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Discussions

Interactive comment on "Demonstrating change from a drop-in engagement activity through pre- and post- graffiti walls: Quantitative linguistics and thematic analysis applied to a space soundscape exhibit" *by* Martin O. Archer et al.

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***General comments* This is a good paper that presents a useful approach to evaluating drop-in public engagement activities. The detailed statistical analysis is particularly interesting, perhaps more for its explication of a rigorous analysis of graffiti walls and word clouds than for its demonstration of the efficacy of this particular activity. The analysis is very impressive and this paper stands to be a constructive best-practice guide for other public engagement practitioners.**

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Discussion paper

We thank the reviewer for their time in assessing the manuscript and have taken their comments into account with the following responses.

Nevertheless, I think the novelty of using before-and-after graffiti walls is perhaps overstated. For example, I was part of an interactive drop-in exhibit in March 2018, where we asked attendees to write words / ideas related to the exhibit theme on small cards, both on entry and just prior to leaving, giving us both pre- and post- data, in the form of collections of words and phrases, in much the same way. However, I think the subsequent analysis of data performed here is what makes this work noteworthy, and, as far as I am aware, original.

We do not doubt that others may have had the idea to put graffiti walls both before and after an activity, however in our literature search we have found no published evidence of this. This is likely because practitioners often do not share their evaluations publicly and thus the learning which develops in science communication and public engagement does not get passed on effectively. This is why journals like Geoscience Communication are important. We rephrase lines 74-75 to "we are unaware of any *published* public engagement activity that has captured *and analysed* data both before and after a drop-in activity using them" to clarify this position. We thank the reviewer for their comments on the novelty of the analysis of the captured before and after data.

The title adequately reflects the contents of the paper, and the abstract gives a neat summary too. Overall, the paper is well-structured and clear, and of an appropriate length for the material covered. The language is fluent and precise, although there are one or two points (as noted in the specific comments below) where the readability drops off a bit and it becomes confusing. Nevertheless, this paper is largely well-written, useful and enjoyable to read. It makes a worthwhile contribution to the literature of this field.

We thank the reviewer for these comments.

***Specific comments* - Line 20: Is it worth explaining at this point, in just a few**

words, what a 'graffiti wall' is? It doesn't become clear until you get to the images in Figure 1 and lines 55-60.

We will add here that "Graffiti walls are large areas (often a wall, whiteboard, or large piece of paper) where participants are free to write or draw responses in reaction to the engagement activity or some prompt question."

- Lines 35-29: This is a little confusing and I think a little more care needs to be taken over the logic here. You are making two points, I think, that get conflated: (1) Space is not empty: there is lots of tenuous plasma filling it. (2) There is sound in space: there are pressure waves in plasma. I think it could be worth disentangling the two ideas a little more carefully.

We will rephrase this paragraph as follows:

> The presence of a medium in space allows for plasma wave analogues to ordinary sound (pressure waves) that occur at ultra-low frequencies — fractions of milliHertz up to 1 Hz — and are routinely measured by space missions. One way in which these waves are generated is through the highly dynamic solar wind buffetting against Earth's magnetic field, a process that plays a key role within space weather and thus how phenomena from space can affect our everyday lives (e.g. Keiling et al., 2016). However, the belief by the public that space is completely empty in turn leads many to incorrectly think that there is absolutely no sound in space, reinforced by school science demonstrations such as the bell-jar experiment (see Caleon et al., 2013, for a nuanced discussion) or even popular culture like in the marketing to the movie 'Alien'. Public engagement with this research area is thus needed to help correct this fallacy.

- Line 67: 'The researchers would use what they had written or drawn to prompt a short dialogue about aspects of the space environment - a method informed

by the 'science capital' research'. The relationship between science capital research and the researchers undertaking a dialogue with attendees is not immediately obvious here. It might be interesting to draw out a couple of details from the research that prompted / informed this aspect of the activity.

This brevity was due to the word limit of the GC letter format. We will expand the discussion of this link between the 'science capital' research and how it informed this aspect of the activity. These stem from the issue of whether people feel included in science and that it is for "people like me". The 'science capital' researchers recommend using and valuing participants' own experiences as part of engagements instead of the typical transmissive approach which can alienate lower science capital audiences from the scientists who are trying to engage.

- Line 89-91. The discussion of the power law / Zipf exponent is a little confusing here. In line 89, you say the exponent is -1. However, in lines 90-91, you suggest the exponent can take different values. When is it -1 and when is it something else? Or are these two different things? Some further clarity here would be beneficial.

While the Zipf exponent is typically quoted as -1, it can indeed vary as we later indicate with further references and the more generalised form is that of a power law. We will clarify both these points in the text.

- Line 124-129. I'm struggling to piece this together a bit. Is the implication that the people who initially said 'empty' then went on to say something else afterwards, but they didn't say 'full'? I think you need to re-examine how you set out your findings here, because it is a bit confusing as it stands.

Again the concise nature of this paragraph was driven by the word limit of the GC letter format. We will expand the discussion to make this much clearer, but essentially the reviewer is correct.

- Line 201-2. Why do you give 16 responses before and 15 responses after? Overall, the explanation of the contents of Table 2 is hard to follow.

This was because ties in the ranks of words made it impossible to select a suitable subset of equal size in both datasets for the reliability testing. Nonetheless, the log-linear analysis (like a chi-square test) does not require equally sized datasets. We will, however, clarify this as:

> To ensure the reliability of the main qualitative coding of the entire dataset, second coders applied the thematic analysis to a subset of the data. This subset constituted the top 16 words before (58% of total responses) and 15 words after (49%), with the slightly different number of words used in the two datasets being due to ties in the ranking of words making it impossible to have exactly the same number in both. Table B2 shows the totals of how these unique words were grouped across all three coders. These results are used in the log-linear analysis to test reliability, which we note does not require equally sized datasets. The codes' association to the raw data can be found in the supplementary material, both for the main and second coders.

We will also rephrase the caption to the Table.

***Technical corrections* - Line 9: 'the power of data sonification in innately communicating science' – I'm not sure 'innately' is the right word here. I'm not quite sure what you mean.**

Again due to word limits we were not able to further elaborate on this. Given that the words on the graffiti wall afterwards were purely based on participants' reflections to their experience, their innate sense of sound was able to convey key aspects of the science to them before they even spoke to the researchers. We will clarify this in the revised manuscript.

- Line 35: 'The solar wind is highly dynamic and as it buffets against Earth's magnetic field generates plasma wave analogues to ordinary sound at ultra-low frequencies' – this is difficult to follow as it stands. Consider putting an extra 'it' in: 'as it buffets against Earth's magnetic field, it generates plasma wave analogues'

We will make this correction.

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