

stops; that is, the handle movements control the *position* of the pointer. In *first-order*, or velocity control, movement of the handle causes changes in the *velocity* of the pointer. Moving the handle further in one direction causes the velocity of the pointer to increase in the same direction, and stopping the handle movement off center results in a constant velocity of pointer movement. In a second-order task, the movements of the control produce changes in the pointer's *acceleration*. Keeping the handle centered produces zero acceleration, but moving the handle to a new position off center accelerates the pointer in the same direction. Each of these kinds of tracking tasks is used in research, and there are real-world examples of each in various control systems (see Poulton, 1974, for more details).

One final type of tracking task is step tracking. In this task, the track "jumps" from one fixed location to another, often unpredictably, and the subject's task is to move the control as quickly as possible to correct this sudden change in the track's location. Step tracking tasks can be either pursuit or compensatory.

Serial movements are neither discrete nor continuous, but usually are comprised of a series of individual movements tied together in time to make some "whole." These types of movements appear in the center of the continuum in figure 2.1 because they can be rather long in duration but are not stopped arbitrarily. Examples are

starting a car, preparing and lighting a wood fireplace, and many tasks involved in production lines in industry. Serial tasks can be thought of as a number of discrete tasks strung together, and the order (and sometimes timing) of the actions is important.

Open Versus Closed Skills

Environmental predictability during the performance provides another basis for classifying movement skills (Poulton, 1957; Gentile, 2000). *Open skills* are those for which the environment is constantly (perhaps unpredictably) changing, so that the performer cannot effectively plan the entire movement in advance (figure 2.2). A good example is the penalty shot in ice hockey. While skating toward the goalie, the player may make a general decision about whether to go left or right, but the final decision may depend on what the goalie does. Another example is driving on a busy freeway. Although you may make a general plan about what you want to do, such as pass another car, your precise plans must be left flexible enough to deal with unexpected actions of other drivers. Success in open skills is largely determined by the extent to which the individual is successful in adapting the planned motor behavior to the changing environment. Often this adaptation must be extremely rapid, and the effective responder must have many different actions ready to implement.

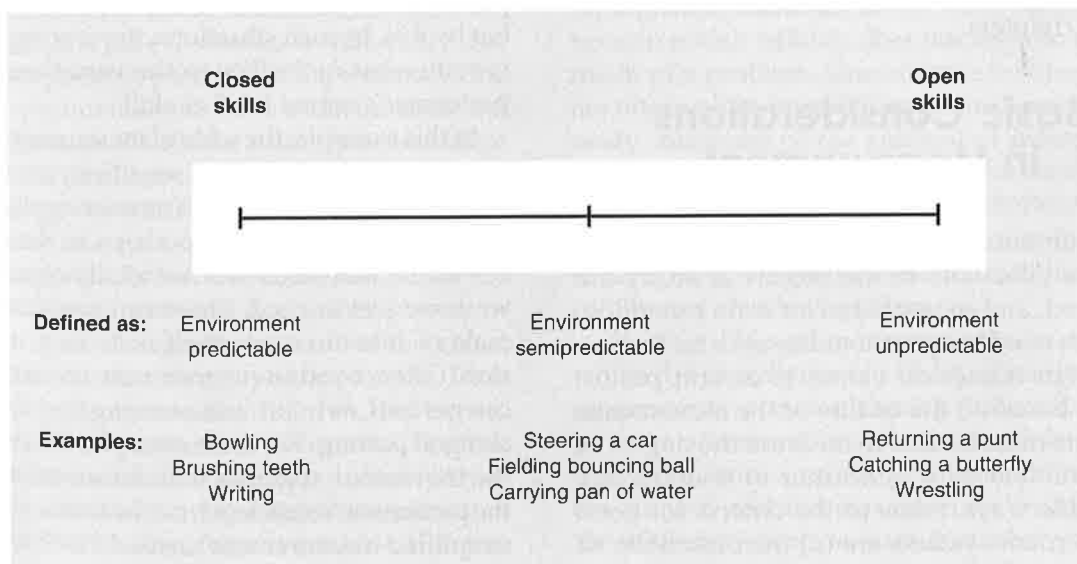


FIGURE 2.2 The open/closed continuum for motor behavior.