

Reasons to Replace Term Ecological Validity with Terms Mundane Realism and External Validity

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Abstract—The term *ecological validity* is widely used across IEEE publications, but its definition and application remain inconsistent and ambiguous. This paper explores how conflicting definitions of *ecological validity* lead to confusion about experimental conditions and data interpretation. Because the term *ecological validity* conflates methods with outcomes and presumes that realism creates validity, we argue against its continued use as a separate term. Instead, we recommend using *external validity* and *mundane realism*. We believe this change would increase rigor in scientific communications, eliminate ambiguities, and open a transdisciplinary dialogue.

Index Terms—Subjective experiments, ecological validity, experiment design, mundane realism, psychological realism, external validity, internal validity, psychological validity

I. INTRODUCTION

IEEE publications increasingly explore the impact of realistic environments on experiment design, systems, and devices. Those publications often use the term ecological validity. Unfortunately, definitions of ecological validity are ambiguous and confusing, making understanding of the contribution of those papers difficult.

The confusion associated with this term extends beyond technology fields served by IEEE publications. The term traces back to 1944 when Egon Brunswik [1] defined “ecological” as “intra-environmental physical relationships.” Hollman et al. [2] examines the history of the term ecological validity in psychology and concludes that this term is interpreted differently among researchers and seldom defined. Suchy et al. [3] systematically analyzes 514 neuropsychology articles and concludes that the term ecological validity is inconsistently defined, conceptualized, and used. Beechey [4] explains that “The use of the term *ecological validity* within hearing science appears to conflate *realism*, which is a means to potentially improve generalizability, and *validity*, which is a method of quantifying generalization.” This ambiguity leads people to understand ecological validity as a measure of realism and to assume that an increase in realism will automatically improve validity, which has not been proven.

We propose engineers and technology scientists discontinue the use of the term “ecological validity” and instead use terms with clear definitions. As supporting evidence and motivation, we present inconsistent use of the term ecological validity and varying meanings across 118 IEEE publications that make it difficult to determine the intended meaning. We provide a detailed description of which terms should be used and the reasons for their selection. We also explain why the concept of external validity needs careful analysis that cannot be abridged by using a new experiment design. We encourage authors

to state the goal of improving external validity and describe their changes to the experiment design, instead of asserting unproven claims of enhanced external validity.

II. DEFINITION OF TERMS

We propose the use of the following definitions from Beechey [4] and the American Psychological Association (APA) Dictionary of Psychology [5] because these definitions are most applicable to IEEE research. Note that realism refers to the experimental methods and validity refers to the outcomes or results of an experiment.

- *Internal validity*: The degree to which a study or experiment is free from flaws in its internal structure and its results can therefore be taken to represent the true nature of the phenomenon [5].
- *External validity*: The extent to which results obtained in one context can be generalized to another context [4].
- *Mundane realism*: Qualitative similarity between experimental conditions and everyday conditions experienced by the subject [4].
- *Psychological realism*: The extent to which psychological states or processes elicited by an experimental task are similar to those that occur during comparable tasks outside the laboratory [4].
- *Ecological validity* def. #2 from [5]: In perception, the degree to which a proximal stimulus (i.e., the stimulus as it impinges on the receptor) covaries with the distal stimulus (i.e., the actual stimulus in the physical environment).

III. VARIOUS DEFINITIONS OF ECOLOGICAL VALIDITY

On November 1, 2024, we searched IEEE *Xplore* for papers that included the term “ecological validity” in either the title or the abstract. We examined the resulting 118 papers to see how the authors used and defined “ecological validity” (see Table I). Surprisingly, 37% of the papers only use ecological validity as a buzzword in the abstract or title; and 31% of the papers mention ecological validity but do not define it. The remaining instances can be split into two categories.

Some authors use ecological validity as a synonym for another term. The distinct definitions we found include: external validity (9%), mundane realism (13%), psychological realism (2%), or ecological validity def. #2 from [5] (3%). Each paper provides a unique definition and many of the definitions are poorly worded, so some of these authors may have intended a different meaning.

TABLE I
EXAMPLES OF UNCLEAR USAGE OF *Ecological Validity* IN IEEE PUBLICATIONS

Applicable Definition	Instances	Example or Explanation
Not used in the body text	44	The term ecological validity was used only in the title or abstract. The term was not defined in the body of the paper. If it was (one case), it is not counted here.
Undefined	37	"... we evaluate a variety of spline- and rotation-based view transitions in a crowdsourced user study focusing on ecological validity." [6]
Mundane Realism	15	"Ecological validity refers to the extent to which a study comprises 'real-world' use of a system." [7]
External Validity	11	"Ecological validity, characterized as whether or not one can generalize from observed behavior in the laboratory to natural behavior in the world, ..." [8]
Ecological Validity def. #2 from [5]	4	"... ecological validity that represents the constraints between the values of proximal information and distal event." [9]
False Assumption	2	"The struggle is one of ecological validity, which is the extent to which an experiment reproduces the situation and environment in which the technology will be used, and hence the extent to which the research findings generalize." [10]
Psychological Realism	2	"To summarize, the classic emotion induction paradigm lacks sufficient 'ecological validity', resulting in a lackluster emotional response....VR could provide ecological validity scenarios that fully engage the psychological and physiological components of the subject." [11]
Mundane Realism and External Validity	2	"... which were criticized as limited in the area of ecological validity (the relevance or similarity that a test or training system has relative to the real world, and its value for predicting and improving daily functioning)." [12]
Mundane Realism and Internal Validity	1	"... ecological validity refers to the extent to which the environment experienced by the subject in a scientific investigation has the properties it is supposed or assumed to have by the investigator." [13]

Other authors define ecological validity as a combination of mundane realism and external validity. This causes two problems. First, this leads to the false assumption that improvements to mundane realism are guaranteed to improve external validity. Second, realism and validity must be examined and proven separately.

Improvements to external validity are difficult to prove because lab data must be compared to real-world data. Real-world data is often unavailable or must be inferred second-hand, because any investigation influences data (the observer's paradox). However, we can compare different experimental designs and draw conclusions about our beliefs or theories regarding external validity. This approach acknowledges that these are merely theories in the absence of real-world data, and it underscores the importance of explaining why we consider these theories plausible. Providing a clear rationale allows for constructive discussion and helps identify potential flaws in the proposed theories.

It is crucial to remember that scientific knowledge rarely stems from a single paper; true understanding emerges from analyzing multiple studies. Unique understanding of scientific terms helps readers find papers and cumulate findings related to the terms. This cumulative approach lies at the heart of scientific progress.

IV. CONCLUSIONS

Misinterpretation reduces the value of IEEE publications. The term ecological validity is popular (see Table II)¹, but conflicting definitions lead to false assumptions and mistakes. The lack of a unique definition warrants the elimination of the term. The terms external validity and mundane realism have distinct definitions that improve comprehension. We encourage the community to make this shift in terminology.

¹We searched IEEE Xplore using the "Full Text & Metadata" field, enclosing each term in quotation marks. The search was conducted on 1 November 2024.

TABLE II
NUMBER OF IEEE PUBLICATIONS THAT INCLUDE TERMS IN FULL TEXT OR METADATA

Term	# Publications
External validity	10501
Ecological validity	1625
Internal validity	52
Psychological realism	26
Mundane realism	16

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