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HUMAN REACTION TIME

While performing a task, reaction time in response to the appearance of a particular potential hazard is the time required from the point of initial detection of the hazard in one's field of view, through various stages of evaluation and decision making, to the time that responsive action is taken, which may, depending on circumstances, include either general or attempted precise movement of the hands, feet, or whole body to prevent or control potential impending injury. Such response may also involve the attempted manipulation or engagement of the physical environment, such as the attempted operation of machine controls, the reaching for a handrail, or the positioning of the body or its parts in an attempt to cushion impending impact.

Perception involves the process of not only detecting an object in a general sense, but also *comprehension of its significance*. Perception must occur before reaction can take place. Most objects perceived in one's environment do not receive specific attention. That is, while attention is given to one object, others are not seen with the same clarity. Likewise, an object may be *seen* but its meaning may not be immediately perceived. Perception delay is the interval between the time that a hazard is reasonably available to be seen and when it is actually seen and fully understood.

If a person, by chance, is looking at the exact place where a *simple* hazard appears, it will be seen and understood almost instantly, and there is virtually no delay in perception. However, if a person is looking in some other direction, a particular hazard may not be perceived until one's attention either happens to be directed to it, or is somehow drawn to it. This may require several seconds. In many circumstances, individuals may not perceive a hazard before it is actually encountered.

Four different kinds of reaction time have been recognized in the literature, based on the expectancy and amount of evaluation and decision making required by each.

Reflex reactions are instinctive or mostly so and require the shortest time because they involve no thought. An eye blink, the turning of the head away from a strong light, or the withdrawal of a hand from a hot surface are typical reflex actions. When a strong unexpected stimulus is presented to a person, a reflex (hysterical or convulsive) action may result. Such reflex or startle actions are often wrong and can be disastrous.

Simple reactions (and simple reaction times) are the most common of human responses to ordinary or routinely encountered situations because the stimulus is reasonably expected and the individual has already decided (and practiced) what is to be done when the stimulus appears. Simple reaction time is often a matter of habit. Such reaction times normally take about a quarter of a second to initiate action. The changing of a green traffic light to yellow or the viewing of a stop sign in a driver's visual field and the typical reactions to them would be examples of simple reaction.

Complex reactions (and accompanying complex reaction time) generally call for a choice among several possible responses, where the decision related to the most appropriate response has not been made in advance. Even situations involving little ultimate choice can fall into this category. Complex reactions are slower than simple reactions and depend on how complex the stimulus is, how many choices there are for reaction, and how often the individual has been in a similar situation, with response times typically taking from one-half to two seconds or more.

Discriminative reactions (and associated discriminative reaction time) occur when a person is required to make a choice between two or more actions *that are not habitual or practiced*. Here, there is a great need to gather information regarding available alternatives, the nature (positive and negative aspects) of each alternative, probabilities regarding the appropriateness (dangers vs. successful hazard avoidance) related to each alternative, as well as the possible moral issues of the alternatives. This is the slowest of all the reactions and may require as much as a minute if the situation is complicated and the urgency slight. When the situation is urgent, there is a high probability that the response will be inappropriate or no response will be initiated before it is too late to respond at all.

The driving task provides an excellent means to illustrate the combination of factors that result in total discriminative reaction time. In this regard, the use of evasive tactics in response to relatively unfamiliar driving hazards is affected by the elements of initial and full awareness (perception) of specific objects in the driving visual field, required mental evaluations of such perception, the search for alternative evasive tactics, decision (or indecision) concerning appropriate reaction, and the time required for physical (bodily) reaction to operate vehicle controls (followed by the time necessary for vehicle response to the controls used).

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Select References

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