

CONFLATIONS OF CORRELATION WITH CAUSATION IN RESEARCHERS' DESCRIPTIONS OF THEIR WORK

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Background

- Humans are biased toward seeing associations between independent events and assuming causal explanations for those associations.^{1,2} In short, people often conflate correlation with causation.^{3,4}
- Recent research out of our lab suggests that the lay public *incorrectly* infers causality from descriptions of *non*-experimental research as often as they correctly infer causality from descriptions of experimental research.⁵ Even university students have difficulty distinguishing between causal and correlational statements.⁶
- One culprit might be the conflation of correlation with causation in the media,⁷ such as press releases and news headlines that “spin” scientific results⁸ and make exaggerated causal claims.⁹
- However, scientists are not immune to the error. Researchers in education have been criticized for using inappropriate causal statements in their articles;^{10,11} and counseling psychologists have been warned against utilizing counseling practices that have not been supported by randomized experimental designs.¹²
- We suspect that these warning calls to educational and counseling psychologists are indicative of the state of research in the social sciences more generally. We aim to determine the frequency with which social scientists use unjustified causal language in scholarly descriptions of their work.

Method

Sample

- We sampled accepted poster submissions from the 2015 Association for Psychological Science (APS) convention program. The entire 2015 convention program was available online at http://www.psychologicalscience.org/index.php/convention/2015-convention-program#VxfIH_krLcs.
- Each submission included a research title, abstract (~50 words), and supporting summary (~500 words).
- The 2015 APS Convention held 21 poster sessions. Each session contained approximately 135 accepted submissions. We sampled every fifth submission in each session, except for Session 1, for which we coded all submissions as we established the coding rules.

Procedure

- We recorded each poster number and full title. We then coded each submission for use of causal language in the title, abstract, and supporting summary; if causal language was present, we recorded the specific words used and whether their research design supported that language.

Coding Rules

Causal language

- Coded as “yes” if elements of the current study description included words such as influence, effect, produce, boost, depend, etc.
- Coded as “no” if there was no causal language; if the causal language was preceded by “may” or “perhaps,” if the causal language was posed in the form of a question; if the causal language was used in descriptions of past studies that provided a rationale for the current study; or if the causal language was used in discussion of the potential implications of the current study’s findings. If the causal word (e.g., “effect”) was used in a statistical sense (e.g., “main effect of”), it was not coded as causal language. Finally, we did not count “modulate” and “moderate” as causal.

Justified Use of Causal Language

- Coded as “yes” if the researchers’ design included an imposed manipulation and the causal words pertained to the manipulated variable; if the researchers used a longitudinal ‘pre-post’ design involving a comparison group; if the research involved a single-subject design (e.g., ABAB design); or if the research was a genetically informed design (e.g., twin or adoption design).
- Coded as “no” if the researchers’ design included an imposed manipulation, but the causal words pertained to a subject variable or a variable that was not manipulated; if the researchers did not include an imposed manipulation, but they nonetheless used causal language; or if the researchers used causal language but utilized a ‘pre-post’ or cross-sectional design without a control group comparison.

Coding Reliability

- The research team coded all submissions from Poster Session I (n=136) together to establish the coding rules.
- For each of the remaining sessions (Sessions II thru XXI), three members of the team independently coded every fifth submission. Using a subset of ratings, we computed pairwise agreements ranging from 75% to 100%; disagreements were resolved via full-group discussion.

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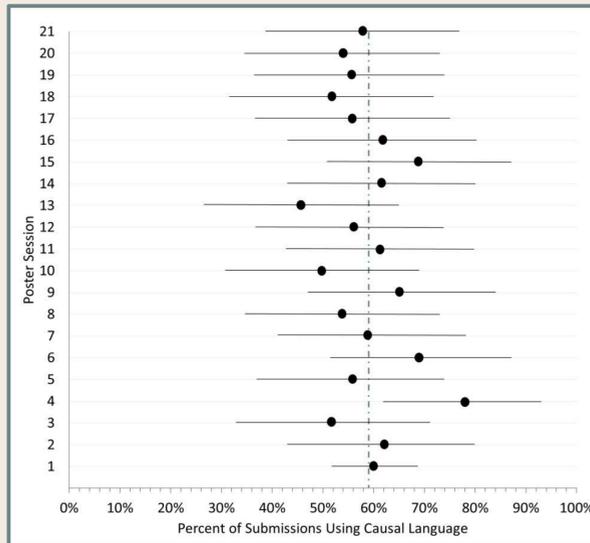
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Figure 1. Percent of accepted submissions in each poster session that included cause-and-effect language in either the title, abstract, or supporting summary. Horizontal lines represent 95% CIs. The mean across sessions, as denoted by the dotted vertical line, was 59%.



Results

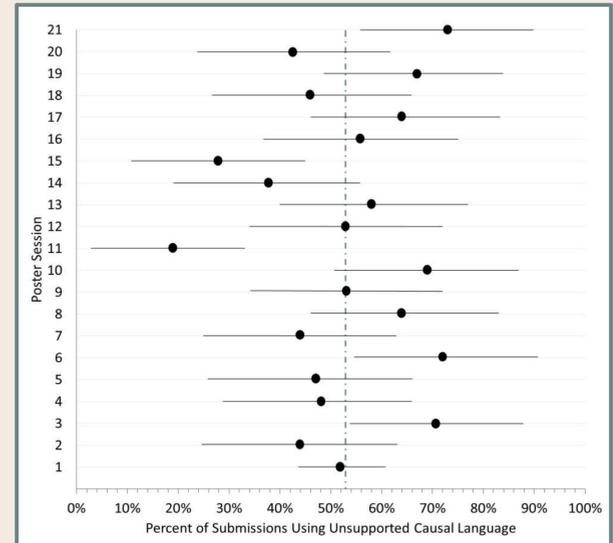
As shown in Figure 1, averaged across the 21 poster sessions, on average 59% contained cause-and-effect language in either the title, abstract, or supporting summary. As shown in Figure 2, 53% of those with causal language were coded as unjustified in their use.

On average, 32% of the accepted submissions contained causal language in the title, and 47% of those were coded as unjustified in their use.

On average, 36% contained causal language in the abstract, with 45% coded as unjustified.

Finally, 47% of submissions contained causal language in the supporting summary, with 51% of those coded as unjustified.

Figure 2. Percent of accepted submissions in each poster session with causal language that was not justified by their research design. Horizontal lines represent 95% CIs. The mean across sessions, as denoted by the dotted vertical line, was 53%.



Ethnic Identity Enhances Asian Ethnic Adjustment to College...

Factors Affecting Persistence Rates Among College Freshmen

Social Influences on Food Choice: Women Eat Like Their Peers



As shown in the infographic above, we documented a wide variety of causal phrases, with the most common phrases including derivatives of *effect*, *influence*, *impact*, and *lead*.

Conforming to Gender Norms Leads to Infidelity

The Impact of Masculinity on Interaction Anxiousness...

Discussion

- We sought to investigate the frequency with which social scientists conflate correlation with causation in technical descriptions of their research. Of over half of accepted submissions with causal language, over half of those were coded as unjustified in their use; hence, approximately 1 in 4 submissions used causal language incorrectly. These results suggest that educational researchers are not alone in conflating correlation with causation.^{10,11}
- It is possible that our numbers are an underestimate of the actual frequency with which causal language is used without clear justification. For example, under our rules, causal language was allowed if qualified by modal words such as “may” or if posed as a question. Common words such as “moderate” and “modulate,” which frequently denote causality, were also allowed.
- Of particular concern is our finding that about 1 in 7 accepted submissions included unjustified causal language in their title (47% of 32%). Some people attend to only a study title to draw inferences about an entire study. Journalists, too, might use titles to help them draft headlines and frame their research blurbs, which could perpetuate the dissemination of incorrect causal inferences.

- We did not investigate potential correlates of using unjustified causal language, such as the researchers’ academic status or institutional prestige. Future research could address that question, as well as the question of how often unjustified causal language is employed in scholarly organizations with a less rigorous scientific reputation than that of APS.
- Our findings suggest that scientists are not immune to the tendency to confuse correlation with causation. We propose that efforts to remedy the concern be directed not only at the lay public, who have to independently navigate the implications of research headlines and blurbs they are exposed to on a daily basis, but also at scientists, who are responsible for communicating what their findings do and do *not* mean.¹³