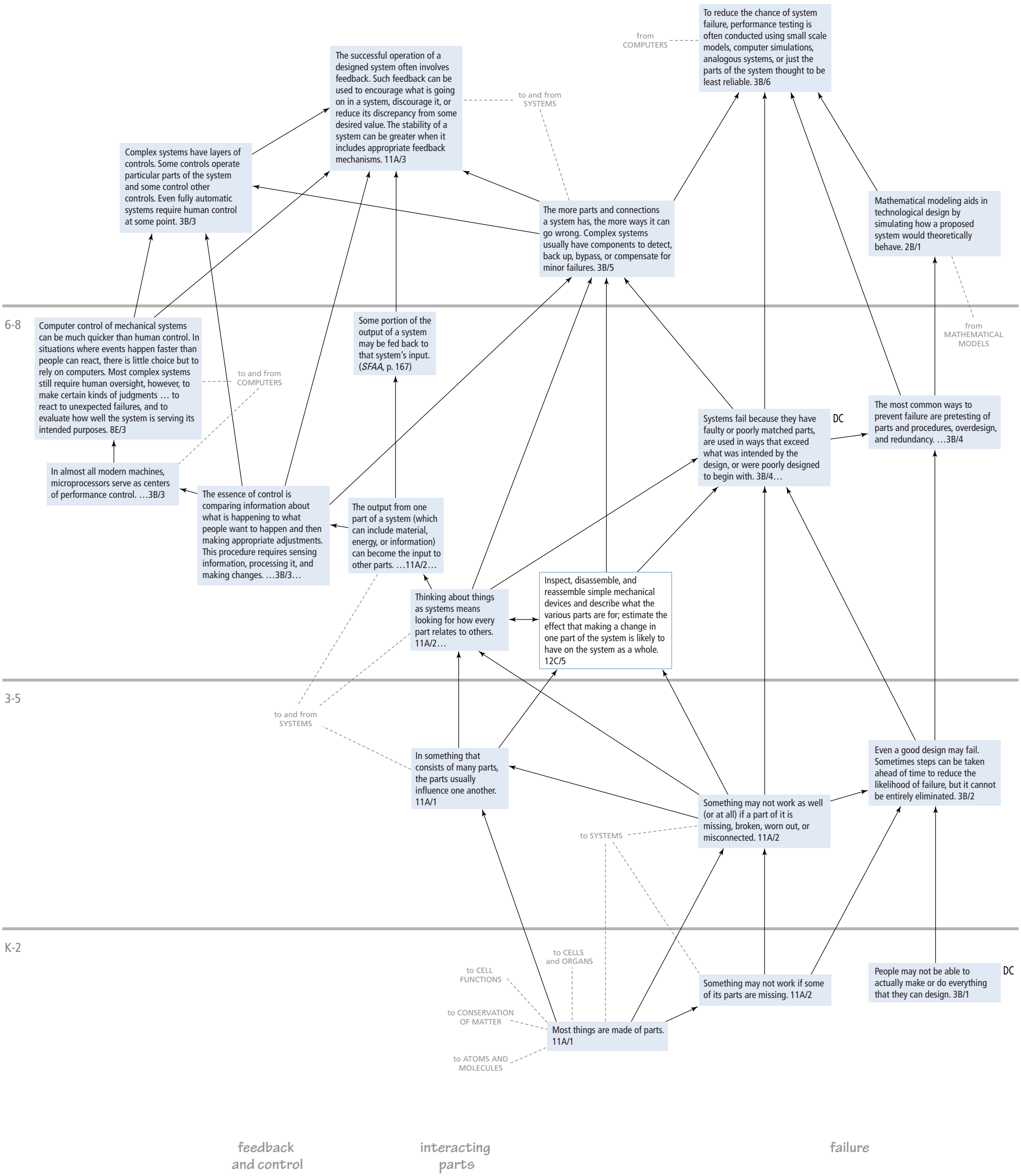
9-12
6-8
3-5
K-2
The successful operation of a designed system often involves feedback. Such feedback can be used to encourage what is going on in a system, discourage it, or reduce its discrepancy from some desired value. The stability of a system can be greater when it includes appropriate feedback mechanisms. 11A/3
to and from SYSTEMS
from COMPUTERS
To reduce the chance of system failure, performance testing is often conducted using small scale models, computer simulations, analogous systems, or just the parts of the system thought to be least reliable. 3B/6
Complex systems have layers of controls. Some controls operate particular parts of the system and some control other controls. Even fully automatic systems require human control at some point. 3B/3
The more parts and connections a system has, the more ways it can go wrong. Complex systems usually have components to detect, back up, bypass, or compensate for minor failures. 3B/5
Mathematical modeling aids in technological design by simulating how a proposed system would theoretically behave. 2B/1
from MATHEMATICAL MODELS
Computer control of mechanical systems can be much quicker than human control. In situations where events happen faster than people can react, there is little choice but to rely on computers. Most complex systems still require human oversight, however, to make certain kinds of judgments … to react to unexpected failures, and to evaluate how well the system is serving its intended purposes. 8E/3
to and from COMPUTERS
Some portion of the output of a system may be fed back to that system's input. (SFAA, p. 167)
Systems fail because they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with. 3B/4…
DC
The most common ways to prevent failure are pretesting of parts and procedures, overdesign, and redundancy. …3B/4
In almost all modern machines, microprocessors serve as centers of performance control. …3B/3
The essence of control is comparing information about what is happening to what people want to happen and then making appropriate adjustments. This procedure requires sensing information, processing it, and making changes. …3B/3…
The output from one part of a system (which can include material, energy, or information) can become the input to other parts. …11A/2…
Thinking about things as systems means looking for how every part relates to others. 11A/2…
Inspect, disassemble, and reassemble simple mechanical devices and describe what the various parts are for; estimate the effect that making a change in one part of the system is likely to have on the system as a whole. 12C/5
to and from SYSTEMS
In something that consists of many parts, the parts usually influence one another. 11A/1
Something may not work as well (or at all) if a part of it is missing, broken, worn out, or misconnected. 11A/2
to SYSTEMS
Even a good design may fail. Sometimes steps can be taken ahead of time to reduce the likelihood of failure, but it cannot be entirely eliminated. 3B/2
to CELLS and ORGANS
to CELL FUNCTIONS
to CONSERVATION OF MATTER
to ATOMS AND MOLECULES
Most things are made of parts. 11A/1
Something may not work if some of its parts are missing. 11A/2
People may not be able to actually make or do everything that they can design. 3B/1
DC
feedback and control
interacting parts
failure