

## **Exposing an Art Audience to Science: Art and Space Exhibition Case Study**

Art and Science collaborations can help communicate scientific concepts to the public. This case study considers the impact that an art exhibition on a scientific theme has for its audience and hence the effectiveness of such a communication strategy. The *Art and Space* exhibition comprised artworks which were the culmination of collaborations between scientists and artists. The exhibition reached an audience which came predominantly from a non-science background and which attended the exhibition primarily due to a general interest in art. The exhibition was effective in raising awareness of and generating interest in the aspects of science represented. Visitors also enjoyed the exhibition. The impact of such an exhibition could be extended by providing opportunities for visitors to pursue the interest generated.

### INTRODUCTION

The *Art and Space* exhibition was held in Dunedin, New Zealand, from 16 September to 2 October 2016. This was the fourth in a series of art and science collaborations between the University of Otago and the Dunedin School of Art at Otago Polytechnic. The exhibition venue was off campus, at the Otago Museum's H D Skinner Annexe, and it was also supported by the Dodd-Walls Centre for Photonic and Quantum Technologies.

For the exhibition a group of artists and a group of scientists collaborated to produce artworks that were not merely illustrations but explorations of the scientific concepts. The curator, Peter Stupples, described the process of collaboration in the exhibition catalogue: "The task of the artists is to familiarise themselves with the research of the scientists, during initial presentations and subsequent discussions, and for "something" creative to emerge from the artists out of this experience." Space provided a broad remit, encompassing social space and inner space as well as outer space. A wide variety of artworks were produced for the exhibition, and a small number of existing artworks relevant to the theme were included also.

This case study examines the use of art as a strategy to communicate scientific concepts of space. The effectiveness of the strategy was tested by examining the impact of the *Art and Space* exhibition for its audience. A questionnaire was used to discover the impact of the exhibition. This study does not examine the impact of the art/science collaboration for the artists or scientists, only the impact of the resulting exhibition for the public.

## ART/SCIENCE COLLABORATION

Art is being recognised as one way to increase public interest in and understanding of science, forming part of an arsenal of tools to communicate scientific information.<sup>1</sup> Information connected with imagination through art is more memorable over time.<sup>2</sup> Art and science share a desire to build and encourage dialogue with society.<sup>3</sup> We are not speaking of artists as illustrators of the science, tasked with dissemination of a fixed body of knowledge. Rather the artists bring to the table a range of skills to engage with the science and contribute to development of knowledge, exploring the issues and providing new perspectives.<sup>4</sup> This is true collaboration, making art with people from non-art disciplines.<sup>5</sup> Art/science collaboration can be achieved through scientific organisations hosting artists in residence.<sup>6</sup> Another example of art/science collaboration is through artist/scientist pairings, with a joint exhibition and symposium resulting.<sup>7</sup>

It is not straightforward to measure the effectiveness of art in communicating science. Like other science communication strategies, it is easier to measure success in achieving the desired impacts by focussing on short term quantifiable results, rather than possible longer term consequences such as behaviour change as a result of changed thinking from new exposure and experience.<sup>8</sup> Burns et al<sup>9</sup> have developed a definition of science communication that describes its purpose or objectives. These objectives comprise five possible short term responses or impacts, which can be summarised AEIOU:

Awareness, including familiarity with new aspects of science – this incorporates making people aware that a subject exists, so they are exposed to some new aspect of science.

Enjoyment or other affective responses, e.g. appreciating science as entertainment or art – this is a “highly desirable component” of all science communication, incorporating pleasure and satisfaction.

Interest, as evidenced by voluntary involvement with science or its communication – this is expected to enhance recall and understanding, and improve scientific culture.

Opinions, the forming, reforming, or confirming of science-related attitudes – causing people to reflect on their attitudes is powerful.

Understanding of science, its content, processes, and social factors – this is a prerequisite for higher levels of scientific literacy.

Art/science collaborations have the potential to benefit the scientists involved as well as the artists involved and the public.<sup>10</sup> Yet after an arts programme was included in the annual conference of the Ecological Society of Australia, although 50% of survey respondents were persuaded that the arts have a role in helping the general public understand complex scientific information, only 24% of respondents said that they would consider using the arts in conjunction with their own work in future.<sup>11</sup>

The Aeolus artwork is an example of a collaboration between an artist and acoustics scientists. The project aim was to “create a greater awareness of the existence of acoustic science and engender a greater appreciation of its contribution to quality of life”. The sculpture needed to work visually as well as aurally, and it was accompanied by an exhibition, workshops, and engagement programme for schools and community groups. This project identified that the science message needed to be

asserted proactively, for example in press releases and promotional activities.<sup>12</sup> Art may complement rather than replace other forms of science communication.<sup>13</sup>

Another study has explored the impact on audiences of art/science collaborations in a science festival. The science festival studied explored the theme of conscience. It was hoped that new and existing artworks related to this theme would bring science closer to people who would not be reached by a pure scientific event.<sup>14</sup> Art/science collaboration can enable science to reach an audience that is not traditionally interested in that science, however it may only reach those with the cultural capital to engage with art.<sup>15</sup>

To reach the non-academic public and “people who are not part of the culture elites already visiting art institutions”, Kagan recommends that an exhibition or equivalent public activity should be located outside academic and cultural institutions, in spaces where it will connect with their everyday life.<sup>16</sup> This was also the conclusion of von Roten and Moeschler’s science festival study: events sited in public places, a hospital, and libraries, rather than in cultural institutions, will attract a different demographic. Museums, shopping centres and town halls are considered neutral rather than cultural institutions. Similarly different types of event attract different people; the more artistic events in a science festival are more likely to attract people with an interest in art.<sup>17</sup>

## METHODOLOGY

This was an exploratory case study to test the effectiveness of an art exhibition for science communication. The definition of science communication espoused by Burns et al<sup>18</sup> was used.

One of the strengths of the *Art and Space* exhibition was the range of aspects of science represented and the variety of artistic media. Ten scientists were involved in the exhibition, from the disciplines of psychology (place cells in the brain), botany (growing and transporting plants in outer space), neuroscience (mapping the brain, spaces created when brain cells die), information science (virtual and real space), physics (spacetime), astronomy (outer space), geographical information science (spatial mapping), and geography (moving ice sheets). The artistic works exhibited included painting, sculpture, jewellery, photography, and sound and fabric works. Some of these were interactive, for example a curtain to walk through, sculptures that could be touched, and a map mat to stand on which produced sounds.

The exhibition was open from 12 noon to 3pm daily from 16 September to 2 October 2016. At all times one of the artists was in attendance. Seven different talks by the curator, artists and scientists were held, one on each of the three Saturdays, one on each of the three Sundays, and one on a Wednesday for a group visit that had been arranged at 10am.

The questionnaire in large measure followed the same format as the survey used the previous year, for the *Art and Light* exhibition in the same art and science series.<sup>19</sup> These questions included two about the visitors’ agreement or disagreement with two statements about the interplay of art and science, and two about whether the exhibition had changed their interest in science and in art. For the *Art and Light* exhibition visitors were asked whether they were interested in learning more about the science represented in these art works. This question was removed from the questionnaire for *Art and Space*, because visitors may have already been interested in learning more about the

science before seeing the exhibition. Two new questions were introduced, asking what visitors liked most and least about the exhibition, in order to gain a broader understanding of the impact without limiting visitors to a finite set of responses.

## FINDINGS

The exhibition attracted 300 visitors, 36 of whom completed a one page paper questionnaire (reproduced in the appendix). The questionnaire was available throughout the exhibition for visitors to complete anonymously and voluntarily. There was no attempt to obtain a representative sample of visitors so the respondents are a random sample of audience members who had the time and inclination to answer the questions. One of the completed questionnaires was excluded from analysis because it had been completed with humorous answers to all questions except question one. Only one of the remaining 35 respondents did not answer all questions.

### *Who were the respondents*

Five of the respondents (14%) had a professional background in both science and arts/humanities, compared with 15 from arts/humanities only (43%) and four from science only (11%). The remaining 11 respondents (31%) had a professional background in neither science nor arts/humanities, a significant increase from the previous year when this group comprised only 21% of visitors.<sup>20</sup> Other demographic information, such as age and gender and level of education attained was not collected.

By far the most common way people heard about the exhibition was by word of mouth (49%). Only two respondents (6%) heard about the exhibition from the University of Otago and three (9%) from the Otago Polytechnic, compared with 26% who heard about it from the Otago Museum. Another nine respondents (26%) heard about the exhibition from some other source three of these added a comment that they were walking past. All respondents answered this question. Most respondents (89%) heard about the exhibition from only one source.

Most respondents (59%) gave multiple reasons why they were attracted to the exhibition, and one respondent with an arts/humanities background did not answer this question. The main reason given was a general interest in art (71%); 86% of those respondents with an arts/humanities background only gave this reason. Thirteen (38%) came because of a general interest in science. Of the four respondents with a science background only, 75% were attracted to the exhibition because of a general interest in science but 75% were also attracted to the exhibition because of a general interest in art.

The second most popular reason respondents gave for being attracted to the exhibition was an interest in how science and art can combine (50%). This reason was given by 50% of those with an arts/humanities background only and 75% of those with a science background only. Some respondents (32%) came to see a colleague's work and one to see a family member's work. Respondents were also attracted to the work because they were fascinated by space (24%) and because they had enjoyed one of the previous exhibitions in the art and science series (15%). Another respondent, who did not identify a previous exhibition in the series as a reason attracting them to the exhibition, commented in the questionnaire that they look forward to it "each year" (17). One respondent came because a friend brought them along.

We asked respondents how much they agreed with two statements about the role of art with respect to science. Respondents could choose between three possible responses. One arts/humanities respondent did not answer these two questions. We did not ask whether respondents' level of agreement with these two statements had changed as a result of this exhibition.

The first of these statements was: "Art can be used to generate interest in scientific research". Only two respondents did not agree at all with this statement; neither was from a science background. The majority of respondents agreed completely (65%) and the remainder agreed somewhat (29%). Most of those with an arts/humanities background only (79%), most of those with a science background only (75%) and most of those with a background in both (80%) completely agreed that art can generate interest in scientific research. It was only in the group of respondents from a background of neither arts/humanities nor science that most (55%) agreed only somewhat.

The second statement was: "Art can help us understand aspects of science". Again only two respondents did not agree at all with this statement, again neither from a science background. Again the majority of respondents completely agreed (65%) and the remainder agreed somewhat (29%). Those with an arts/humanities background only (86%) were more likely to completely agree than those with a science background only (50%) and those with a background in both (60%). Respondents from a background of neither arts/humanities nor science were divided between complete agreement (45%) and agreeing somewhat (36%).

#### *What was the impact of the exhibition for the respondents*

The impact of the exhibition for the respondents was measured with two sets of questions. One set of questions asked whether viewing this exhibition changed the respondent's interest in an aspect of science and their ideas about the role of art. Respondents could choose between three possible responses, and were invited to elaborate by identifying what changed. One arts/humanities respondent did not answer these questions.

Overall, 26% of respondents answered yes, the exhibition had changed their interest in an aspect of science. Another 44% of respondents answered perhaps. Eight respondents, from both these groups, described what had changed for them:

"I'm more curious about space now" (questionnaire 5, neither arts/humanities nor science)

"Māori perspective – Maui fishing story actually about navigation" (16, both arts/humanities and science)

"At this stage sharpening an interest in science communication as well as a constant consideration of sustainable life" (18, both arts/humanities and science)

"Thought more about space" (20, arts/humanities)

"Issue of sound & noises in our public spaces, noise pollution" (22, neither arts/humanities nor science)

"To apply artistic lens to science" (24, science)

“The combination of science & art I didn’t know could work together and found very interesting” (31, arts/humanities)

“More intrigued about space & world around us” (36, neither arts/humanities nor science)

The exhibition changed their ideas about the role of art for 24% of respondents who answered yes. Another 39% of respondents answered perhaps. Two of those who answered no explained their answer:

“as already perceive art as an interface agent for change/parallel with science” (14, arts/humanities)

“I always new (sic) art was transformative” (23, arts/humanities)

Of those who answered yes or perhaps, eight explained the change for them. Two (16 and 31) referred back to their comments about the change in their interest in science. Other comments were:

“Art can be made with any materials” (5, neither arts/humanities nor science)

“Art is the rock upon which crystals of inspiration form” (6, both arts/humanities and science)

“Like co-operation arts/science” (20, arts/humanities)

“Makes science more interesting (and open to interpretations)” (24, science)

“Art expression of science is awesome” (25, science)

“It can explain science” (28, science)

More respondents from a background only in arts/humanities had their interest in an aspect of science changed (43% yes, 36% perhaps) than their ideas about the role of art (21% yes, 29% perhaps). Conversely, more respondents from a science only background had their ideas about the role of art changed (50% yes, 25% perhaps) than their interest in an aspect of science (none yes, 50% perhaps). More respondents with a background in both science and arts/humanities had their ideas about the role of art changed (40% yes, 60% perhaps) than their interest in an aspect of science (40% yes, 20% perhaps). Respondents from a background in neither science nor arts/humanities had their interest in an aspect of science changed (9% yes, 64% perhaps) more than their ideas about the role of art (9% yes, 45% perhaps). Of the 13 respondents who answered no to the question about whether viewing the exhibition changed their ideas about the role of art, 11 completely or somewhat agreed with the statement that art can generate interest in science and 12 completely or somewhat agreed with the statement that art can help understand aspects of science.

The second set of questions about the impact of the exhibition for the respondents asked them what they liked most and why, and what they liked least and why. There was also a general invitation for people to add additional comments at the end of the questionnaire. Only one respondent did not answer the question about what they liked most. Only 15 respondents gave substantive answers to the question about what they liked least, and another six answered “nothing” or gave an equivalent response. Eleven people provided general comments.

When asked what they liked most, three respondents said they appreciated the whole exhibition, one commenting that it was “thought provoking” (4, 15, 17). In the general comments section at the end, two of these and another seven respondents (3, 7, 9, 10, 15, 17, 20, 24, 26) gave thanks and/or positive feedback. Another respondent (14) added to her comment about what she didn’t like: “But really all is fabulous!! Well done”. One person appreciated the use of the exhibition space (14), and two liked being able to interact with the artists (14, 18). Three respondents commented positively on the collaboration between the scientists and the artists (10, 24, 35).

Seven respondents commented favourably on the interactive works, individually or collectively (1, 12, 14, 22). One of these mentioned touch specifically, and two talked about the accessibility of these works for people with disabilities (13, 19). There were a range of other comments on individual artworks; for example one person said a piece was “amazingly effective” (33) and another said the piece they liked most was “beautiful and informative” (13). Another liked the metaphor of weaving for the space/time grid (3), and two referred to the use of height in a sculpture to show the distance to stars (5, 16).

Some respondents commented on the information provided or lack of it. One liked the detailed explanations of each piece (7) and another said: “Each in their own way has insights I wouldn’t have found without your fascinating speakers” (11). One general comment was: “Was good to come with a scientist, discussion arose / new learning” (14). These positive comments contrast with the following:

“Some works too clever by half to be understandable by me!” (2)

“My one recommendation would be that wall panels provide one paragraph of context of the scientists work” (10)

“There were no descriptions next to the pieces” (28)

Two respondents took the opportunity to provide constructive feedback about the catalogue and open hours of the exhibition, but none reported a negative impact or regret that they had visited the exhibition.

Besides the talks and the catalogue, there were two other ways in which the impact of the exhibition was extended for visitors. Packs of cards, with images of or representing the works of the artists and scientists, were available for sale at the exhibition and at a nearby bookstore. Nine packs of cards were sold at the exhibition (cash sales only), and two at the bookstore. One questionnaire respondent’s answer to the question about what they liked most included “Having packs of cards for sale”. Although the works of art were not available for sale during the exhibition, the artists’ contact details were provided in the catalogue. One couple who visited the exhibition subsequently purchased one of the artworks.

## DISCUSSION

One of the university’s aims for these art/science collaborations is “to increase public engagement with the work of its scientists”, particularly with a non-science audience<sup>21</sup>. Only nine of the 35 respondents had a background in science only or science and arts/humanities, which suggests that this objective was largely met with respect to the *Art and Space* exhibition. The range of scientific disciplines represented in the exhibition also makes it possible that even those with a science background would encounter a scientific discipline with which they were not familiar. It is likely

therefore that the aspects of science represented in the exhibition reached new audiences, thereby increasing public engagement with the work of the scientists.

The most common answer, which 71% of respondents gave, when asked what attracted them to the exhibition, was a general interest in art. By contrast, the primary visitor motivations reported by von Roten and Moeschler<sup>22</sup> for a science festival entitled *Science et Cité*, although it included artistic events, were “to be informed, to learn something” (40.1% of respondents) and “general interest for science” (40%). It is possible that people with a general interest in art were strongly attracted to the *Art and Space* exhibition, due to its name and the nature of the event.

Respondents were asked about the level of their agreement with two statements about the role of art, that it could be used to generate interest in science and that it could help understand aspects of science. These two questions relate closely to two of the AEIOU objectives of science communication articulated by Burns et al<sup>23</sup> - Interest and Understanding. Amongst respondents from all backgrounds there were very high levels of agreement that art can be used to generate interest in science and that art can help understand aspects of science (both having 94% of respondents completely agree or somewhat). While many of these will already have held this view before seeing the *Art and Space* exhibition, 59% of respondents answered yes or perhaps when asked whether the exhibition changed their ideas about the role of art. This widespread support indicates that art can be an effective strategy for science communication.

The results also indicate that the *Art and Space* exhibition in particular was an effective strategy for science communication, up to a point. Although we did not compare the effectiveness of the *Art and Space* exhibition with other ways of communicating the same space concepts, we can assess the exhibition against the AEIOU objectives. The *Art and Space* exhibition achieved increased awareness of a range of scientific concepts, enjoyment by its audience, and increased interest in aspects of science:

#### *Awareness*

Because scientists from a range of disciplines were involved in collaborations with the artists, the exhibition provided an opportunity to expose the audience to many different aspects of science. Audience members were made aware of these aspects of science through the talks and in the catalogue, rather than directly from the art.

#### *Enjoyment*

Of the 35 respondents, only one did not answer the question about what they liked most. Almost all therefore found at least one artwork they enjoyed, and three said they liked the whole exhibition. Nine took the opportunity to express their appreciation in the final open question inviting further comments.

#### *Interest*

A total of 71% of respondents answered yes or perhaps when asked whether the exhibition changed their interest in an aspect of science. A higher proportion (79%) of respondents from a background in the arts/humanities (79%) or in neither arts/humanities nor science (72%) had their interest in an aspects of science changed compared with respondents with a background in science and arts/humanities (60%) or in science only (50%).



### *Opinions*

Eight respondents commented on how their interest in science had changed, however the comments do not indicate whether their opinions or attitudes had changed beyond an increase in interest.

### *Understanding*

Although respondents generally agreed art could help people understand aspects of science, there is no evidence that increased understanding as described by Burns et al (2003)<sup>24</sup> was achieved by the *Art and Space* exhibition.

The *Art and Space* exhibition also changed visitors' ideas about the role of art, especially for those from a background in science only (75%) or in both science and arts/humanities (100%) compared with those from arts/humanities only (50%) or neither (55%). Most of those whose ideas about the role of art were not changed by this exhibition already agreed that art can generate interest in science and that art can help understand aspects of science.

## CONCLUSIONS

The *Art and Space* art exhibition as the product of collaborations between artists and scientists was effective at reaching an audience which predominantly did not have a background in science; 74% of respondents comprised those with a background in arts/humanities only and those with a background in neither science nor arts/humanities. The exhibition also succeeded in reaching an audience with a general interest in the arts (71%). The exhibition was effective at changing audience interest in science, again especially for those with a background in the arts/humanities only (79%). To reach other publics and convey information about aspects of science to them, different strategies may be more effective.

The artworks themselves attracted and interested the audience, and gave enjoyment, however the talks and catalogue were needed to convey information about the aspects of science represented in the artworks. For future exhibitions in this series of art/science collaborations, a paragraph of information about the relevant aspect of science on the wall adjacent to each artwork, as suggested by two respondents, is likely to help increase awareness and possibly also interest for those audience members who did not attend a talk.

Another option to consider for future exhibitions in this Art and Science series, would be to provide opportunities for audience members to find out more about the aspect of science in which they were interested, or to take some other action to pursue their interest. This could assist audience members to move beyond Interest to Opinions and Understanding. Providing such opportunities could potentially increase the impact of the exhibition, and the number of audience members taking advantage of such opportunities would also provide a measure of impact. As a simple example, brochures promoting the nearby planetarium could have been made available at the *Art and Space* exhibition and a count kept of how many brochures were left over and hence how many taken. If a special offer for the planetarium had been negotiated for exhibition visitors, then the number of exhibition visitors who subsequently attended the planetarium, taking advantage of the offer, could also have been ascertained.

## APPENDIX

### Art and Space: Public Thoughts on an Exhibition

1. What attracted you to the exhibition? (tick as many as apply)  
 a general interest in art       interested in how science and art can combine  
 a general interest in science       to see a colleague's work  
 space fascinates me       I enjoyed one of the previous Art & Science exhibitions
  
2. What did you like most? Why was that?
  
3. What did you like least? Why was that?
  
4. Has viewing this exhibition changed your interest in an aspect of science?  
Yes    Perhaps    No  
          
If yes, what interest/s have changed?
  
5. Has viewing this exhibition changed your ideas about the role of art?  
Yes    Perhaps    No  
          
If yes, what idea/s have changed?
  
6. How much do you agree: "*Art can be used to generate interest in scientific research*"?  
Completely agree                          Somewhat                          Not at all
  
7. How much do you agree: "*Art can help us understand aspects of science*"?  
Completely agree                          Somewhat                          Not at all
  
8. What is your professional background (or area of study)?  
Scientific                          Arts/Humanities                          Both                          Neither
  
9. How did you hear about the exhibition?  
University Museum                          Polytechnic                          Word of mouth                          Other
  
10. Any additional comments? Please continue on back of paper ....

**Thank you!**

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17. von Roten and Moeschler, 2007.
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19. Ruth Napper and Jenny Rock, "Art, Science and the Viewing Public: Illuminating Observations from "Art and Light" Viewers", *Junctures* No 16 (2015), 75.
20. Ibid.
21. Ibid.
22. von Roten and Moeschler, 2007.
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