Visibility

The usability of a system is improved when its status and methods of use are clearly visible.

According to the principle of visibility, systems are more usable when they clearly indicate their status, the possible actions that can be performed, and the consequences of the actions once performed. For example, a red light could be used to indicate whether or not a device is receiving power; illuminated controls could be used to indicate controls that are currently available; and distinct auditory and tactile feedback could be used to acknowledge that actions have been performed and completed. The principle of visibility is based on the fact that people are better at recognizing solutions when selecting from a set of options, than recalling solutions from memory. When it comes to the design of complex systems, the principle of visibility is perhaps the most important and most violated principle of design.[1]

To incorporate visibility into a complex system, one must consider the number of conditions, number of options per condition and number of outcomes—the combinations can be overwhelming. This leads many designers to apply a type of kitchen-sink visibility—i.e., they try to make everything visible all of the time. This approach may seem desirable, but it actually makes the relevant information and controls more difficult to access due to an overload of information.[2]

Hierarchical organization and context sensitivity are good solutions for managing complexity while preserving visibility. Hierarchical organization puts controls and information into logical categories, and then hides them within a parent control, such as a software menu. The category names remain visible, but the controls and information remain concealed until the parent control is activated. Context sensitivity reveals and conceals controls and information based on different system contexts. Relevant controls and information for a particular context are made highly visible, and irrelevant controls (e.g., unavailable functions), are minimized or hidden.

Visible controls and information serve as reminders for what is and is not possible. Design systems that clearly indicate the system status, the possible actions that can be performed, and the consequences of the actions performed. Immediately acknowledge user actions with clear feedback. Avoid kitchen-sink visibility. Make the degree of visibility of controls and information correspond to their relevance. Use hierarchical organization and context sensitivity to minimize complexity and maximize visibility.

See also Affordance, Mapping, Mental Model, Modularity, Progressive Disclosure, and Recognition Over Recall.

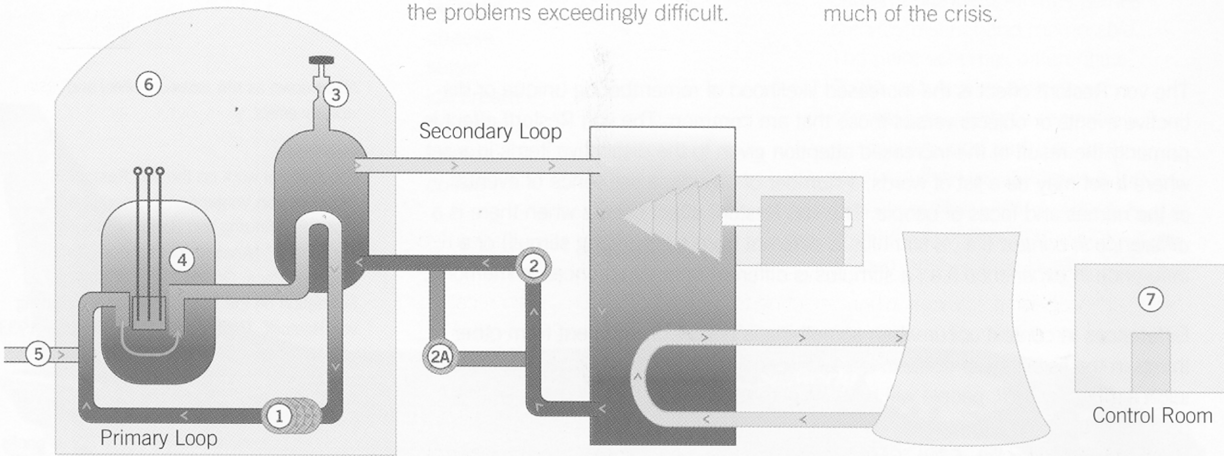
[1] The seminal work on visibility is *The Design of Everyday Things* by Donald Norman, Doubleday, 1990.

[2] The enormity of the number of visibility conditions is why visibility is among the most violated of the design principles—it is, quite simply, difficult to accommodate all of the possibilities of complex systems.

Three Mile Island Unit 2
Harrisburg, Pennsylvania
March 28, 1979, 4:00 A.M.

Visibility of complex systems is essential for problem solving—especially in times of stress. An analysis of key events of the TMI accident reveals a number of blind spots in the system that made understanding and solving the problems exceedingly difficult.

To further complicate matters, alarms were blaring, lights were flashing, and critical system feedback was routed to a printer that could only print 15 lines a minute—status information was more than an hour behind for much of the crisis.



TIME	PLACE	EVENT
00:00:00	(2)	Coolant pumps in the secondary loop malfunction and shut down.
00:00:02		Temperature and pressure in the primary loop increase.
00:00:03	(3)	The pressure release valve (PORV) opens automatically to lower the pressure.
00:00:04	(2A)	Backup pumps automatically turn on.
	(2A) (7)	**Operators do not know that the backup pumps are disconnected.**
00:00:09	(4)	The control rods are lowered to slow the nuclear chain reaction and reduce the temperature.
00:00:11	(3) (7)	The PORV light goes out in the control room, indicating that the PORV closed.
	(3) (7)	**Operators cannot see that the PORV is stuck open. Steam and water is released through the PORV.**
00:02:00	(5)	Emergency water is automatically injected into the primary loop to keep the water at a safe level.
00:04:30	(5) (7)	Instruments in the control room indicate that water level in the primary loop is rising. Operators shut down the emergency water injection.
	(3) (7)	**Operators cannot see that the water level in the primary loop is actually dropping. Steam and water continue to be released through the PORV.**
00:08:00	(2A) (7)	An operator notices that the backup pumps are not working. He connects the pumps and they begin operating normally.
01:20:00	(1) (7)	Pumps in the primary loop vibrate violently because of steam in the line. Two of four pumps are shut down.
01:40:00	(1)	The other two pumps shut down. Temperature and pressure in the primary loop continue to rise.
02:15:00	(3) (4)	The water level drops below the core. Radioactive gas is released through the PORV.
02:20:00	(3) (7)	An operator notices that the temperature at the PORV is high. He stops the leak by shutting a PORV backup valve.
	(7)	**Operators still cannot see that the water level in the primary loop is actually dropping.**
02:45:00		Radiation alarms sound and a site emergency is declared. The level of radioactivity in the primary loop is over 300 times the normal level.
07:30:00	(3) (5) (7)	Operators pump water into the primary loop, but cannot bring the pressure down. They open the backup valve to the PORV to lower pressure.
09:00:00	(6)	An explosion occurs in the containment structure.
	(7)	**Operators cannot see that an explosion occurred. They attribute the noise and instrument readings to an electrical malfunction.**
15:00:00	(1)	The pumps in the primary loop are reactivated. Temperatures decline and the pressure lowers. Disaster is averted—except, of course, for the leaking radiation.