EXTRANEOUS VARIABLE

Authored by
mohammad looti

October 12, 2025

RECOMMENDED CITATION

mohammad looti (2025). *EXTRANEOUS VARIABLE*. PSYCHOLOGICAL SCALES. Retrieved from https://scales.arabpsychology.com/?p=42291

Extraneous Variable

Primary Disciplinary Field(s): Psychology; Experimental Design; Statistics; Research Methodology

1. Core Definition and Distinction from Confounding Variables

An **extraneous variable** (EV) is any factor present in an experiment, other than the intended independent variable (IV), that has the potential to influence the results, specifically affecting the measured outcome, or dependent variable (DV). By definition, extraneous variables are elements that the researcher did not intentionally manipulate or study, but which could nevertheless introduce noise or systematic error into the experimental data, thereby potentially obscuring the true relationship between the IV and the DV. While researchers strive to design experiments that isolate the causal relationship between the manipulated variable and the measured outcome, the complexity of human behavior and environmental settings means that extraneous variables are nearly always present to some degree, necessitating rigorous control measures.

It is crucial to differentiate an extraneous variable from a **confounding variable**. All confounding variables are, initially, extraneous variables, but the reverse is not always true. An extraneous variable becomes a confounding variable only if it systematically co-varies with the independent variable, making it impossible to determine whether the change observed in the dependent variable was caused by the IV or by the confound. For example, if a researcher studies the effect of a new drug (IV) and unintentionally assigns all older participants to the control group and all younger participants to the treatment group, age becomes a confounding variable because it systematically varies alongside the drug treatment, potentially influencing the outcome (DV). The goal of strong experimental design is to identify and control known extraneous variables to prevent them from becoming confounding variables.

The core danger posed by an extraneous variable is its potential to undermine the validity of the conclusion drawn from the experiment. If the effect of the EV is subtle and random, it primarily increases the variability within the groups, making it harder to detect a true effect of the IV (lowering statistical power). However, if the EV is systematically linked to the conditions of the IV, it introduces bias, which threatens the internal validity of the study--the degree to which the experiment accurately demonstrates that the IV caused the changes in the DV. Therefore, the successful management of extraneous variables is the cornerstone of reliable scientific research, ensuring that measured effects are genuinely attributable to the experimental manipulation.

2. The Role in Threats to Internal Validity

The concept of extraneous variables is inextricably linked to the notion of **internal validity**, which represents the confidence one can place in the cause-and-effect relationship established by a study. When an extraneous variable is not adequately controlled, it acts as an alternative explanation for the observed results, directly weakening internal validity. Researchers must meticulously anticipate factors that might differ between the control and experimental groups, as these differences, if unchecked, can lead to spurious correlations or mask real effects. Common sources of threats to internal validity related to uncontrolled extraneous variables include history effects, maturation, testing effects, and instrumentation decay.

History effects occur when an external event, unrelated to the IV, happens during the course of the experiment and affects the participants' responses. For example, if a study on stress reduction runs for several months, and during that time a major national crisis occurs, this event (the extraneous variable) could independently alter the stress levels (DV) of all participants, regardless of the intervention they received. Maturation refers to biological or psychological changes occurring naturally in the participants over time (such as aging, fatigue, or boredom), which are especially critical in longitudinal studies. If these natural changes are not accounted for, they might be mistakenly attributed to the IV.

Furthermore, instrumentation and testing effects represent subtle yet pervasive extraneous factors. A testing effect occurs when the act of being measured in a pre-test influences performance on the post-test (e.g., practice or sensitization). Instrumentation effects relate to changes in the measuring instrument itself, which could include the calibration of equipment or, in behavioral studies, changes in the judgment or skill of the human observers over time. All these variables are extraneous to the central research question, but their influence must be systematically addressed during the design phase to maintain the integrity of the experimental findings.

3. Classification of Extraneous Variables

Extraneous variables are typically categorized based on their source: those originating from the participants, those originating from the situational context or environment, and those stemming from the researcher or experimenter. This systematic classification aids researchers in developing targeted control strategies, as the method for controlling participant variables (like individual differences) is distinct from the method used to control environmental variables (like noise or temperature). Recognizing the source allows for proactive intervention rather than reactive analysis after the data has been collected.

The three major types of extraneous variables include:

Participant Variables: These are individual differences among the study participants that can affect the dependent variable. Examples include age, gender, intelligence, personality traits, previous experience with the topic, motivation level, and general health status. If a research design fails to distribute these inherent differences randomly across all experimental conditions, they can easily become confounding factors. For instance, in a memory study, if one group inadvertently contains significantly more individuals who naturally possess superior memory skills, the results will be biased regardless of the memory training provided.

Situational Variables: These variables relate to the experimental environment or the setting in which the research takes place. They include factors such as temperature, lighting, noise levels, time of day, and the presence of distractions. A poorly controlled environment can introduce differential effects; for example, if one treatment group is tested in a quiet, well-lit room and the other is tested in a noisy, dark room, the situational variables, not the IV, may account for differences in performance.

Experimenter Variables: These are factors related to the researcher or the person conducting the experiment, including personal characteristics and subtle behaviors that unintentionally influence participant responses. These are often discussed in terms of experimenter expectancy effects or observer bias, wherein the researcher's expectations about the outcome subtly change how they interact with participants or how they record data.

4. Researcher-Related Extraneous Variables (Experimenter Effects)

Experimenter effects refer to the unintentional ways in which the researcher can influence the behavior of the participants and subsequently contaminate the results. These effects are particularly insidious because they are often unconscious and stem from the human element in research. The researcher's expectations often serve as a potent extraneous variable, subtly communicated through nonverbal cues, tone of voice, or differential reinforcement of behaviors that align with the hypothesis. This phenomenon is known as the **experimenter expectancy effect**.

For example, if an experimenter believes that a certain drug treatment will lead to improved cognitive performance, they might unknowingly treat the participants in the treatment group more warmly, offer more encouragement, or even interpret ambiguous responses in a way that favors the hypothesis. These subtle differences in interaction constitute an extraneous variable that could influence the DV independently of the drug itself. The results would then reflect not the efficacy of the drug, but the influence of researcher bias.

Another facet of experimenter effects involves **observer bias**. When the dependent variable requires subjective measurement or behavioral observation, the person recording the data might unintentionally misinterpret or selectively record observations that support the predicted outcome. This is especially prevalent in qualitative research or studies involving complex behavioral coding. To minimize these researcher-related extraneous variables, researchers often employ strict protocols, automation where possible, and, most effectively, blinding procedures.

5. Participant-Related Extraneous Variables (Demand Characteristics)

Participant variables, such as personality or intelligence, are inherent differences; however, the influence of the research situation on the participants themselves also constitutes a powerful set of extraneous variables, often termed **demand characteristics**. Demand characteristics are cues within an experimental setting that inform the participant about the purpose of the study or what behavior is expected of them. If participants correctly guess the hypothesis, they may alter their behavior to either help confirm the hypothesis (the "good participant" effect) or deliberately undermine it (the "negativistic participant" effect).

This alteration of behavior, driven by participant knowledge or assumptions rather than the IV, becomes a potent extraneous variable, distorting the dependent measure. For instance, if participants know they are receiving a placebo for anxiety, they might consciously report feeling less anxious merely to fulfill the perceived demands of the study, rather than experiencing a genuine psychological change. This introduces artificiality and bias into the results.

Other significant participant-related factors include the **Hawthorne effect**, where participants temporarily modify their behavior simply because they know they are being observed, and **evaluation apprehension**, where participants are concerned about being judged positively or negatively and consequently alter their responses to present themselves in a favorable light. All these effects are extraneous to the true manipulation but can critically influence the data collected, requiring specialized control techniques like deception (used ethically and sparingly) or non-obtrusive measures.

6. Situational and Environmental Extraneous Variables

Situational variables encompass all environmental elements that are not part of the manipulation but which might impact the participants' state or performance. Maintaining **standardization** across all conditions is the primary strategy for controlling these factors. If the environment is not identical for all participants (except for the manipulation of the IV), the differences introduce extraneous variables.

Examples of common situational extraneous variables include differences in the time of day the experiment is conducted (affecting participant alertness), variations in the instructions read to different groups, inconsistencies in the physical apparatus used, or the presence of uncontrolled distractions (e.g., loud noises, interruptions). Even subtle factors, such as the color of the room or the odor present, can operate as extraneous variables, particularly in studies focused on emotion or cognitive processing.

To combat these environmental inconsistencies, researchers develop highly detailed protocols, scripting every interaction and setting. By standardizing the procedure--from the exact wording of the informed consent form to the precise duration of the exposure period--researchers ensure that the only systematic difference between the experimental groups is the planned variation in the independent variable, thus minimizing the influence of situational extraneous factors.

7. Methods for Controlling Extraneous Variables

Controlling extraneous variables is the most challenging and crucial aspect of experimental design. A variety of methodological techniques are employed to convert potential confounding factors into random noise or to eliminate them entirely. The choice of control method often depends on the type of extraneous variable encountered.

One of the most effective methods for controlling unknown or unmeasurable participant variables is **random assignment**. By randomly placing participants into control and experimental groups, researchers ensure that any inherent differences (like intelligence or motivation) are distributed approximately equally across all conditions. This transforms systematic extraneous bias into random error, which is statistically manageable.

To control experimenter expectancy and demand characteristics, **blinding procedures** are essential. In a **single-blind study**, participants are unaware of which condition (treatment or placebo) they are in. In a **double-blind study**, neither the participants nor the experimenters (or those analyzing the data) know who received which treatment. This effectively neutralizes the extraneous variables arising from both participant expectations and experimenter bias.

Furthermore, researchers use **counterbalancing** to address order effects (a specific type of situational extraneous variable) when participants are exposed to multiple conditions. Counterbalancing involves varying the order in which conditions are presented to different participants, ensuring that the effect of having completed Condition A before Condition B is averaged out across the entire sample. Finally, the use of statistical control methods, such as Analysis of Covariance (ANCOVA), allows researchers to statistically adjust the DV scores for known, measured extraneous variables (covariates) after the data has been collected, providing a final layer of rigor.

8. Further Reading

Confounding (Wikipedia)

Extraneous Variables in Research (Simply Psychology)

Internal Validity (Wikipedia)