

Point-wise response to the reviews

Review of Pokémon Trading Cards reveal visual stereotypes of natural minerals

Author: Cheng-Hung Chen

Anonymous referee #2

The author thanks the referee for the positive assessment. The discussion in Section 4.4 has been further refined to clarify the implications of the findings for geoscience communication and education.

Anonymous referee #3

Overall appreciation and general comments:

This piece of work sheds light on an interesting medium – Pokemon cards, to inform how the minerals are represented in popular culture. The advantage of using Pokemon cards is that there is an extensive catalogue of illustrations, and the brand itself is clearly linked with the natural imagery, but where mineralogy is generally not the focus. Therefore, Pokemon cards can serve as a good record for the public perception of mineralogy and crystallography. The author conducts detailed and rigorous analysis of a large and extensive sample of cards to uncover the main visual stereotype of minerals presented in this medium.

One of my main questions is: How well does AI perform on accurate mineral illustrations versus photographs? Would this be a fairer comparison to use realistic illustrations as a baseline, as you are using AI to look at highly stylised illustrations?

Response:

The author thanks the reviewer for this important suggestion. To address this concern, the revised analysis includes a control experiment using 43 photographs of real mineral specimens, with accuracies of 95% (Gemini), 86% (ChatGPT), and 74% (Rock Identifier) (Section 3.2; Appendix C). The illustrations were also classified by visual plausibility, allowing comparison between geologically plausible and highly stylized fantasy artwork (Section 3.2, paragraph 3; Fig. 4c). Agreement decreased from 62–66% for plausible illustrations to 26–45% for fantasy artwork, suggesting that increasing artistic stylization is associated with lower AI–human agreement.

I also feel that there could be more added to strengthen the conclusions. I think it's important to highlight the cards that are exceptions from the 'universal template' (which is mentioned in L249 and in the pictures) in the conclusions. As these exception cards could be considered one of the 'easter eggs' that the authors states would be useful in geoscience education and engagement. Although, the majority are the 'universal crystal type', do you think that there are enough 'easter eggs' in the PTCG collection right now that can be used by geoscience educators?

Response:

The author thanks the reviewer for this helpful suggestion. Section 4.4 has been revised to highlight existing cards that depart from the universal template, including examples depicting cleavage, fractures, and coexisting minerals (Figs. 1e, g, i). The revised discussion notes that these examples can serve as educational "Easter eggs" alongside real mineral specimens. Furthermore, the text now explicitly affirms that the current dataset already provides a sufficiently rich baseline for immediate educational use. The Conclusion has also been revised to highlight these mineralogical exceptions as additional entry points for science communication.

Also, in the conclusions there could be an added justification on why the Pokemon company would/could be interested in providing accurate mineral 'easter egg' cards, or creating cards with greater mineralogical diversity. Of course, as you mention that PTCG/the Pokemon company is a creative medium and they have no 'need' to make the work scientifically accurate if it is aesthetically pleasing. However, there is plenty of evidence of the Pokemon company engaging with science (such as hosting Pokemon fossil exhibitions in museums). I feel that the Pokemon company seems to understand that revealing and exploring the inspiration for their Pokemon adds another layer to their media and increases engagement from players/consumers. It is not just educators using popular media as a tool to engage people.

Response:

The author thanks the reviewer for this helpful perspective. Section 4.4 (paragraph 2) has been expanded to include the Pokémon Fossil Museum, including its 2026 exhibition at the Field Museum in Chicago, as a concrete precedent for using the franchise to communicate Earth science. The following paragraph further discusses how scientifically informed mineral "Easter eggs" could give players another way to explore the real-world ideas behind the artwork and add another layer of engagement. The broader implication is retained in the Conclusion through the discussion of scientifically informed elements in future artwork.

Line Comments:

L265, L284: I'm not sure how the Calvo & Lucha reference is relevant to the sentences? The sentences ultimately describe your findings (i.e the results show that the crystals drawn are overly simplified?)

Response:

The author thanks the reviewer for identifying this issue. The Calvo & Lucha (2024) citation has been repositioned to distinguish the findings of this study from previous literature. The citation has been removed from the sentence describing the PTCG results in Section 4.3 and is now used in Section 4.4 only to support the statement that similar limitations in mineral representation have been reported in other informal educational resources.