Device-centric or Environment-centric Function

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Many researchers have studied the definition and representation of function for engineered artifacts. A device is often viewed as having a function independent of the environment in which it might be used. The view caters to the *intended function*, tends only to mention a device's properties or behavior, and assumes an intended environment: it is "device-centric". "Environment-centric" definitions include aspects of the environment.

Chandrasekaran and Josephson [2000] define function by viewing it as a set of effects that an entity has on its environment. These effects must be desired by some agent in order for them to have meaning as a function: e.g., a click's ticking doesn't help someone know the time.

Functions are usually utilized by agents in the environment (e.g., users or other devices) to achieve goals. Ideally, designers intend effects and users desire them. Effects may be due to behaviors or properties of the functioning entity: e.g., a clock's hand moving, or chair's flat seat (see Appendix).

The "mode of deployment" is the way that causal interactions between the entity and the environment are instantiated. Some things only function when in certain physical relationships to the environment (e.g., "plugged in") or due to some action (e.g., "press button to start").

Behavioral constraints are any constraints on the behavior of the environment, such as a required voltage being achieved, or some condition producing some action. If a set of them is satisfied when the entity is deployed then that entity can be said to play a 'role' in that environment.

If the entity plays a role in the environment *and* that role is *desired* by some agent in the environment, then the entity has (or performs) a function. The actual function is defined by the constraints being satisfied. Thus a knife may cut, may act as a pointer, or act as a paperweight. Thus function is a potential and functioning produces effects.

Reference:

Chandrasekaran B & Josephson JR (2000) Function in Device Representation, *Engineering with Computers*, Special Issue on Computer Aided Engineering, (2000) 16:162-177.

Appendix: Questions

- Can an object have more than one function?
- Does a knife function when you're not holding it?
- If a clock is broken can it still function?
- Can a functioning object be useless?
- Does a component of an object have a function?
- What is the function of a flower?
- What is the behavior of something that doesn't move?
- How does a brick function?
- How does a chair behave?
- If a brick behaves the same way as a chair,
  why isn't a brick a chair?
- If an object doesn't do what it was intended to do by its designer,
  is it still functioning?
- Can a pen point?
- How can a pen have multiple functions?
- What is it about a pen that allows it to act as a pen?
- What is it about a pen that allows it to act as a pointer?
- What is it about a chair that allows it to function?
- What is it about a stop sign that allows it to function?
- If the function of a key is to open a lock, is the function of a lock
  to be openable by a key?
- How many functions are there?
  An infinite number? A finite number? A few types?