Commentary

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Don't Shoot the Messenger: Still No Evidence That Video-Game Experience Is Related to Cognitive Abilities—A Reply to Green et al. (2017)

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Green et al. (2017) raise two broad concerns with our two studies (Unsworth et al., 2015) showing little association between self-reported video-game experience and cognitive abilities: (a) Our analyses assumed linear gaming-cognition relationships and ignored possible confounding associations among different video-game genres, and (b) the video-game experience questionnaires were problematic and misapplied. We rebut these critiques in this Commentary.

Reanalyses of the Data in Unsworth et al. (2015)

If the functions linking video-game experience to cognitive ability are exponential, they still should have yielded detectable (if underestimated) linear associations in our original analyses (e.g., Eichenbaum, Kattner, Bradford, Gentile, & Green, 2015). We nonetheless explored nonlinear relations (quadratic and cubic) between each ability composite and video-game genre (see Table S1 in the Supplemental Material available online). Only 3 of 36 (Study 1) and 4 of 24 (Study 2) were significant in the hypothesized direction. In addition, we reran our latent-variable analyses after log-transforming all the questionnaire data. The results (see Table S2 in the Supplemental Material) mirrored the original results (cf. Tables 4 and 8 in Unsworth et al., 2015). The only significant correlations in Study 1 were between fluid intelligence and shooter- and action-game experience, but these were not replicated in Study 2, which instead revealed significant but weak correlations between attention control and experience playing role-playing and sports-action games. Thus, our findings did not depend on a faulty assumption of linearity.

Green et al. also argue that we failed to control for experience with other gaming genres while individually analyzing experience with each specific gaming genre; that is, if people who played shooter games never played action games, for example, the association between ability and action-game experience might be underestimated with shooter-game experts in the data set (because they might show strong cognitive ability despite having no apparent video-game experience). Note that this criticism is applicable only if experience across genres is uncorrelated or negatively correlated; as we show later, neither is the case. We nonetheless conducted a structural equation model in which experience with the individual gaming genres simultaneously predicted each cognitive-ability factor. For both studies, none of the paths from video-game experience to cognition were significant (Fig. 1).

To further assess whether some common processes that are influenced by cross-genre gaming experiences might predict cognitive ability (as proposed by Green et al.), we conducted confirmatory factor analyses with a single factor of general video-game experience and examined its association with cognitive abilities. These analyses demonstrated positive correlations among the various video-game genres, as all video-game experience in Study 2 and all video-game experience except turn-based strategy-game experience in Study 1 loaded significantly on the latent video-game factor (Fig. S1; see also Fig. 1). The only significant latent correlation between video-game

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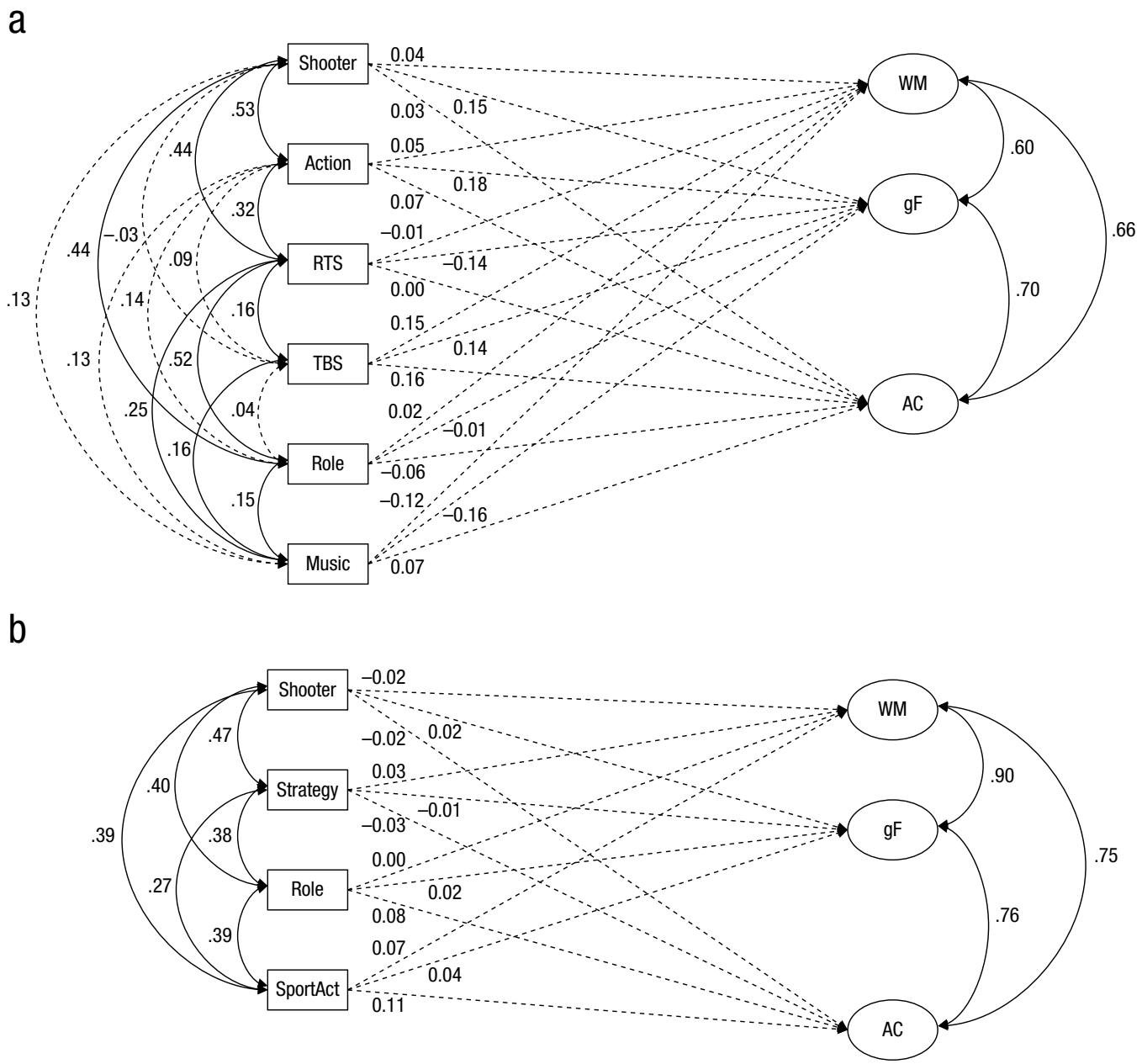

Fig. 1. Structural equation models predicting working memory (WM), fluid intelligence (gF), and attention control (AC) in (a) Study 1 and (b) Study 2. In both models, these cognitive abilities were predicted simultaneously by experience with the individual gaming genres. Both models were based on the log-transformed questionnaire data. Ellipses indicate latent variables, and rectangles indicate observed variables. Values alongside double-headed arrows are correlations, and values alongside single-headed arrows are standardized path coefficients. Paths that were statistically significant, $p < .05$, are represented by solid lines, whereas paths that were not statistically significant are represented by dashed lines. Shooter = shooter-game experience; Action = action-game experience; RTS = real-time strategy-game experience; TBS = turn-based strategy-game experience; Role = role-playing-game experience; Music = music-game experience; Strategy = strategy-game experience; SportAct = sport-/action-game experience.

experience and a cognitive ability was a correlation between video-game experience and fluid intelligence in Study 1. This result was not replicated in Study 2 (Fig. S1); in other words, the results of these new analyses reflected the results of our original analyses. Thus, controlling for experience with other video-game genres did not bring out effects that were potentially obscured in our original analyses.

Finally, although we did not report extreme-groups analyses for Study 2 in our original article, we do so here to address Green et al.'s concern (which we discuss further in the next section) that our video-game-experience questionnaires can distinguish only extreme groups and thus support only extreme-groups analyses. As Table S3 in the Supplemental Material shows, a handful of the group differences were significant (one in the wrong

direction) in these analyses. However, only one of the nine tasks administered in both studies showed significant group differences in both Study 1 and Study 2 (cf. Table S3 with Table 1 in the original article). Thus, even using the preferred method of Green et al., our results suggest only weak associations between video-game experience and the cognitive abilities we assessed. For these analyses, and those reported earlier, we acknowledge the possibility that the inconsistencies between Studies 1 and 2 may reflect false positives in one study or the other. In addition, we note that associations between gaming and cognitive ability may not be robust across different populations or measures.

Critiques of the Video-Game-Experience Questionnaires

We used a different video-game questionnaire in each study, the first provided by Hubert-Wallander, Green, and Bavelier (2011). Although Green et al. object that our questionnaires accounted for subjects' experiences in only the prior year, we simply followed the standards established in previous work (e.g., Li, Polat, Makous, & Bavelier, 2009; McDermott, Bavelier, & Green, 2014). We are also surprised that Green et al. object to our analyzing the video-gaming data continuously, rather than via extreme groups, as some of these authors analyzed their own data in exactly this way in an article published the same year as ours (Eichenbaum et al., 2015).

Even so, we must consider whether their position is correct. Do quantity-frequency (Q-F) questionnaires that retrospectively probe the frequencies of behaviors (e.g., gaming, drinking alcohol) have insufficient validity as continuous measures? Are they, instead, suitable only for gross discriminations (e.g., for distinguishing heavy gamers or drinkers from light gamers or drinkers)? We understand the well-documented challenges of retrospective self-report, but Green et al. misconstrue the critiques of Q-F questionnaires in the alcohol-use literature (e.g., Room, 1990; Shakeshaft, Bowman, & Sanson-Fisher, 1999). These critiques discuss the limitations of Q-F questionnaires but nonetheless acknowledge that these measures correlate strongly with each other (rs = .61–81 in Room, 1990) and with state-of-the-art diary measures (rs = .63–.86 in Shakeshaft et al., 1999) when treated as continuous variables (Sobell et al., 2003, reported rs from .65 to .82 for correlations between Q-F questionnaire and diary measures). Therefore, Q-F questionnaires can provide useful information about distributions of endorsed behaviors, preserving individual differences distinctions (and relative rankings) and allowing for valid correlational analyses. Indeed, both Room's (p. 62) and Shakeshaft et al.'s (pp. 640–641) critiques suggest that Q-F measures actually have difficulties in accurately classifying heavy drinkers, thus providing no support for using Q-F measures only to define extreme groups.

To further criticize our using video-game questionnaires for continuous measurement, Green et al. report new data indicating inconsistencies in self-report between two time points: At Time 1, students reported their gaming experience separately for each genre, and at Time 2, they reported their gaming experience for all genres combined. Of course, all self-report measures are subject to error, and any such inconsistencies are cause for concern. However, we note the following about these new data (we thank the authors for providing the data file): First, some of the inconsistencies reflect clearly invalid responses that would typically be deleted before analysis. Some respondents reported 65 to 117 hr per week on one retrospective questionnaire and 0 hr on the other; these inconsistencies do not reflect subtle cognitive biases or failures. Second, despite some measurement error, the questionnaires still supported individual difference distinctions. The Spearman-Brown correlations between the measures were .49 in the full sample (N = 824) and .58 after conservatively dropping the data of 8 respondents who reported 99 to 690 gaming hours per week at Time 1. Third, the greatest discrepancies between Times 1 and 2 were for respondents reporting an extremely high level of experience on one measure and almost none on the other, so the use of these questionnaires is as problematic for extreme-groups analyses as it is for continuous analyses.

Finally, we note that our own questionnaires also yielded sufficient systematic variance to be used in a continuous fashion. First, the separate gaming genres' totals correlated significantly with each other in both Study 1 and Study 2 (Fig. 1). Second, self-report values by video-game genre loaded significantly onto a common latent variable, with hours engaged in first-person shooter games producing the highest loadings in both Study 1 and Study 2 (Fig. S1). Third, hours engaged in first-person shooter games correlated significantly with fluid intelligence in Study 1.

Conclusions

After addressing the questions raised by Green et al.—by reanalyzing our data, by reconsidering the use of video-game questionnaires as continuous measures, and by inspecting their new questionnaire-discrepancy data—we are left confirming our original conclusions. There are weak to no associations between video-game experience and the cognitive abilities we tested, no matter how we analyze the data. Perhaps with other cognitive measures (e.g., useful field of view), we might have observed a different pattern of relationships. Along with Green et al., we reiterate the call for more rigorous design and methodology in future video-game studies, including the use of daily diaries or event-sampling methods to

assess gaming experience and expertise, particularly given the inherent limitations on causal claims from quasiexperiments.

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Author Contributions

T. S. Redick and N. Unsworth performed the data analysis. T. S. Redick, N. Unsworth, and M. J. Kane drafted the manuscript, and D. Z. Hambrick provided critical revisions. All the authors approved the final version of the manuscript for submission.

Declaration of Conflicting Interests

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Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/0956797617698527

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