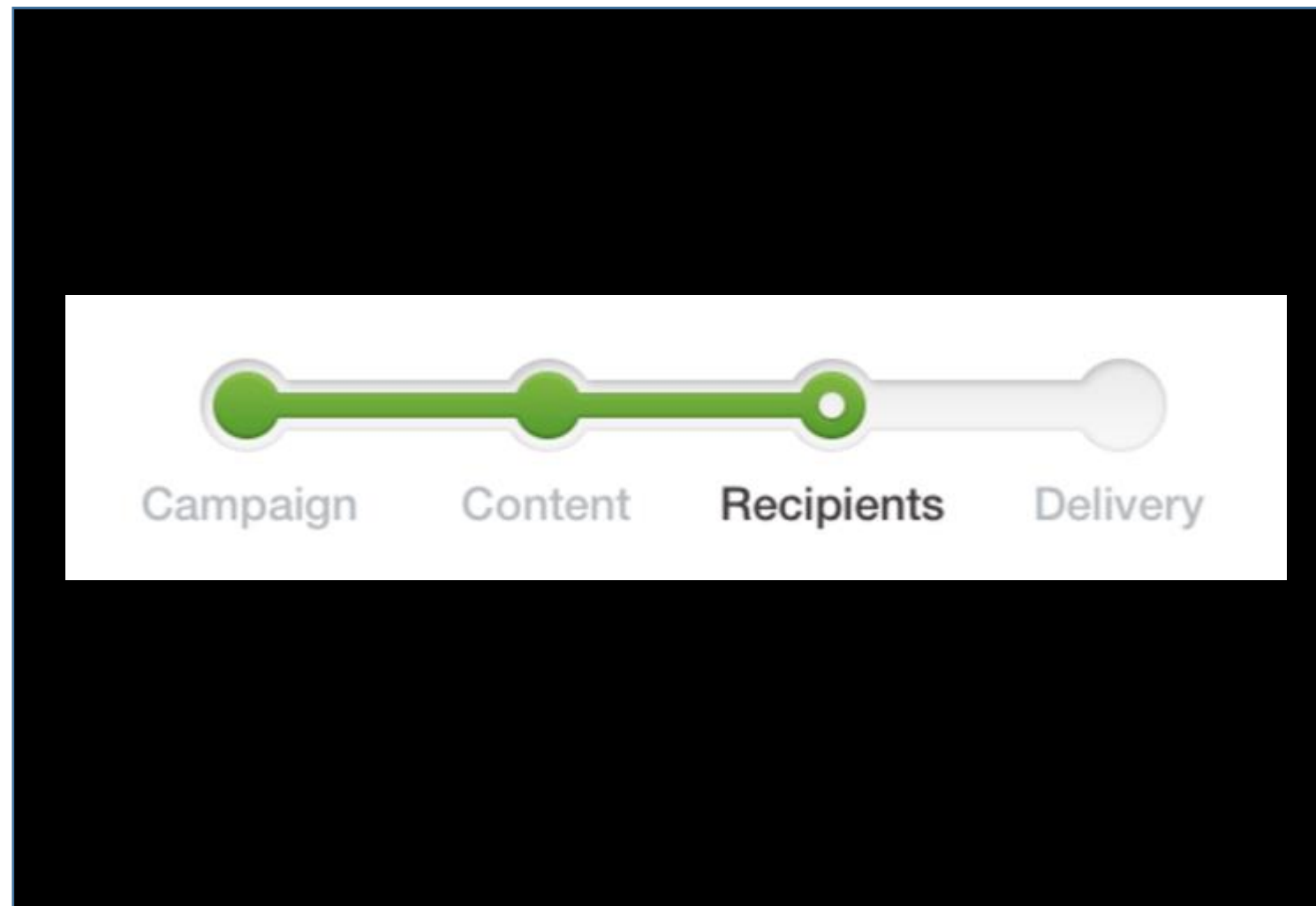


- Recognition vs. recall (e.g., menu vs. commands).
- Externalize information through visualization.
- Perceptual procedures.
- Hierarchical structure.
- Default values.
- Follow UI standards.



Feedback

Users should be given prompt and informative feedback about their actions.



- Information that can be directly perceived, interpreted, and evaluated.
- Levels of feedback (novice and expert).
- Concrete and specific, not abstract and general
- Location in the UI
- Next Steps

Flexibility & Efficiency

Users always learn and users are always different. Give users the flexibility of creating customization and shortcuts to accelerate their performance.

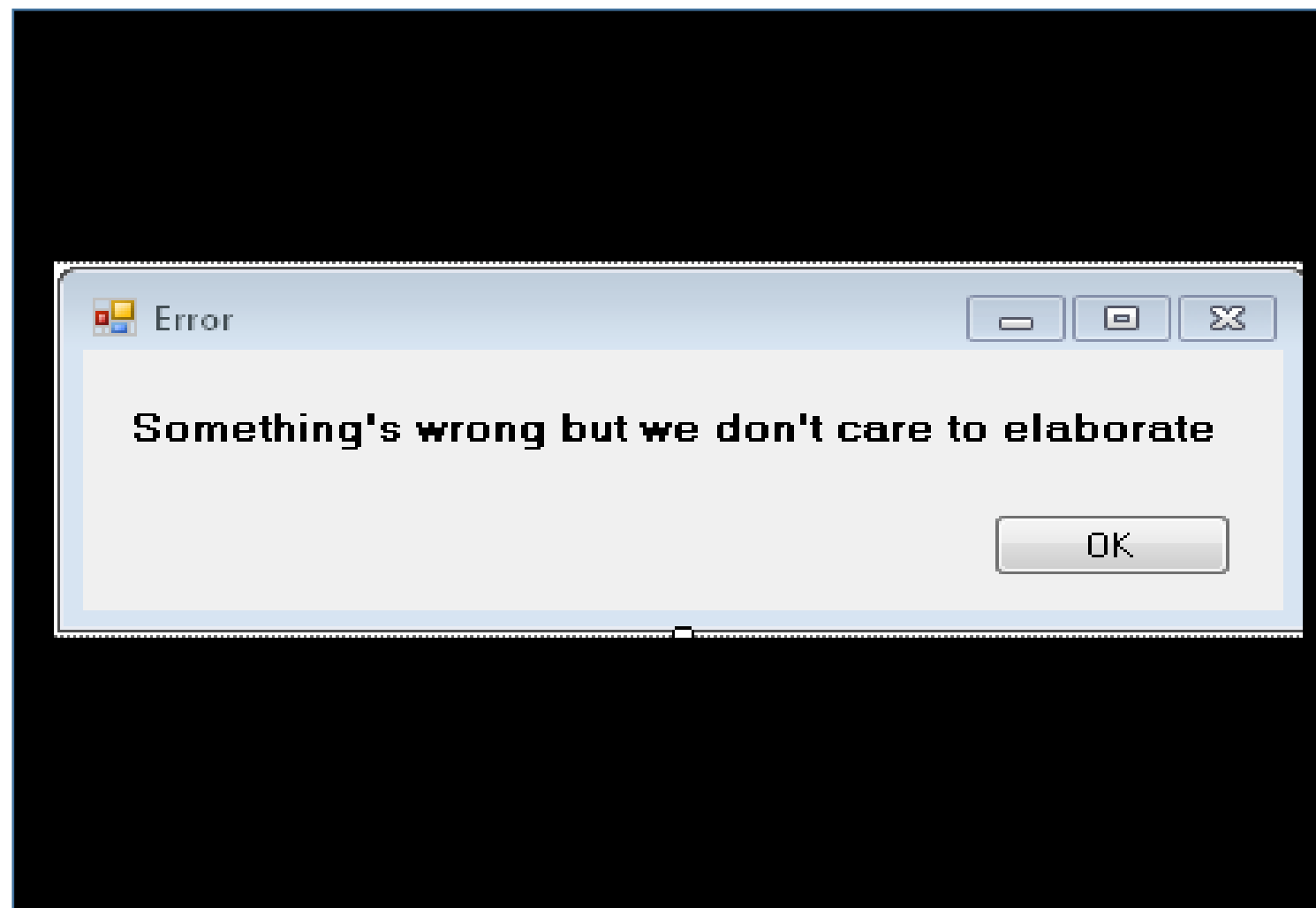


- Shortcuts for experienced users.
- Shortcuts or macros for frequently used operations.
- Skill acquisition through chunking.
- Examples:
 - Abbreviations, function keys, hot keys, command keys, macros, aliases, templates, type-ahead, bookmarks, hot links, history, default values, etc.



Good Error Messages

The messages should be informative enough such that users can understand the nature of errors, learn from errors, and recover from errors.



- Phrased in clear language, avoid obscure codes. Example of obscure code: "system crashed, error code 147."
- Precise, not vague or general. Example of general comment: "Cannot open document."
- Constructive.
- Polite. Examples of impolite message: "illegal user action," "job aborted," "system was crashed," "fatal error," etc.



Prevent Errors

It is always better to design interfaces that prevent errors from happening in the first place.

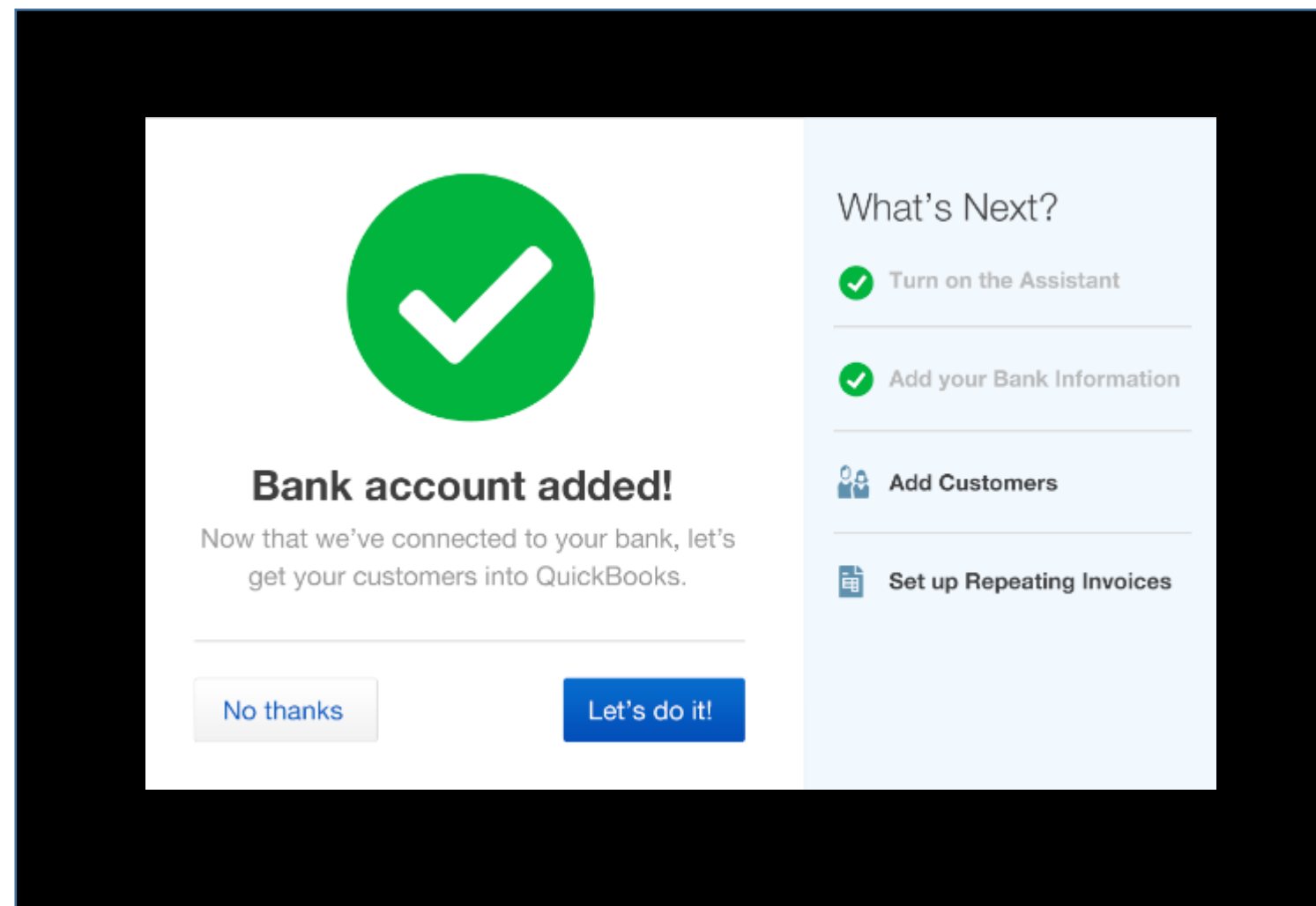


- Interfaces that make errors impossible.
- Avoid modes or use informative feedback, e.g., different sounds.
- Execution error vs. evaluation error.
- Various types of slips and mistakes.



Provide Clear Closure

Every task has a beginning and an end. Users should be clearly notified about the completion of a task.



- Clear beginning, middle, and end.
- Clear feedback to indicate goals are achieved and current stacks of goals can be released.
- Examples of good closures include many dialogues.



Undo / Reversible Actions

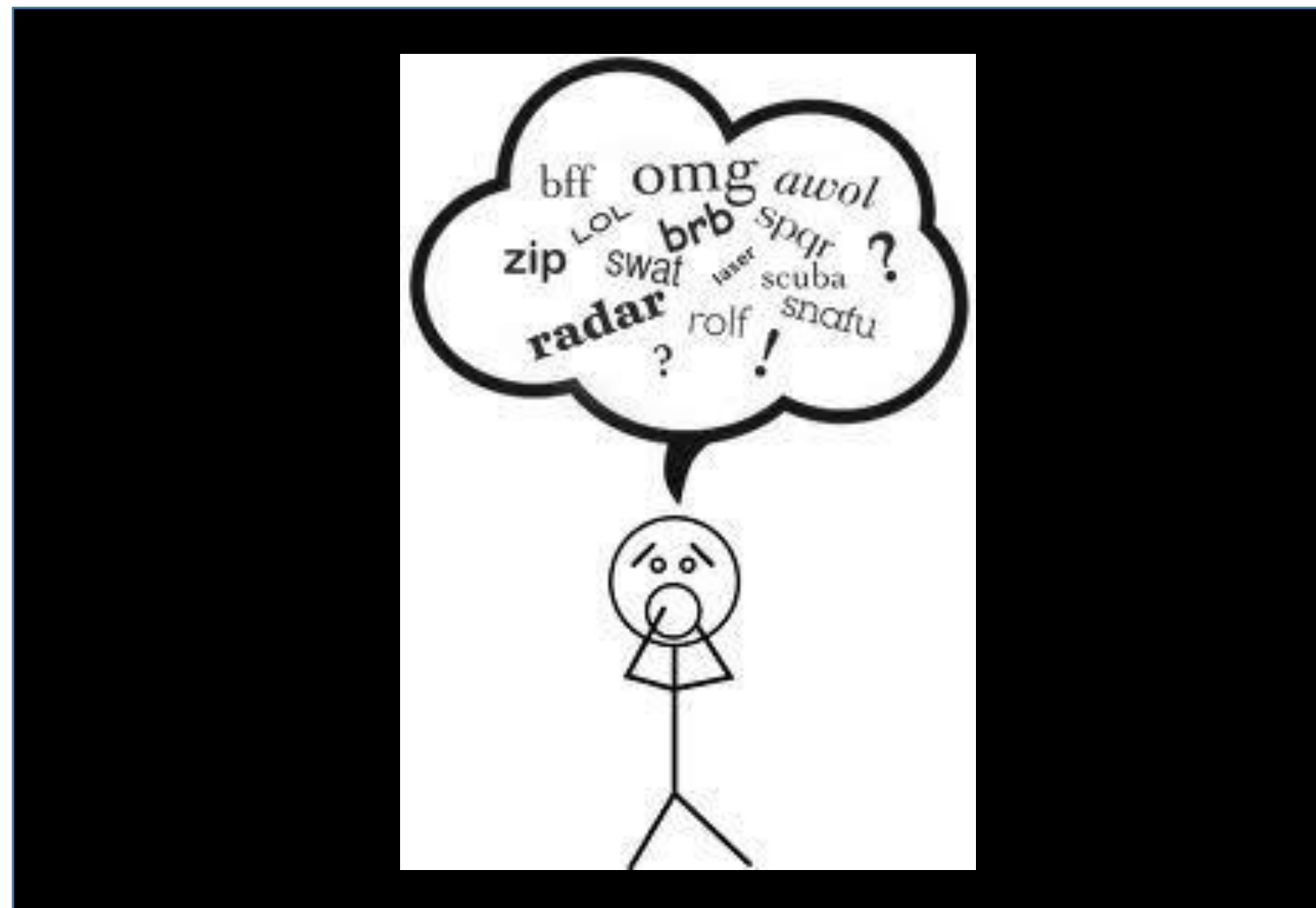
Users should be allowed to recover from errors. Reversible actions also encourage exploratory learning.



- At different levels: a single action, a subtask, or a complete task.
- Multiple steps.
- Encourage exploratory learning.
- Prevent serious errors.

Use Users' Language

The language should be always presented in a form understandable by the intended users.



- Use standard meanings of words.
- Specialized language for specialized group.
- User defined aliases.
- Users' perspective. Example: "we have bought four tickets for you" (bad) vs. "you bought four tickets" (good).



Users in Control

Don't give users the impression that they are controlled by the systems.



- Users are initiators of actions, not responders to actions.
- Avoid surprising actions, unexpected outcomes, tedious sequences of actions, etc.



Help & Documentation

Always provide help when needed.



- Context-sensitive help.
- Four types of help.
 - task-oriented
 - alphabetically ordered
 - semantically organized
 - search
- Help embedded in contents.



Small Group Exercise

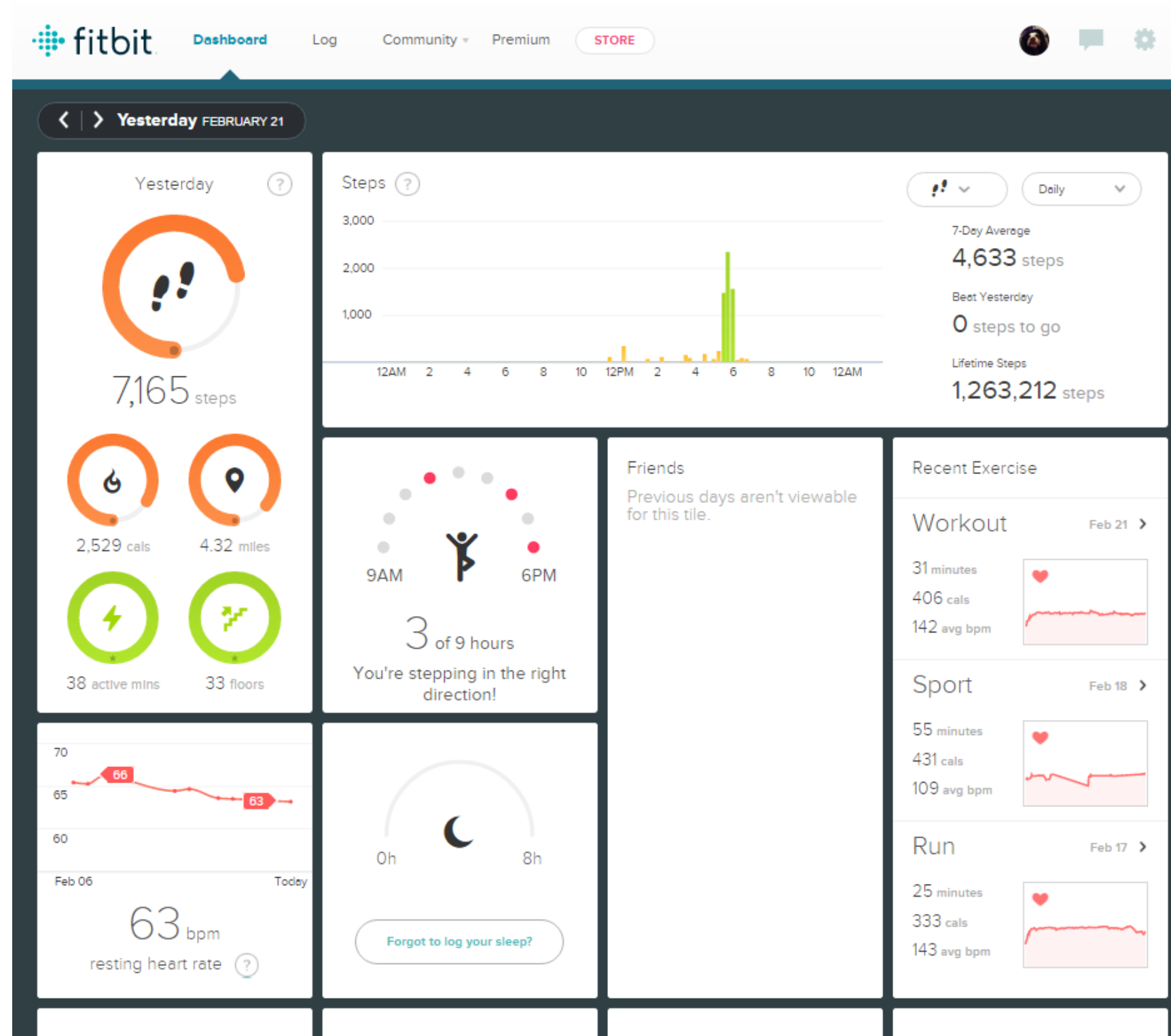


Fitbit Dashboard as a Patient Monitoring Tool



Fitbit HR

- Steps
- Heart Rate



HE Method Steps

1 Define

Users



Patient

- May not be tech savvy, no training on product
- Primary goals:
 - Understand personal data
 - Monitor progress and trends

Healthcare Provider

- Domain expert, tech savvy
- Primary goal:
 - Quickly understand patient's status and trends
 - Spot problems or warning signs



HE Method Steps

1 Define

Tasks



Patient

- How many steps were taken yesterday?
- In the last week, how many days met goal of 10,000 steps?
- How many miles were walked last week?

Healthcare Provider

- Take a few minutes to get a sense of this patient's fitness level. What is your general impression?
- What day in the last week had the most steps? How many steps were taken?
- What is your patient's average resting heart rate?



HE Method Steps

1 Define

Heuristics



Zhang et. al, 2003

- Consistency & standards
- Visibility of system state
- Match b/n system and real world
- Minimalist
- Minimize memory load
- Informative feedback
- Flexibility & efficiency
- Good error messages
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- Clear closure
- Reversible actions
- Use users' language
- Give users control
- Help & documentation

HE Method Steps

1 Define

Evaluators





- YOU!
- Work in small groups
- You'll be assigned 3-4 heuristics to focus on



Fitbit Dashboard Evaluation

2 Evaluate

1. Consistency & standards
2. Visibility of system state
3. Match b/n system and real world
4. Minimalist
5. Minimize memory load
6. Informative feedback
7. Flexibility & efficiency
8. Good error messages
9. Error Prevention
10. Clear closure
11. Reversible actions
12. Use users' language
13. Give users control
14. Help & documentation

 User	 UX Expert
<ul style="list-style-type: none">• Walkthrough tasks• Play the part• Consider each user group independently	<ul style="list-style-type: none">• Walkthrough UI multiple times• Consider each heuristic independently



Discussion / Q&A



References

Nielsen, J. & Mack, R. L., Eds. (1994). *Usability Inspection Methods*. John Wiley & Sons.

Nielsen, J. 1992. *Finding usability problems through heuristic evaluations*. Proceedings ACM CHI'92 Conference (Monterey, CA, May 3-7); 373-380.

ZHANG, J., et al. (2003) *Using usability heuristics to evaluate patient safety of medical devices*, J of Biom Info (36)1:23-30





Upcoming PEP Talks

April 13

Conducting a Task Analysis, speaker: Jody Solem

June (exact date TBD)

Conceptual Mapping Technique, , speaker: Bob Smith