Constraint

A method of limiting the actions that can be performed on a system.

Constraints limit the possible actions that can be performed on a system. For example, dimming or hiding unavailable software controls constrains the options that can be selected. Proper application of *constraints* in this fashion makes designs easier to use and dramatically reduces the probability of error during interaction. There are two basic kinds of constraints: physical constraints and psychological constraints.[1]

Physical constraints limit the range of possible actions by redirecting physical motion in specific ways. The three kinds of physical constraints are paths, axes, and barriers. Paths convert applied forces into linear or curvilinear motion using channels or grooves (e.g., scroll bar in software user interfaces). Axes convert applied forces into rotary motion, effectively providing a control surface of infinite length in a small space (e.g., a trackball). Barriers absorb or deflect applied forces, thereby halting, slowing, or redirecting the forces around the barrier (e.g., boundaries of a computer screen). Physical constraints are useful for reducing the sensitivity of controls to unwanted inputs, and denying certain kinds of inputs altogether. Paths are useful in situations where the control variable range is relatively small and bounded. Axes are useful in situations where control real estate is limited, or the control variables are very large or unbounded. Barriers are useful for denying errant or undesired actions.

Psychological constraints limit the range of possible actions by leveraging the way people perceive and think about the world. The three kinds of psychological constraints are symbols, conventions, and mappings. Symbols influence behavior by communicating meaning through language, such as the text and icon on a warning sign. Conventions influence behavior based on learned traditions and practices, such as "red means *stop*, green means *go*." Mappings influence behavior based on the perceived relationships between elements. For example, light switches that are close to a set of lights are perceived to be more related than switches that are far away. Symbols are useful for labeling, explaining, and warning using visual, aural, and tactile representation—all three if the message is critical. Conventions indicate common methods of understanding and interacting, and are useful for making systems consistent and easy to use. Mappings are useful for implying what actions are possible based on the visibility, location, and appearance of controls.[2]

Use constraints in design to simplify usability and minimize errors. Use physical constraints to reduce the sensitivity of controls, minimize unintentional inputs, and prevent or slow dangerous actions. Use psychological constraints to improve the clarity and intuitiveness of a design.

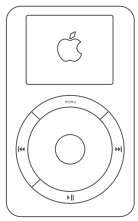
See also Affordance, Archetypes, Control, Errors, Forgiveness, Mapping, and Nudge.

[1] The seminal work on psychological constraints is *The Design of Everyday Things* by Donald Norman, Doubleday, 1990.

[2] Note that Norman uses the terms *semantic constraints*, *cultural constraints*, and *logical constraints*.

Physical Constraints

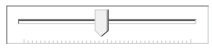
Paths



Brightness

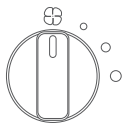
Contrast

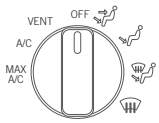
Hue

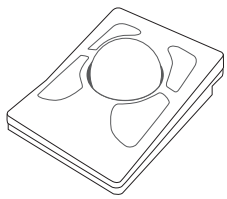


Saturation

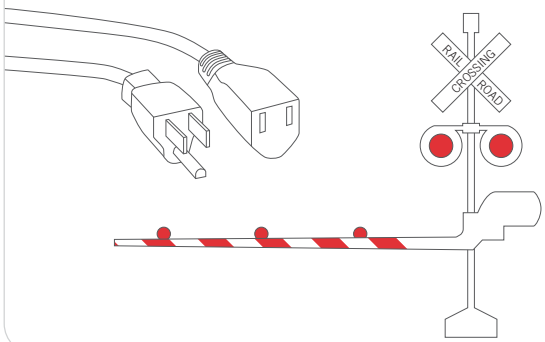
Axes







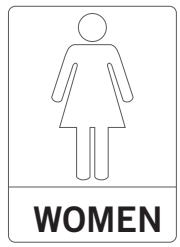
Barriers



Psychological Constraints

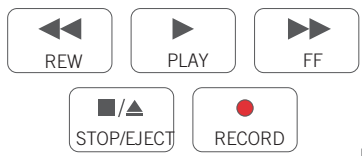
Symbols

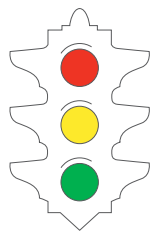
POISON



WOMEN

Conventions





Mappings