Type 1 and Type 2 Experiments

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In thinking about experiments that are designed to discover knowledge about perception, it is useful to make a distinction between two kinds of experiments, or more generally, two types of observations, which I shall designate as Type 1 and Type 2.†. Like many binary distinctions, e.g., male/female, right/wrong, it is not absolute and does not apply to every situation, but nevertheless is very useful.

In a **Type 1** observation or experiment, there is a correct and incorrect answer, and the subject (human or animal) can be--and usually is--rewarded for giving the correct answer and punished for giving a wrong answer.

Example 1: A threshold determination. A subject is presented with either a dim test flash or a blank and asked which was presented. After responding, the subject is told whether the response was right or wrong.

Example 2. A subject is asked which of two light flashes was brighter. After responding, the subject is told whether the response was right or wrong.

In a **Type 2** experiment, the experimenter cannot define correctness or incorrectness of a response.

Example 3. A subject is shown a flash of blue light and a flash of red light and asked which was brighter. Here, there is no obvious correct answer; indeed, the aim of this experiment is to determine the relative brightness of red and of blue light flashes.

Interpretation: Type 2 experiments are inherently semantic experiments. That is, prior to a Type 2 experiment, the subject learns the meaning of of the word "brightness" in Type 1 experiments, i.e., with practice and feedback in situations where two flashes have exactly the same configuration and color, and differ only in intensity. In such Type 1 experiments, the subject (human or animal) can be reinforced for correct judgments, and the subject learns to make correct judgments of brightness.
Subsequently, the two stimuli being compared differ in color or configuration, and the experimenter now wishes to determine how the subject *generalizes* the previously learned concept to the new situation. The experimenter cannot give feedback because, although the experimenter knows the relative physical energy in red and blue lights, the experimenter doesn't know the relative brightness--the subjective appearance--of these stimuli.

Example 4. Muller-Lyer illusion: Which is longer `<->` or `>-<` ?

Prior to the experiment, the subject has been taught the concept of length by using simple stimuli for which there is a correct answer: e.g., -- versus --- . At the time of the illusion experiment, if the experimenter were to reinforce the subject for objectively correct judgments, the illusion would become unobservable to the experimenter. That is, the subject would say, in effect: "The line on the left (or right) appears to me to be shorter, but I know that is an illusion because I am always corrected when I report this. Therefore, I will report that the left line is longer unless it appears more than 10% shorter."

Used with sufficient practice, Type 1 experiments measure aptitude or capacity. By aptitude or capacity we mean how well subjects could do if they had enough practice to fully exploit their aptitude or capacity. This practice is provided in the initial stages of the Type 1 experiment; the ultimate level of performance is limited only by the subject's "aptitude" or "capacity."

Type 2 experiments measure ecological achievement--the ability of subjects to extrapolate their past training and experience to the current stimuli.

Both Type 1 and Type 2 experiments are important for perception. For example, the Snellen Chart eye test, which is used for determining corrective lenses in spectacles, is a classical Type 1 procedure. The tester asks the subject to identify a particular letter on the test chart. However, the tester often does not provide feedback because the tester is worried that the subject might memorize the test chart. A better procedure would be to not reuse the same test chart, i.e., to generate test letters on a computer screen or to have a large number of test charts available. On the other hand, when the optometrist asks the subject "Which of these two lenses is sharper, one or two?" that is a Type 2 procedure, although the subject may convert it into an implicit Type 1 procedure by looking at the test chart and seeing how many letters he/she can identify.

A typical Type 2 situation occurs when a hi-fi enthusiast wishes to buy new audio speakers that are twice as loud as his current ones. It turns out that to double (perceived) loudness listeners typically require a five- or ten-fold increase in acoustic energy. The perceived loudness of a sound (e.g., a hi-fi speaker) or brightness of a light source (e.g., a computer or TV screen) is not simply proportional to its physical energy. Only subject knows brightness or loudness (versus light or acoustic power). The experimenter has no direct access to the subject's thoughts, and therefore must rely on the subject's prior training (in the use of numbers and in the use of the concepts "loudness" and "brightness") to guide the subject to an appropriate generalization to the present task. The precise determinations of scales of brightness and loudness (i.e., perceived brightness or loudness as a function stimulus intensity) and most especially determining scales of "preference," (e.g., of beverages or cars) is an industry of enormous financial consequence, and it is inherently based on Type 2 procedures.

Occasionally, Type 1 procedures are referred to as "accuracy" procedures and I may refer to Type 2 procedures as "semantic generalization" experiments. When in doubt, think of how you would train a monkey to do the task in question.

References

†G. S. Brindley, Physiology of the retina and the visual pathway. London: Edward Arnold Ltd, 1960; Pp. 144-145. Brindley distinguishes between two types of observations which he calls type A and type B. In type A experiments, the brain receives either identical or nonidentical signals from the sense organs, and the observer's task is restricted to saying whether two stimuli are identical or not. Type B incorporates all more complicated paradigms.

Sperling, G., B. A. Dosher, & M. S. Landy, How to study the kinetic depth effect experimentally. *Journal of Experimental Psychology: Human Perception and Performance,* 1990, *16,* 445-450. Sperling et al propose a more general distinction than Brindley's by considering whether or not feedback about the correctness of responses is given to subjects, and consequently whether tasks measure aptitude or capacity (Type 1) versus achievement (Type 2).