

# CS3724 Human-computer Interaction

## User Interaction Guidelines

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## Topics

- Organizing usability issues: The User Action Framework
- The Interaction Cycle
- Affordances
- Selected usability design guidelines
- In-class exercises on guidelines

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## The User Action Framework (UAF)

- The Interaction Cycle is highest level of categories in the UAF
  - Adapted and Extended Norman's "stages of action"  
Norman, D.A. Cognitive engineering. Chapter 3 in *User centered system design: New perspectives on human-computer interaction*. Norman and Draper ed. Lawrence Erlbaum Associates, Hillsdale, NJ, 1986, 31-61.
- All about what users **think**, **do** and **see** during cycle of interaction with computer
  - **THINK** – represents all cognitive actions
  - **DO** – represents all physical actions
  - **SEE** – represents all sensory actions

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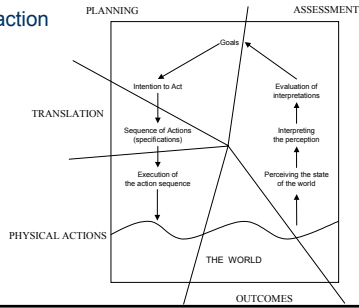
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## Norman's 'Stages of Action' Model

- User interaction with any machine



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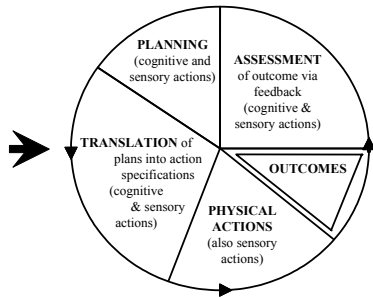
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## Transition to Interaction Cycle



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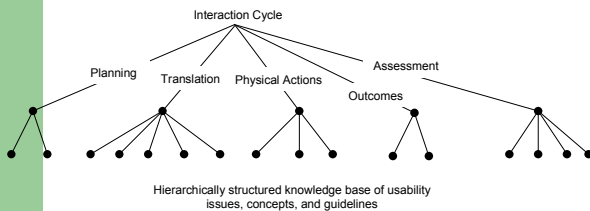
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## Transition to User Action Framework



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## Norman vs. UAF

- Norman's model and our Interaction Cycle is about what users do within a cycle of interaction with a computer or other machine
- The UAF is about design, about how interaction designs support users in performing sensory, cognitive, and physical actions during interaction with a machine

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## The User Action Framework

- Hierarchical knowledge base of usability concepts and issues organized on Interaction Cycle
  - Organizes usability concepts in terms of user actions during task performance
  - Works for interaction with any kind of machine, any style of interaction
  - Puts usability problems in context of relevant design guidelines and principles
  - Not claimed complete, but self-extending

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## The User Action Framework

- Integrated framework for UE tools for:
  - Usability inspection
  - Usability problem analysis (problem extraction and diagnosis)
  - Usability problem reporting
  - Usability data management
  - **Design guidelines**

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## Affordances

- Affordances\* – an essential concept
  - An affordance gives or provides something that helps a user do something
  - In interaction design, affordances are attributes of user interface artifacts that help users perform tasks

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\* Hartson, H. R. (2003). Cognitive, Physical, Sensory, and Functional Affordances in Interaction Design. *Accepted for publication in Behaviour and Information Technology.*

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## Affordances

- Cognitive affordance
  - A cognitive affordance is a design feature that helps, aids, supports, facilitates, or enables thinking and/or knowing about something
  - Example: Clear and precise words in button label enabling users to understand meaning of button in terms of functionality behind it and consequences of clicking on it
  - Plays starring role in interaction design for less experienced users

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## Affordances

- Physical affordance
  - A physical affordance is a design feature that helps, aids, supports, facilitates, or enables physically doing something
  - Example: Adequate button size and easy-to-access location enable users to click easily on the button
  - Plays starring role in interaction design for experienced (power) users

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## Affordances

- Sensory affordance
  - A sensory affordance is design feature that helps, aids, supports, facilitates, or enables user in sensing (e.g., seeing, hearing, feeling) something
  - Includes design features or devices associated with visual, auditory, haptic/tactile, or other sensations
  - Plays critical supporting role to cognitive affordance and physical affordance
  - Example: Button label text in font large enough and appropriate color to support legibility

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## Affordances

- Functional affordance
  - Functionality of non-IU software
  - Adds purpose for physical affordance
  - Adds sense and goal orientation to design discussion
  - Connects usability with usefulness (of system functionality)
  - About higher-level user enablement in the work domain

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## Affordances

- Affordances work together in design
  - Example: Devices for opening doors (round doorknobs and lever-type door handles)
  - Visual design of each conveys cognitive affordance via implied message “this is what you use to open a door”
  - Doorknob and lever suggest, each in own way, grasping and rotating for door operation
  - But message is received only because of shared cultural conventions

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## Affordances

- Affordances work together in design
  - Door operating devices also provide physical affordance, to help users open and close doors
  - Some devices work better than others as physical affordances
  - Push-bar on double doors is another type of physical affordance for doors

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## Affordances

- False cognitive affordances misinform and mislead
  - Example: Web page links that only look like buttons
- The "booby-trapped" X in a pop-up advertisement
- Horizontal line in Web page that falls at bottom of screen

Simple Search    Advanced Search    Browse    Register    Submit to CaRR    About NCSTRL    OAI    Help

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## Affordances

- Trails of user-made artifacts
- Tape added to shovel handle, Post It note added to monitor or keyboard



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## Affordances

- Trails of user-made artifacts



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## The User Interaction Cycle



- Simplest view of the Interaction Cycle
  - Planning (What to do)
  - Translation to determine actions (How to do it)
  - Physical actions (Doing it)
  - Assessment of outcome (Did it turn out right?)

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## Planning – Selected Design Guidelines



- Provide clear model of how users view system in terms of tasks
  - Help users with system model, metaphors, work context
  - Help users plan goals, tasks
    - Help users decompose tasks logically

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## Planning – Selected Design Guidelines

- Make possibilities clear what users can do at every point
- Keep users aware of system state for planning next task
- Keep users aware of task progress (what's been done and what's left do)



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## Translation – Selected Design Guidelines

- Provide effective cognitive affordances – cues (e.g., in labels, data field formats, icons) that help users get access to system functionality
  - Help users know/learn what action are needed to carry out intentions
    - Users get knowledge from experience, training, AND: 0cognitive affordances in design
  - Help users predict outcome of actions
  - Help users determine what to do to get started



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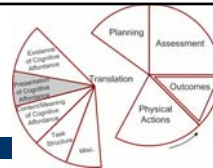
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## Translation – Selected Design Guidelines

- Support user with effective sensory affordances in **presentation** of cognitive affordances
  - Make noticeable
    - Object contrast, size layout complexity, location with respect to user focus
  - Make legible, readable (discernable)
    - Font size, font type, font color, font contrast
  - Avoid irritation in presentation of cognitive affordances (e.g., color, blinking, audio)



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## Translation – Selected Design Guidelines



- Support user with effective sensory affordances in **presentation** of cognitive affordances
  - Control complexity with effective layout, organization, and grouping
    - Avoid screen clutter

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## Translation – Selected Design Guidelines



- Help user determine actions with effective content/meaning in cognitive affordances
  - Design for clarity
    - Use precise wording in labels, menu titles, menu choices, icons, data fields
      - Example: "email" rather than "answer mail" or "read mail" (Note that longer label isn't always more precise: "Answer mail" is more specific but not more precise.)
    - Use dynamically changing labels when toggling (e.g., play/Pause, Partial view/Full view)

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Marked for deletion

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## Translation – Selected Design Guidelines



- Design for clarity
  - Provide clearly marked exits
    - Example: "Return to XYZ" instead of Cancel or Exit
  - Provide clear "Do It" mechanism
    - Example: for add-record task, use "Add Record" instead of just Ok or Return
  - Be complete – include enough information for user to determine correct action
  - Be predictable; help users predict outcome of actions (feedforward)
    - Predictability helps learning and error avoidance

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## Translation – Selected Design Guidelines



- Design for clarity
  - Be consistent (a guideline with interpretation difficulties)
    - Consistency: Similar semantics  $\leftrightarrow$  similar syntax (wording or user actions)
    - Use consistent wording in labels for menus, buttons, icons, fields [Continue vs. retry](#)
    - Custom style guides help consistency
  - Use appropriate layout and grouping by function to convey content and meaning [Group by function](#)

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## Translation – Selected Design Guidelines



- Design for clarity
  - Furnish useful defaults (e.g., most likely values, cursor position) [Use most likely date as default, also shows format](#)
  - Support human memory limits with recognition over recall [Show file names](#)
- Design for cognitive directness
  - Minimize mental transformations
  - Examples (thanks to Paul Kemmerling)

29 UAF-GL [Cognitive directness 1](#) [Cognitive directness 2](#) [Cognitive directness 3](#)

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## Translation – Selected Design Guidelines



- Design for completeness
  - Use enough words for unambiguous labels
    - Long labels are not necessarily bad
  - Give enough information for users to make confident decisions
  - Prevent loss of productivity due to hesitation, pondering [Revert to saved](#)
  - Give enough alternatives for user needs

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## Translation – Selected Design Guidelines



- Help users avoid errors
  - Example: Gray out to make inappropriate choices unavailable (case of content conveyed by presentation medium)
- Offer constructive help for error recovery
  - "To err is human; forgive by design"
  - Provide clear way to undo (multiple levels) and reverse actions

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## Translation – Selected Design Guidelines



- Design carefully for modes
  - Modes are states where actions have different meanings
  - Distinguish modes clearly
  - Avoid confusing modalities
    - Users cannot easily shift focus
    - Even works against expert users

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## Translation – Selected Design Guidelines



- Support user with effective task structure and interaction control
  - Keep users in control
    - Avoid *feeling* of loss of control (e.g., bossy attitude projected to users)
      - Example: "You need to answer your mail" or "Enter next command" vs. "Ready for next command"
    - Avoid too much automation and *real* loss of control (actually appears under Outcomes)
      - Example: Changing folder name "IRS" to "Irs"
      - Unnecessarily preemptive dialogue box interrupts normal planning

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## Translation – Selected Design Guidelines



- Design task structure for flexibility and efficiency
  - Provide alternative ways to perform task
  - Provide shortcuts (e.g., hot keys)
  - Don't undo user's work
    - Example: user fills out part of form, goes away, and returns to empty form
    - Example: Retain user preferences; retain navigation through directory structures !!

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## Translation – Selected Design Guidelines



- Design natural interaction control
  - Give direct manipulation support
    - Example: Direct editing of text object instead of requiring user to ask system to put it away
  - Anticipate likely related tasks; support task thread continuity
    - Example: if message suggests something, offer an easy way to do it

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## Translation – Selected Design Guidelines



- Other guidelines for Translation
  - Support human memory limitations
    - Avoid requirement to retype or copy from one place to another
  - Always provide a way to 'bail out'
    - Example: Error message box has button for Task A, Task B (not enough: needs Cancel, too)

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## Translation – Selected Design Guidelines



- Accommodate different user classes with preferences

Lead	Novice
Follow	Intermittent
Get out of the way	Expert

- Don't let affordances for new users be performance barriers to experienced users

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## Physical Actions – Selected Design Guidelines



- Support user with effective sensory affordances for **sensing** physical affordance – e.g., help in *seeing* objects to manipulate
  - Make objects discernable, legible, noticeable
- Support user with effective physical affordances for manipulating objects – help in *doing* actions

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## Physical Actions – Selected Design Guidelines



- Avoid physical awkwardness
  - Example: Time-consuming switches between multiple input devices (e.g., mouse and keyboard, touchscreen)
- Accommodate physical disabilities-limited motion, motor control, vision, hearing

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## Physical Actions – Selected Design Guidelines



- Design layout to support Fitts' law, manual dexterity
  - Support hand-eye coordination limits by making selectable objects large enough
  - Locate related clickable objects close together
    - Avoid fatigue, slow performance
  - But not too close
    - Avoid erroneous selection

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## The System's Turn – Outcome and System Response



- Outcome is internal computation or state change
  - Not directly visible to user
  - Interaction designer must make visible via feedback in system response
  - System response is only way user knows about outcome of actions
  - System response can contain:
    - Feedback – information about course of interaction so far
    - Information display – results of outcome computation
    - Feed-forward – information about what to do next

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## The System's Turn – Outcome and System Response



- System response example
  - “The value you entered for your name was not accepted by the system.” (feedback → Assessment)
  - “Please try again using only alphabetic characters.” (feed-forward → Translation)

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## Assessment – Selected Design Guidelines



- Assessment issues are similar, parallel to those for Translation
  - Existence (of feedback)
  - Presentation (of feedback)
  - Content, meaning (of feedback)

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## Assessment – Selected Design Guidelines



- Make sure of **existence** of feedback
  - Provide feedback
    - No news is no news!
    - Feedback keeps users on track
  - Provide progress report on long operations (e.g., percent-done indicator)
  - Request confirmation as a kind of intervening feedback, to prevent errors (especially for potentially destructive actions)
    - But don't overuse and annoy

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## Assessment – Selected Design Guidelines



- Support user with effective sensory affordances in **presentation** of feedback
  - Make feedback noticeable
    - Locate feedback within user focus of attention
    - Make large enough to see
    - Present feedback promptly
    - Make feedback persistent (avoid flashing)

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## Assessment – Selected Design Guidelines



- Make presentation of feedback text legible
  - Use mixed case for extensive text
  - Avoid too many different fonts, sizes
  - Use legible fonts
  - Make font size large enough for all users
  - Use color other than blue for text
  - Avoid red, except for urgency
  - Use good contrast (color and intensity) with background
  - Accommodate sensory disabilities and limitations (e.g., visually challenged, color blind)

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## Assessment – Selected Design Guidelines



- Use most effective presentation medium
  - Consider audio as alternative channel
    - To get attention if heavy task or sensory work load
    - For vision impaired users

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## Assessment – Selected Design Guidelines



- Support user with effective **content/meaning** in feedback
  - Design for clarity
    - Support clear understanding of outcome (system state change), so users can assess effect of actions
    - Give clear indication of error conditions

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Slash in file name

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## Assessment – Selected Design Guidelines



- Design for completeness
  - Provide enough feedback so users can be either confident their command worked or certain about why it didn't
- Help users understand what the real error is
- Provide helpful, informative error messages, not "cute" unhelpful messages

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Unsupported

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## Assessment – Selected Design Guidelines



- Design feedback wording (especially error messages) for positive psychological impact
  - Make system take blame for errors
  - Be positive, to encourage
  - Avoid violent, negative, demeaning terms
  - Avoid use of "illegal"
- Employ user-centered wording (language of user and work context) in displays, messages, other feedback

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Gobbledygook

Printer message

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## Assessment – Selected Design Guidelines



- Design for consistency
  - Label outcome (e.g., title of new screen or dialogue box) consistently with starting point and action (e.g., button label or menu choice) [Madam - match](#)
- Organize feedback for ease of understanding
  - Provide user control over amount and detail of feedback
  - Give only most important information; more on demand

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## Assessment – Selected Design Guidelines



- Organize information displays for ease of understanding
  - Provide user control over amount and detail of feedback
  - Give only most important information; more on demand
  - Eliminate unnecessary words
  - Group related information
  - Control density of displays; use white space to set off
  - Columns are easier to read than wide rows
  - Use abstraction per Shneiderman's "mantra": Overview first; zoom and filter; details on demand

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Train example

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## Independent (of Place in Cycle) – Selected Design Guidelines

- Independent means overall issue, not just in one part of Interaction Cycle (e.g., overall wording, style, color)
- Examples of overall style issues
  - Use user-centered (language of user and work context) wording
  - Avoid anthropomorphism-attributing human characteristics to non-human objects
  - Avoid poor attempts at humor
    - Easy to do badly
    - Easily misinterpreted

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## Independent (of Place in Cycle) – Selected Design Guidelines

- Examples of overall style issues
  - Avoid irritation in displays (e.g., color, blinking, audio, offensive messages)
    - Use pastels, not bright colors
    - Be aware of color conventions (especially red)
    - Allow user settings, preferences (e.g., sounds levels, blinking, color)
    - Watch out for focusing problem with red and blue

[Red and blue](#)

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## Design Guidelines: Conclusions

- Be cautious using guidelines
  - Need careful thought, interpretation
  - In application, they can conflict and overlap
  - They do not guarantee usability
  - Using guidelines does NOT eliminate need for usability testing
- Design by guidelines, not by politics or personal opinion

Daytime

Jim Foley: "The only correct answer to any UI design question is: It depends"

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