

# COGNITIVE WALKTHROUGH



## What Is a Cognitive Walkthrough?

- step by step execution (evaluation) of selected typical tasks with a system
- **keep an eye out for certain problems** that often arise, especially with beginning users
- Discover mismatches between **HOW** the user **thinks about a task**, and **HOW** the UI designer thinks about the same task

# Cognitive Walkthrough

- Answer this question
- “How successfully does this design guide the **unfamiliar user** through the performance of the task?” [Newman & Lamming]
- **Principle of Learnability**

# Cognitive Walkthrough

- Going through a **scenario of interaction**
- Checking for usability problems in each step
  - ▣ Try to empathize with the user
  - ▣ “What would the user see/do now?”
  - ▣ Evaluation informed by users’ cognitive processes
- Collecting the usability problems
- Requires a detailed description of the UI prototype

# Cognitive Walkthrough – When it is needed?

- Early phase of the design
  - ▣ Implementation is not needed
    - Paper prototypes are enough
  - ▣ “Invest some effort now. Save time/money later.”
  - ▣ Allows rapid iteration of the design cycle

# Cognitive Walkthrough – Procedure

## □ Input

### ▣ Identify the users

- Their level of experience
- Their level of knowledge

### ▣ Identify relevant tasks for the following examples

- “Buy ticket” using a ticket machine
- “Check the balance” using ATM
- “Withdraw money” using an ATM;

# Cognitive Walkthrough – Procedure

- ▣ Identify relevant task for
  - “Buy ticket” using a ticket machine
- ▣ Identify the sequence of actions needed for carrying out the task
  - “Choose the destination”
  - “Choose the fare type”
  - “Insert money”
  - “Take the ticket”
  - “Get the change back”
- ▣ Identify what could go wrong on users’ side
  - E.g. “User may not have enough money”

# Cognitive Walkthrough – Procedure

- Output

- ▣ List of findings

- Who do we do this for?

- ▣ Decision on purchase

- “Binary ruling”: Good enough, not good enough
    - No need to bring up any suggestions

- ▣ Designers

- Suggest improvements to the design

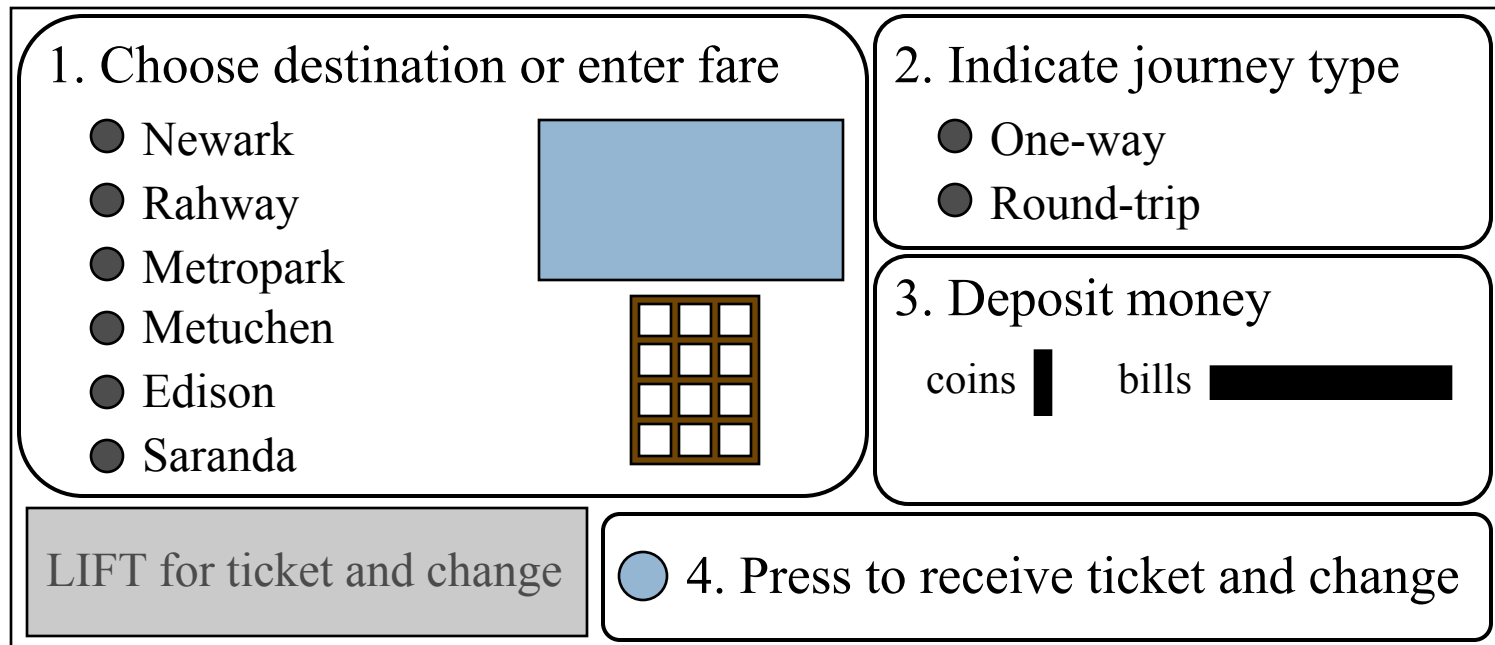


# Cognitive Walkthrough – Procedure

- Task-definition question:
  - ▣ Q0 = “What does the user want to achieve?”
  - ▣ At the beginning of the test
- Questions for each step:
  - ▣ Q1 = “Will the correct action(s) be evident to the users?”
    - *Will users know what to do?*
  - ▣ Q2 = “Will the users connect the label of an action with their goals?”
    - *Will users see how to do it?*
  - ▣ Q3 = “Will the user receive a sensible feedback?”
    - *Will users understand from the feedback whether their action are correct or not?*

# Cognitive Walkthrough Example

- Train ticket vending machine from [Newman & Lamming 1995]



# Cognitive Walkthrough Example

- Scenario

- ▣ A user wants to buy a one-way ticket to Saranda. She has a \$5 bill in her pocket + some change.

- Task-definition question Q0: “What does the user want to achieve?”

- ▣ Answer: “Purchase a one-way ticket to Saranda.”

# Cognitive Walkthrough Example

## 1. Will the correct action be evident to the user?

1. Choose destination or enter fare

☐ Newark

☐ Rahway

☐ Metropark

☐ Metuchen

☐ Edison

☐ Saranda

2. Indicate journey type

☐ One-way

☐ Round-trip

3. Deposit money

coins

bills

LIFT for ticket and change

☒ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

1. Will the correct action be evident to the user? (sub goals provided to user)

Yes →

The diagram illustrates a subway ticket machine interface with four numbered steps for a cognitive walkthrough. Step 1, 'Choose destination or enter fare', is highlighted with a red circle and a red arrow pointing to it from the word 'Yes'. It includes a list of destinations with radio buttons: Newark, Rahway, Metropark, Metuchen, Edison, and Saranda. To the right of the list is a blue rectangular display and a brown grid icon representing a keypad. Step 2, 'Indicate journey type', is also circled in red and includes radio buttons for 'One-way' and 'Round-trip'. Step 3, 'Deposit money', is circled in red and shows input fields for 'coins' (with a vertical bar) and 'bills' (with a thick black bar). Step 4, 'Press to receive ticket and change', is circled in red and features a blue circular button. A grey button labeled 'LIFT for ticket and change' is located at the bottom left of the machine interface.

1. Choose destination or enter fare

- Newark
- Rahway
- Metropark
- Metuchen
- Edison
- Saranda

2. Indicate journey type

- One-way
- Round-trip

3. Deposit money

coins | bills

LIFT for ticket and change

4. Press to receive ticket and change

# Cognitive Walkthrough Example

2. Will the user connect the correct action's description/label with his/her intent?

1. Choose destination or enter fare

☐ Newark

☐ Rahway

☐ Metropark

☐ Metuchen

☐ Edison

☐ Saranda

2. Indicate journey type

☐ One-way

☐ Round-trip

3. Deposit money

coins

bills

LIFT for ticket and change

☐ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

2. Will the user connect the correct action's description/label with his/her intent?

Yes

The diagram illustrates a transit ticket machine interface. It is divided into several sections. The top-left section, titled '1. Choose destination or enter fare', contains a list of destinations: Newark, Rahway, Metropark, Metuchen, Edison, and Saranda. The 'Saranda' option is highlighted with a red box. To the right of this list is a blue rectangular area and a 3x3 grid of squares. The top-right section, titled '2. Indicate journey type', contains two options: 'One-way' and 'Round-trip'. The bottom-right section, titled '3. Deposit money', contains two input fields: 'coins' with a vertical bar and 'bills' with a horizontal bar. The bottom-left section is a grey box labeled 'LIFT for ticket and change'. The bottom-right section, titled '4. Press to receive ticket and change', contains a blue circle icon. A red line with the word 'Yes' points to the 'Saranda' option in the first section.

1. Choose destination or enter fare

- Newark
- Rahway
- Metropark
- Metuchen
- Edison
- Saranda

2. Indicate journey type

- One-way
- Round-trip

3. Deposit money

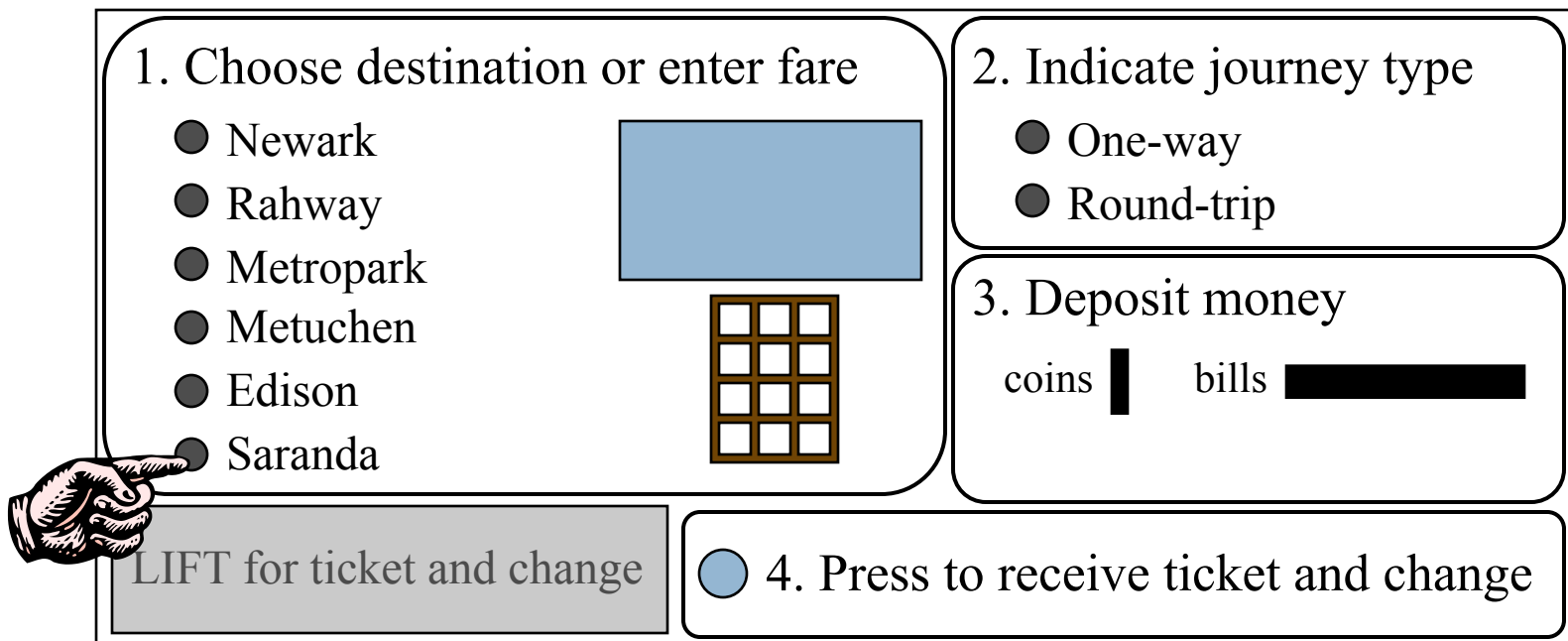
coins | bills

LIFT for ticket and change

4. Press to receive ticket and change

# Cognitive Walkthrough Example

3. Will the user properly interpret the system's response? (know if chose right/wrong?)



The diagram illustrates a transit ticket machine interface with the following components:

- 1. Choose destination or enter fare:** A list of destinations with radio buttons: Newark, Rahway, Metropark, Metuchen, Edison, and Saranda. A hand icon is pointing at the 'Saranda' option. To the right of the list is a blue rectangular display screen and a brown grid icon representing a keypad.
- 2. Indicate journey type:** Radio buttons for 'One-way' and 'Round-trip'.
- 3. Deposit money:** Input fields for 'coins' (a vertical bar) and 'bills' (a horizontal bar).
- 4. Press to receive ticket and change:** A button with a blue circle icon and the text '4. Press to receive ticket and change'.
- LIFT for ticket and change:** A grey rectangular area at the bottom left with the text 'LIFT for ticket and change'.



# Cognitive Walkthrough Example

3. Will the user properly interpret the system's response? (know if chose right/wrong?)

Yes (if  
button  
lights  
up...)



1. Choose destination or enter fare

- ☐ Newark
- ☐ Rahway
- ☐ Metropark
- ☐ Metuchen
- ☐ Edison
- ☒ Saranda



2. Indicate journey type

- ☐ One-way
- ☐ Round-trip

3. Deposit money

coins  bills

LIFT for ticket and change

☐ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

## 1. Will the correct action be evident to the user?

1. Choose destination or enter fare

☐ Newark

☐ Rahway

☐ Metropark

☐ Metuchen

☐ Edison

☒ Saranda

2. Indicate journey type

☐ One-way

☐ Round-trip

3. Deposit money

coins

bills

LIFT for ticket and change

☒ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

## 1. Will the correct action be evident to the user?

Yes

The diagram illustrates a subway ticket machine interface with four steps highlighted for a cognitive walkthrough. Step 1, 'Choose destination or enter fare', includes a list of destinations with radio buttons: Newark, Rahway, Metropark, Metuchen, Edison, and New Brunswick (which is selected with a red dot). To the right of the list is a blue rectangular input field and a 3x3 grid of buttons. Step 2, 'Indicate journey type', includes radio buttons for 'One-way' and 'Round-trip'. Step 3, 'Deposit money', includes input fields for 'coins' and 'bills'. Step 4, 'Press to receive ticket and change', is represented by a blue circle button. A red arrow points from the word 'Yes' to step 2, indicating that the correct action is evident to the user.

1. Choose destination or enter fare

- ☐ Newark
- ☐ Rahway
- ☐ Metropark
- ☐ Metuchen
- ☐ Edison
- ☒ New Brunswick

2. Indicate journey type

- ☐ One-way
- ☐ Round-trip

3. Deposit money

coins  bills

LIFT for ticket and change

☐ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

2. Will the user connect the correct action's description/label with his/her intent?

1. Choose destination or enter fare

☐ Newark

☐ Rahway

☐ Metropark

☐ Metuchen

☐ Edison

☒ New Brunswick

2. Indicate journey type

☐ One-way

☐ Round-trip

3. Deposit money

coins

bills

LIFT for ticket and change

☐ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

2. Will the user connect the correct action's description/label with his/her intent?

Yes

The diagram illustrates a transit ticket machine interface with four main sections. The first section, '1. Choose destination or enter fare', lists six destinations with radio buttons: Newark, Rahway, Metropark, Metuchen, Edison, and New Brunswick (which is selected with a red dot). To the right of this list is a blue rectangular display and a brown grid icon representing a keypad. The second section, '2. Indicate journey type', is highlighted with a red box and contains two radio buttons: 'One-way' (highlighted with a red box) and 'Round-trip'. The third section, '3. Deposit money', features input fields for 'coins' (a vertical bar) and 'bills' (a horizontal bar). The fourth section, '4. Press to receive ticket and change', contains a blue circle icon and the text 'Press to receive ticket and change'. A grey button at the bottom left is labeled 'LIFT for ticket and change'. Red lines connect the 'Yes' label to the 'New Brunswick' option and the 'One-way' option, indicating successful user intent recognition.

1. Choose destination or enter fare

- ☐ Newark
- ☐ Rahway
- ☐ Metropark
- ☐ Metuchen
- ☐ Edison
- ☒ New Brunswick

2. Indicate journey type

- ☒ One-way
- ☐ Round-trip

3. Deposit money

coins  bills

LIFT for ticket and change

☐ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

2. Will the user properly interpret the system's response? (know if chose right/wrong?)

1. Choose destination or enter fare

☐ Newark

☐ Rahway

☐ Metropark

☐ Metuchen

☐ Edison

☒ New Brunswick

2. Indicate journey type

☐ One-way

☐ Round-trip

3. Deposit money

coins

bills

LIFT for ticket and change

☐ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

2. Will the user properly interpret the system's response? (know if chose right/wrong?)

Yes ...

1. Choose destination or enter fare

☐ Newark

☐ Rahway

☐ Metropark

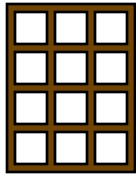
☐ Metuchen

☐ Edison

☒ New Brunswick

One-way

\$6.35





2. Indicate journey type

☒ One-way

☐ Round-trip

3. Deposit money

coins 

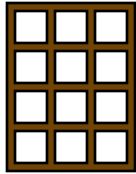
bills 

LIFT for ticket and change

☒ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

## 1. Will the correct action be evident to the user?

<p>1. Choose destination or enter fare</p> <ul style="list-style-type: none"><li><input type="radio"/> Newark</li><li><input type="radio"/> Rahway</li><li><input type="radio"/> Metropark</li><li><input type="radio"/> Metuchen</li><li><input type="radio"/> Edison</li><li><input checked="" type="radio"/> Saranda</li></ul> <div data-bbox="768 664 1078 825"><p>One-way</p><p>\$6.35</p></div> <div data-bbox="859 839 994 1011"></div>	<p>2. Indicate journey type</p> <ul style="list-style-type: none"><li><input checked="" type="radio"/> One-way</li><li><input type="radio"/> Round-trip</li></ul>
<p>LIFT for ticket and change</p>	<p>3. Deposit money</p> <p>coins <input type="text"/> bills <input type="text"/></p> <p><input checked="" type="radio"/> 4. Press to receive ticket and change</p>



# Cognitive Walkthrough Example

## 1. Will the correct action be evident to the user?

Yes

The diagram illustrates a transit fare machine interface with the following components:

- Step 1: Choose destination or enter fare**
  - Radio buttons for destinations: Newark, Rahway, Metropark, Metuchen, Edison, and Saranda. Saranda is selected (red dot).
  - A blue box displays "One-way" and "\$6.35".
  - A coin slot icon is shown below the fare box.
- Step 2: Indicate journey type**
  - Radio buttons for "One-way" (selected, red dot) and "Round-trip" (grey dot).
- Step 3: Deposit money**
  - Fields for "coins" and "bills" with corresponding input bars.
- Step 4: Press to receive ticket and change**
  - A blue circle icon next to the text "4. Press to receive ticket and change".

Additional interface elements include a grey button labeled "LIFT for ticket and change" and a red arrow pointing from the word "Yes" to the "One-way" fare box.

# Cognitive Walkthrough Example

2. Will the user connect the correct action's description/label with his/her intent?

1. Choose destination or enter fare

☐ Newark

☐ Rahway

☐ Metropark

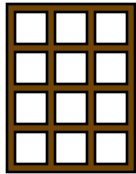
☐ Metuchen

☐ Edison

☒ Saranda

One-way

\$6.35




LIFT for ticket and change


2. Indicate journey type

☒ One-way

☐ Round-trip

3. Deposit money

coins 

bills 

☒ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

2. Will the user connect the correct action's description/label with his/her intent?

Yes

1. Choose destination or enter fare

- ☐ Newark
- ☐ Rahway
- ☐ Metropark
- ☐ Metuchen
- ☐ Edison
- ☒ Saranda

One-way  
\$6.35


2. Indicate journey type

- ☒ One-way
- ☐ Round-trip

3. Deposit money

coins  bills

LIFT for ticket and change

☒ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

3. Will the user properly interpret the system's response? (know if chose right/wrong?)

1. Choose destination or enter fare

☐ Newark

☐ Rahway

☐ Metropark

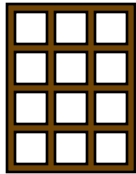
☐ Metuchen

☐ Edison

☒ Saranda

One-way

\$6.35





2. Indicate journey type

☒ One-way

☐ Round-trip

3. Deposit money

coins 

bills 

LIFT for ticket and change

☒ 4. Press to receive ticket and change

# Cognitive Walkthrough Example

3. Will the user properly interpret the system's response? (know if chose right/wrong?)

<p>1. Choose destination or enter fare</p> <ul style="list-style-type: none"><li><input type="radio"/> Newark</li><li><input type="radio"/> Rahway</li><li><input type="radio"/> Metropark</li><li><input type="radio"/> Metuchen</li><li><input type="radio"/> Edison</li><li><input checked="" type="radio"/> Saranda</li></ul> <div data-bbox="768 725 1078 889"><p>One-way</p><p>\$6.35</p></div> <div data-bbox="859 901 994 1072"></div>	<p>2. Indicate journey type</p> <ul style="list-style-type: none"><li><input checked="" type="radio"/> One-way</li><li><input type="radio"/> Round-trip</li></ul> <p>3. Deposit money</p> <p>coins <input type="text"/> bills <input type="text"/></p>
<p>LIFT for ticket and change</p>	<p><input checked="" type="radio"/> 4. Press to receive ticket and change</p>

# Cognitive Walkthrough Example

3. Will the user properly interpret the system's response? (know if chose right/wrong?)

The diagram illustrates a transit fare machine interface with four main sections:

- 1. Choose destination or enter fare:** A list of destinations with radio buttons: Newark, Rahway, Metropark, Metuchen, Edison, and Saranda (selected). To the right, a blue box displays "One-way \$6.35" and "Recv'd: \$5.00" in red. Below this is a coin slot icon.
- 2. Indicate journey type:** Radio buttons for "One-way" (selected) and "Round-trip".
- 3. Deposit money:** Input fields for "coins" and "bills".
- 4. Press to receive ticket and change:** A button with a blue circle icon.

A red arrow points from the text "No, need feedback!" to the "Recv'd: \$5.00" display, indicating a cognitive walkthrough finding.

No, need feedback!

→ Add received amount display

# Cognitive Walkthrough Example

- We also need to handle common error-prone situations
  - “What if the user does not have enough money but she already put some bills in?”
  - The task gets redefined → “Want cancel and get money back!”

# Cognitive Walkthrough Example

Not enough \$...

1. Will the correct action be evident?

<p>1. Choose destination or enter fare</p> <ul style="list-style-type: none"><li><input type="radio"/> Newark</li><li><input type="radio"/> Rahway</li><li><input type="radio"/> Metropark</li><li><input type="radio"/> Metuchen</li><li><input type="radio"/> Edison</li><li><input checked="" type="radio"/> Saranda</li></ul> <div data-bbox="755 743 1062 903"><p>One-way \$6.35 Recv'd: \$5.00</p></div> <div data-bbox="846 918 979 1089"></div>	<p>2. Indicate journey type</p> <ul style="list-style-type: none"><li><input checked="" type="radio"/> One-way</li><li><input type="radio"/> Round-trip</li></ul> <p>3. Deposit money</p> <p>coins <input type="text"/> bills <input type="text"/></p>
<p>LIFT for ticket and change</p>	<p><input checked="" type="radio"/> 4. Press to receive ticket and change</p>



# Cognitive Walkthrough Example

Not enough \$...

1. Will the correct action be evident?

Probably not!

The diagram illustrates a transit ticket machine interface with four numbered steps. A red arrow points from the text 'Probably not!' to step 4, indicating a cognitive walkthrough finding. The interface includes a list of destinations, a display for journey type and fare, a coin slot, and a button to receive the ticket and change.

1. Choose destination or enter fare

- ☐ Newark
- ☐ Rahway
- ☐ Metropark
- ☐ Metuchen
- ☐ Edison
- ☒ Saranda

One-way \$6.35  
Recv'd: \$5.00

2. Indicate journey type

- ☒ One-way
- ☐ Round-trip

3. Deposit money

coins  bills

LIFT for ticket and change

4. Press to receive ticket and change

# Cognitive Walkthrough Example

Not enough \$...

Probably not!  
→ Add a new UI  
element to make it  
clear!

1. Choose destination or enter fare

☐ Newark

☐ Rahway

☐ Metropark

☐ Metuchen

☐ Edison

☒ Saranda

One-way  
\$6.35  
Recv'd: \$5.00

2. Indicate journey type

☒ One-way

☐ Round-trip

3. Deposit money

coins

bills

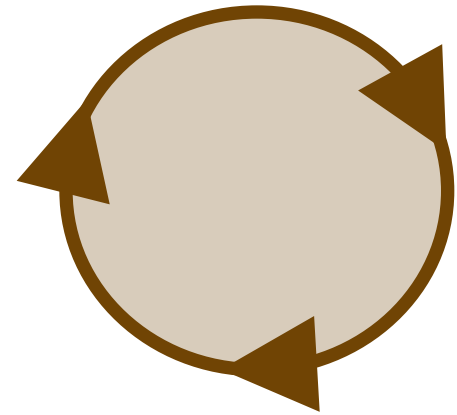
☒ Cancel & return money

LIFT for ticket and change

☐ 4. Press to receive ticket and change

# Cognitive Walkthrough – Reporting

- Content of the document:
  - ▣ Scenario
    - Application of the questions
    - Answers to the questions
  - ▣ Interleave with critical phases
    - Suggest the solution of the problems
- ... then start a new round the design cycle



# Cognitive Walkthrough – Reporting

- Step 3: Deposit money
  - ▣ Q3: Will the User properly interpret the system response?
  - ▣ Answer: No. The system does not indicate any amount deposited.
  - ▣ Suggestion: Need feedback on the amount of money deposited.
- Step 4b: Cancel the operation
  - ▣ Q1: Will the correct action be evident?
  - ▣ Answer: No.
  - ▣ Suggestion: Add the Cancel button under the coin slot.

# Cognitive Walkthrough – Limitations

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- ❑ Only diagnostics of the usability problems
- ❑ No estimate of time
- ❑ Not a quantitative method

# Cognitive Walkthrough-Example-2

- ▣ Identify relevant tasks for the following examples
  - “Check the balance” using ATM
  - “Withdraw money” using an ATM;
- ▣ Identify the sequence of actions needed for carrying out the task

# Over view of the actual Walkthrough Processes

## Pre-preparation:

## Cognitive Walkthrough-Example-2

- 1. Define Users :** Who are the users. Identify them.  
(Categorise them as Novices, Intermittent & Experts)

## 2. Identify the tasks for the evaluation

Ex: Evaluation for “Checking out Balance on an ATM”

Prepare notes on what the user must know prior to performing the task and what the user should be learning while performing the task.

## 3. Prepare action sequences for completing the Tasks

Make a “AND THEN “ list of Goals & sub goals.

Ex: Overall Goal: Find out balance from the ATM

Subgoal1 : Activate ATM [Physical action Insert Card]

Subgoal2: Identify self [ Input pin code]

Sub goal 3 : Get balance [ press action button with label]

Sub goal 4: Get a print out [ if required]

Sub goal 5: Log out from ATM .

## 4. Conduct the Walk Through Session

# Cognitive Walkthrough-Example-2

- ▣ Identify what could go wrong on users' side
  - E.g. "User may not have enough money in an account"



# Comparison

## □ Cognitive Walkthrough

- ▣ Informed by cognitive psychology
- ▣ Done by one person (the researcher)
- ▣ More formal
- ▣ Better for highly structured tasks

## □ Heuristic Evaluation

- ▣ Informed by design practices
- ▣ Done by appointed experts
- ▣ Less formal
- ▣ Better for less structured tasks
- ▣ Good for testing an artifact in extreme[~ish] conditions

# PHYSIOLOGICAL METHODS

Eye tracking  
Physiological measurement

# Eye tracking

- Head or desk mounted equipment tracks the position of the eye
- Eye movement reflects the **amount of cognitive processing** a display requires
- Measurements include
  - ▣ Fixations:
    - Eye maintains **stable position**
    - Number and duration indicate **level of difficulty with display**
  - ▣ Saccades: Rapid eye movement from one point of interest to another
  - ▣ Scan paths: Moving straight to a target with a short fixation at the target is optimal

# Physiological measurements

- Emotional response linked to physical changes
- These may help determine a user's reaction to an interface
- Measurements include:
  - ▣ Heart activity, including blood pressure, volume and pulse.
  - ▣ Activity of sweat glands: Galvanic Skin Response (GSR)
  - ▣ Electrical activity in muscle: electromyogram (EMG)
  - ▣ Electrical activity in brain: electroencephalogram (EEG)
- Some difficulty in interpreting these physiological responses
  - ▣ More research needed

# Choosing an evaluation method

When in process	: Design vs. implementation
Style of evaluation	: Laboratory vs. field
How objective	: Subjective vs. objective
Type of measures	: Qualitative vs. quantitative
Level of information	: High level vs. low level
Level of interference	: Obtrusive vs. unobtrusive
Resources available	: Time, subjects, equipment, expertise

THE END