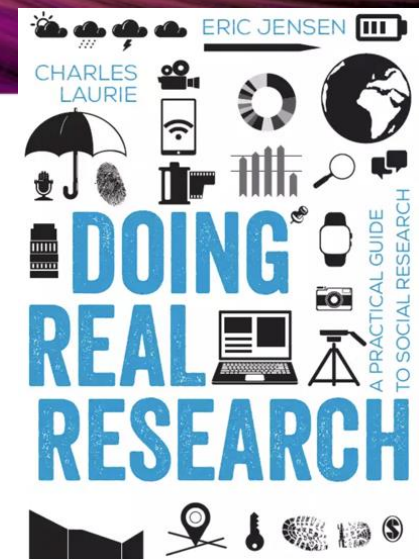


@JensenWarwick

# Science Communication Outcome Evaluation

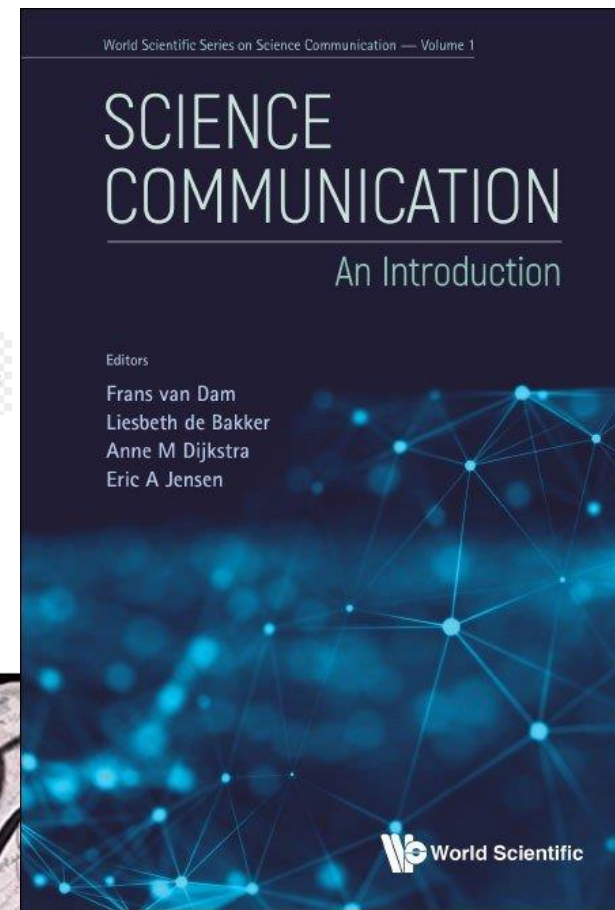
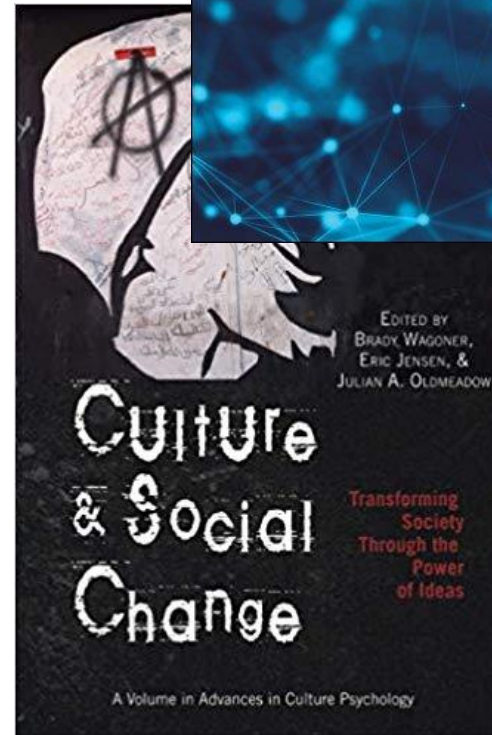
Dr Eric A. Jensen  
(eric@methodsinnovation.org)



# Background

## Academic background:

- Communication  Portland State UNIVERSITY
- Psychology  Portland State UNIVERSITY
- Sociology
- PhD, Sociology





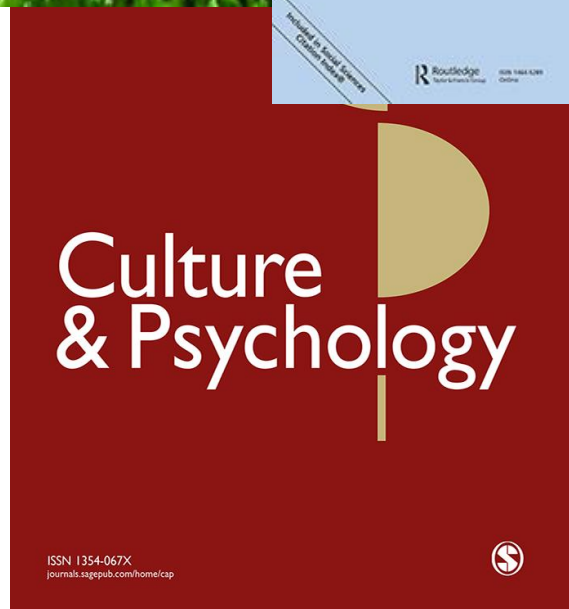
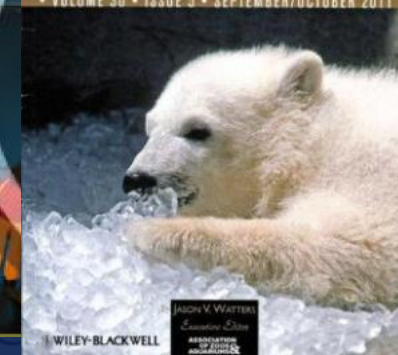
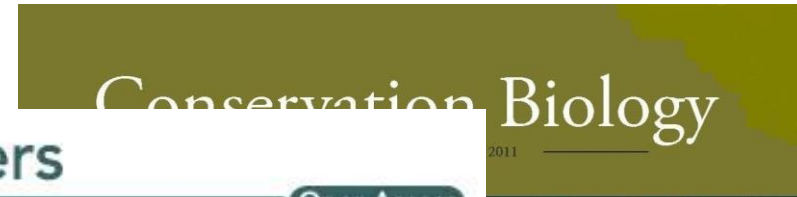
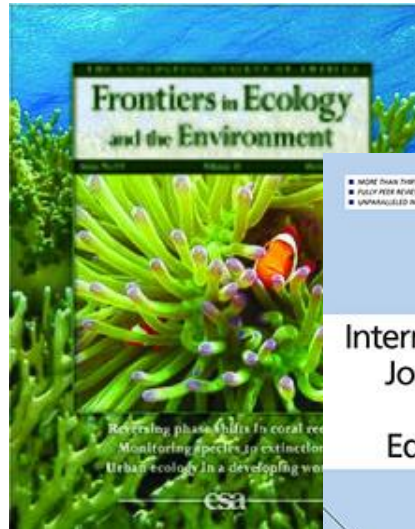
# Background

@JensenWarwick

## Current main roles:

- 1) Sociology professor, University of Warwick [part-time]
  - Social research methods
  - Media audiences and social change
- 2) Co-founder and Research Director, Institute for Methods Innovation (methodsinnovation.org)

# Experience: Academic





# Experience: Policy



Australian Research Data Commons



GEFÖRDERT VOM



Bundesministerium  
für Bildung  
und Forschung



Department  
for Environment  
Food & Rural Affairs



World Association of Zoos  
and Aquariums | **WAZA**  
United for Conservation

European Space Agency



Department for  
Business, Energy  
& Industrial Strategy



National  
Research  
Foundation



Research  
Council of  
Lithuania



CONICYT  
Ministerio de  
Educación

Gobierno de Chile



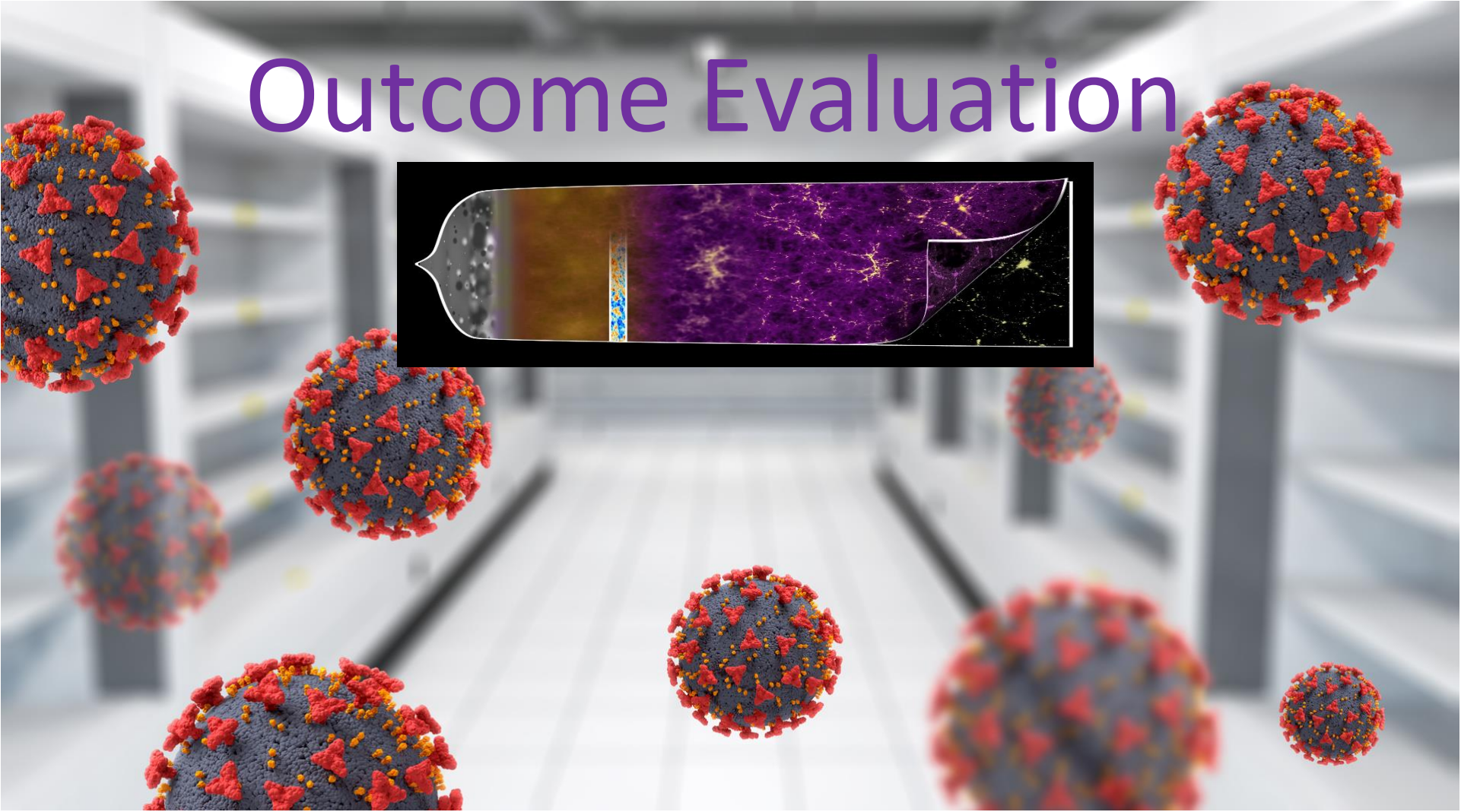
European  
Commission



# Experience: Practice

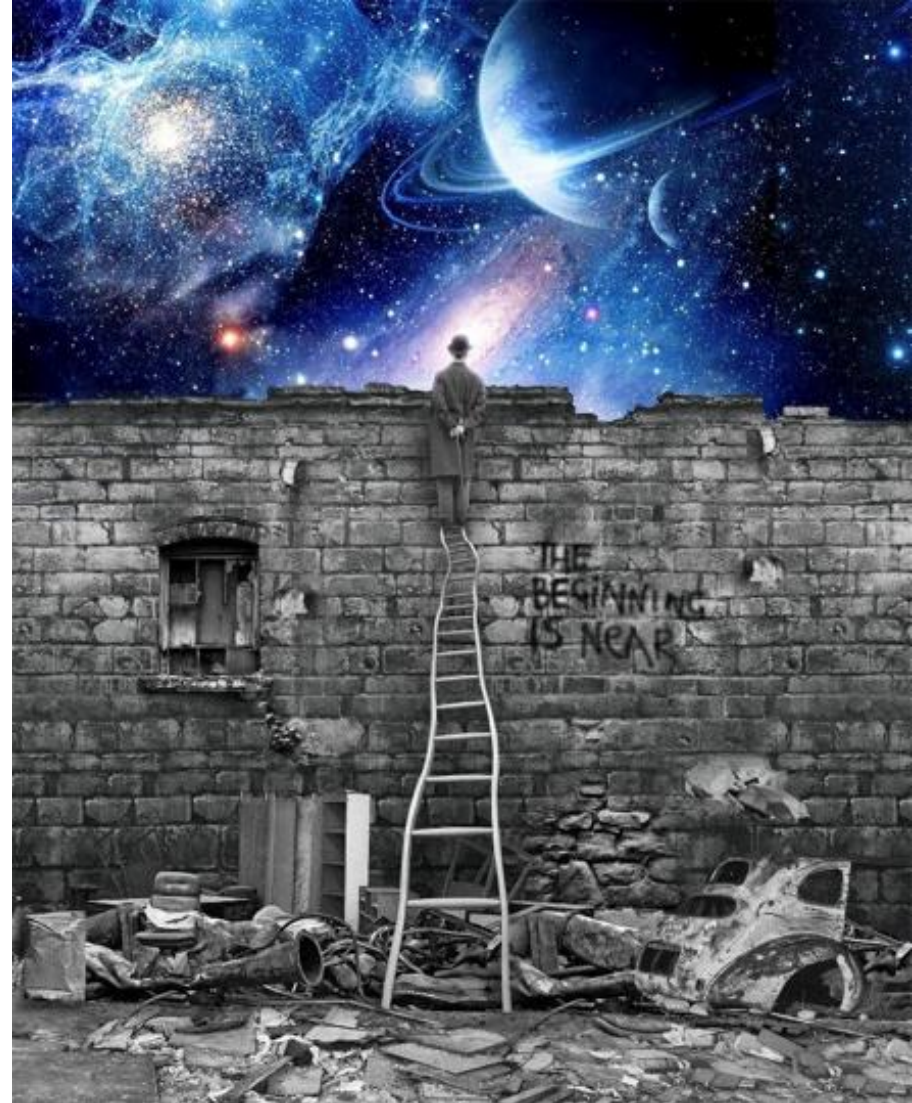


# Rationale for Science Communication Outcome Evaluation





Science  
Communication  
should be  
evidence based





# Evidence-based Science Communication

*‘Using robust social scientific evidence [...] to ensure success should be viewed as a basic necessity across the sector’*

The screenshot shows the top of a Frontiers article page. The header includes the Frontiers logo and the journal title 'Science and Environmental Communication'. A navigation bar contains links for SECTION, ABOUT, ARTICLES, RESEARCH TOPICS, FOR AUTHORS, EDITORIAL BOARD, and ARTICLE ALERTS. A purple box on the right contains the URL 'sciencecomm.science'. The article title is 'Evidence-Based Science Communication' by Eric A. Jensen and Alexander Gerber. It is a PERSPECTIVE article published on 23 January 2020. The article has 20,068 total views and an Altmetric score of 280. A yellow sticky note with 'theory' and 'practice' written on it is visible in the bottom right corner.

frontiers  
in Communication | Science and Environmental  
Communication

SECTION ABOUT ARTICLES RESEARCH TOPICS FOR AUTHORS EDITORIAL BOARD ARTICLE ALERTS

< Articles

**PERSPECTIVE article**  
Front. Commun., 23 January 2020 | <https://doi.org/10.3389/fcomm.2019.00078>

**Evidence-Based Science Communication**

Eric A. Jensen<sup>1†</sup> and Alexander Gerber<sup>2†</sup>

<sup>1</sup>Department of Sociology, University of Warwick, Coventry, United Kingdom  
<sup>2</sup>Department of Science Communication, Rhine-Waal University of Applied Sciences, Kleve, Germany

Check for updates

Download Article Export citat

20,068  
TOTAL VIEWS

Altmetric scores 280

View Article Impact

theory  
practice

## Evidence-based science communication

*Be open to research that ‘invalidates previously accepted’ practices and ‘replaces them with new ones that are more powerful, more accurate, more efficacious’*  
(Sackett et al. 1996: 71).



sciencecomm.science

IMI

Institute for  
Methods  
Innovation



# Priorities in evidence-based science communication

- Using evidence to inform efforts at social and cultural inclusion.
- Research/theory informs how to reduce social inequality and not exacerbate it.



sciencecomm.science



# Priorities in evidence-based science communication

 **Visitor Studies** >  
Volume 14, 2011 - Issue 2

Enter keywords, authors, DOI, ORCID

[Submit an article](#) [Journal homepage](#)

3,697 Views

45 CrossRef citations to date

10 Altmetric

Reflections on the Field

## Towards A Contextual Turn in Visitor Studies: Evaluating Visitor Segmentation and Identity-Related Motivations

Emily Dawson & Eric Jensen  
Pages 127-140 | Published online: 13 Oct 2011

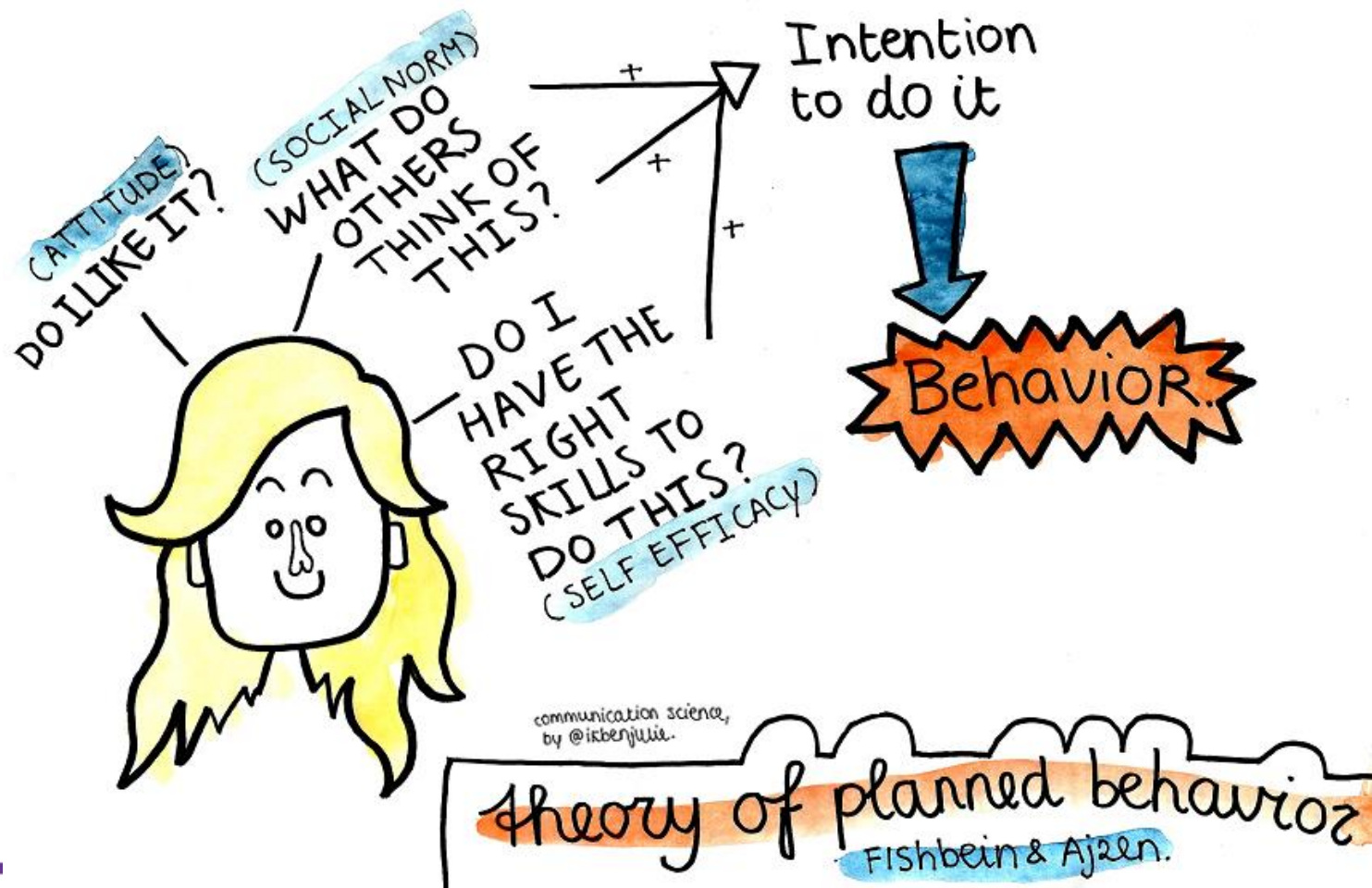
- Importance of collecting **demographic** data (e.g., ethnicity and socio-economic status)
- Such data highlights social inclusion issues that are otherwise **hidden**





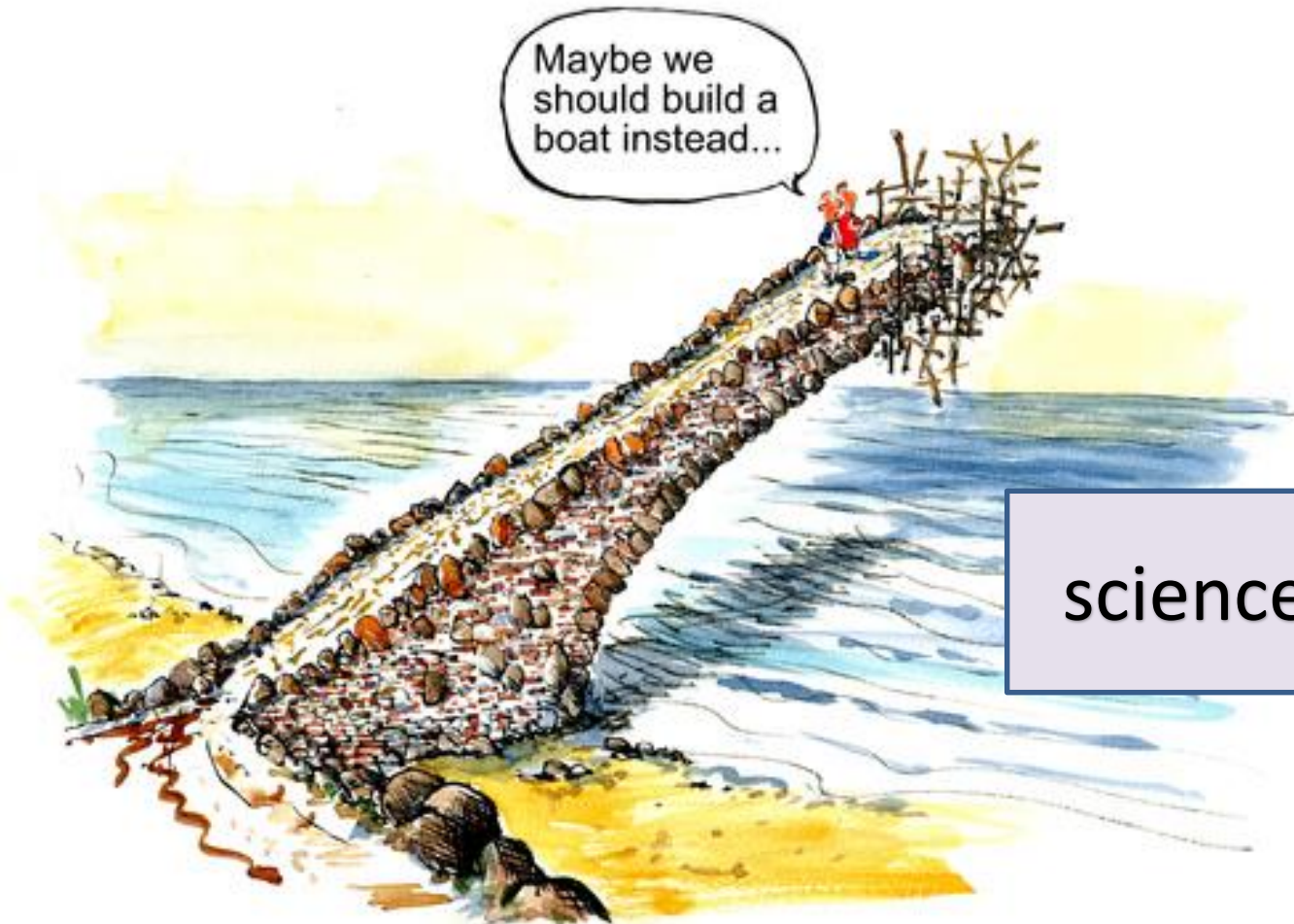
# Priorities in evidence-based science communication

- Applying relevant research and theory to avoid well-known pitfalls and improve the odds of success.



# Priorities in evidence-based science communication

- Aligning communication approaches to needs of specific stakeholders or audiences.



sciencecomm.science



# Priorities in evidence-based science communication

- Willingness and capability to reflect on and address **limitations.**



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IMI

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Innovation

# Priorities in evidence-based science communication

- Continually improve practice based on ongoing collection and analysis of robust **evaluation** evidence.



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Innovation

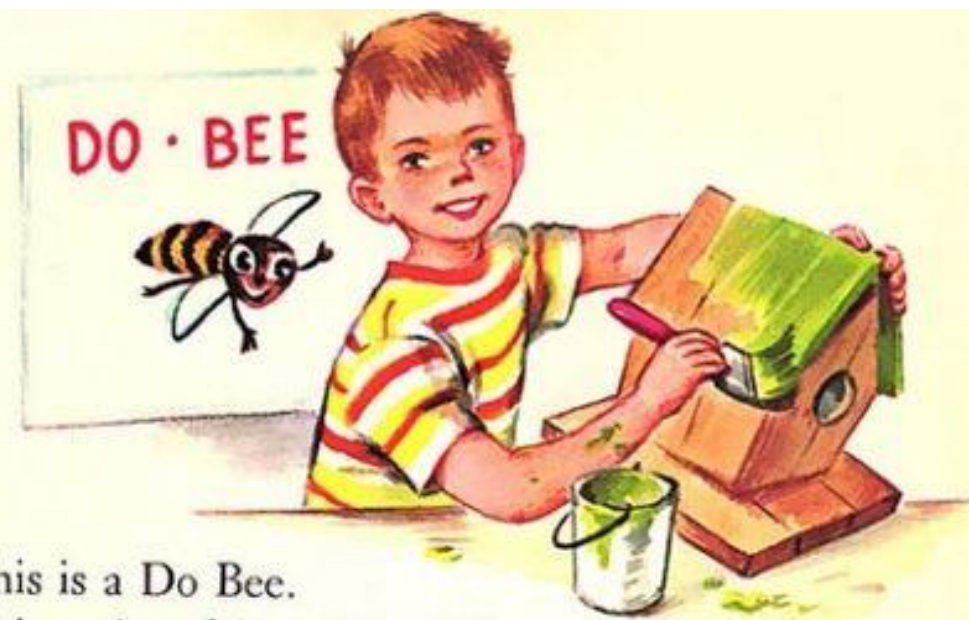
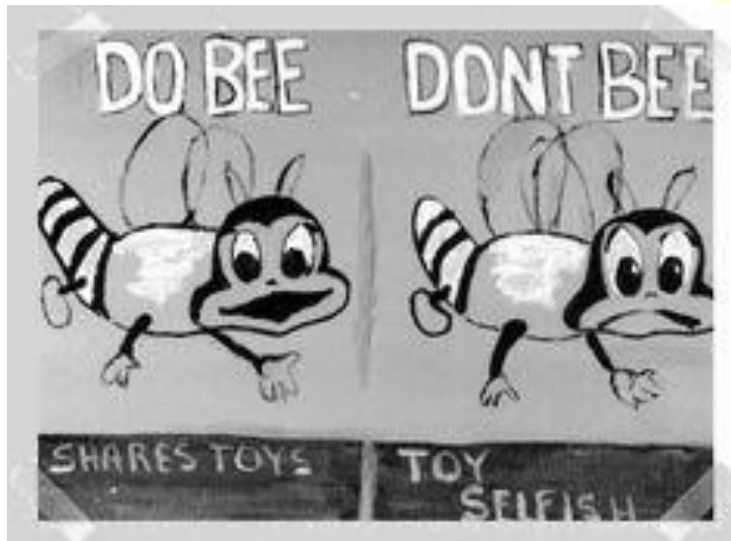


Future of  
Science  
Communication  
is **self-reflective**

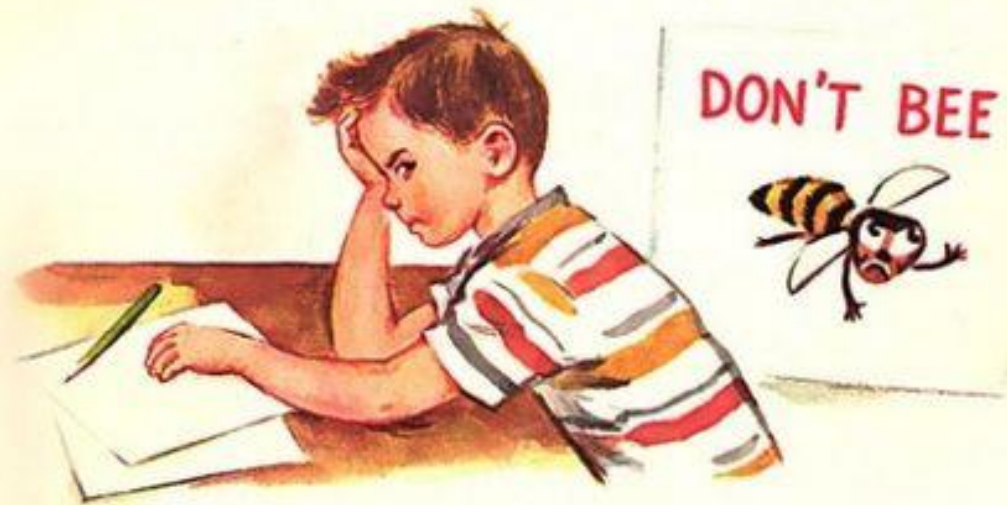




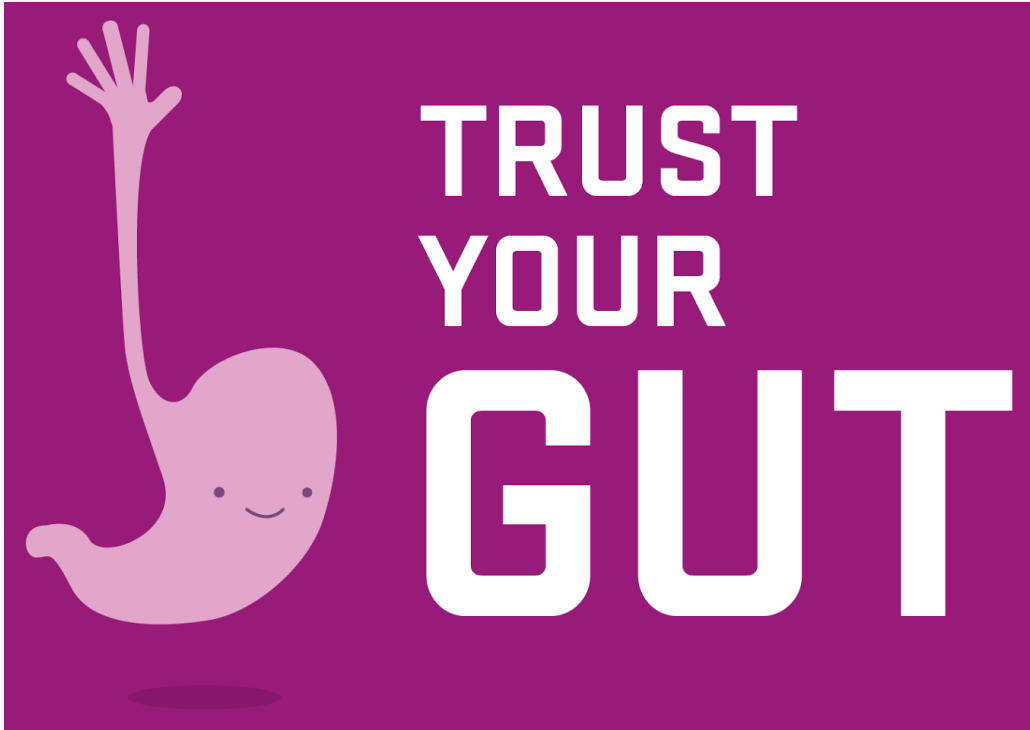
# Evidence-based Science Communication



This is a Do Bee.  
He's a cheerful, smiling fellow.



This is a grouchy old Don't Bee.  
He's never very happy.





*'We do this because  
we have always  
done it'*



*'This how I like to do  
science communication'*



# The evidence-based science communicator

*Seek first to **understand**, then to be **understood***





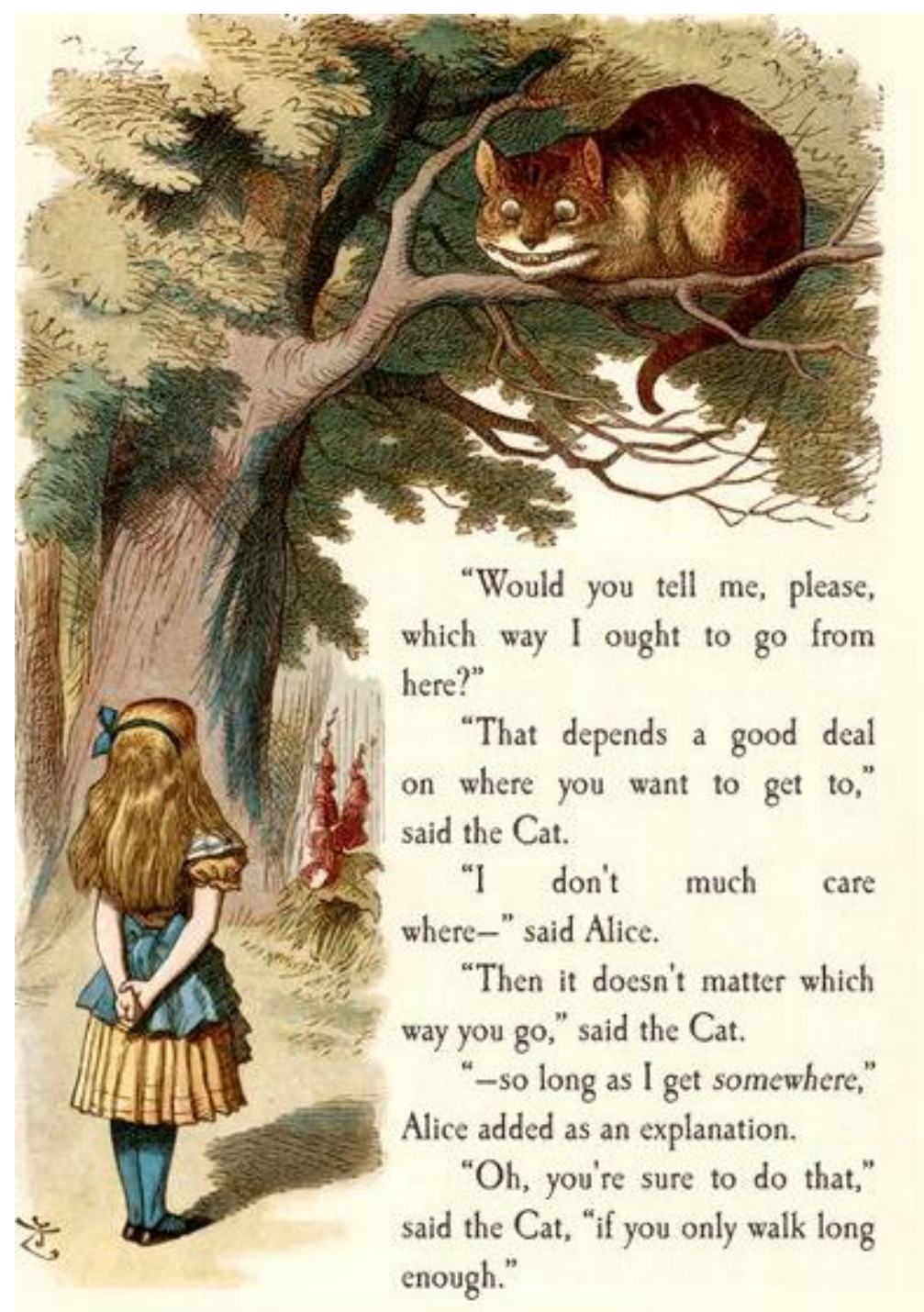
# The evidence-based science communicator

*Use evidence to boost social inclusion*



# The evidence-based science communicator

*Be clear about where you are going*



“Would you tell me, please, which way I ought to go from here?”

“That depends a good deal on where you want to get to,” said the Cat.

“I don't much care where—” said Alice.

“Then it doesn't matter which way you go,” said the Cat.

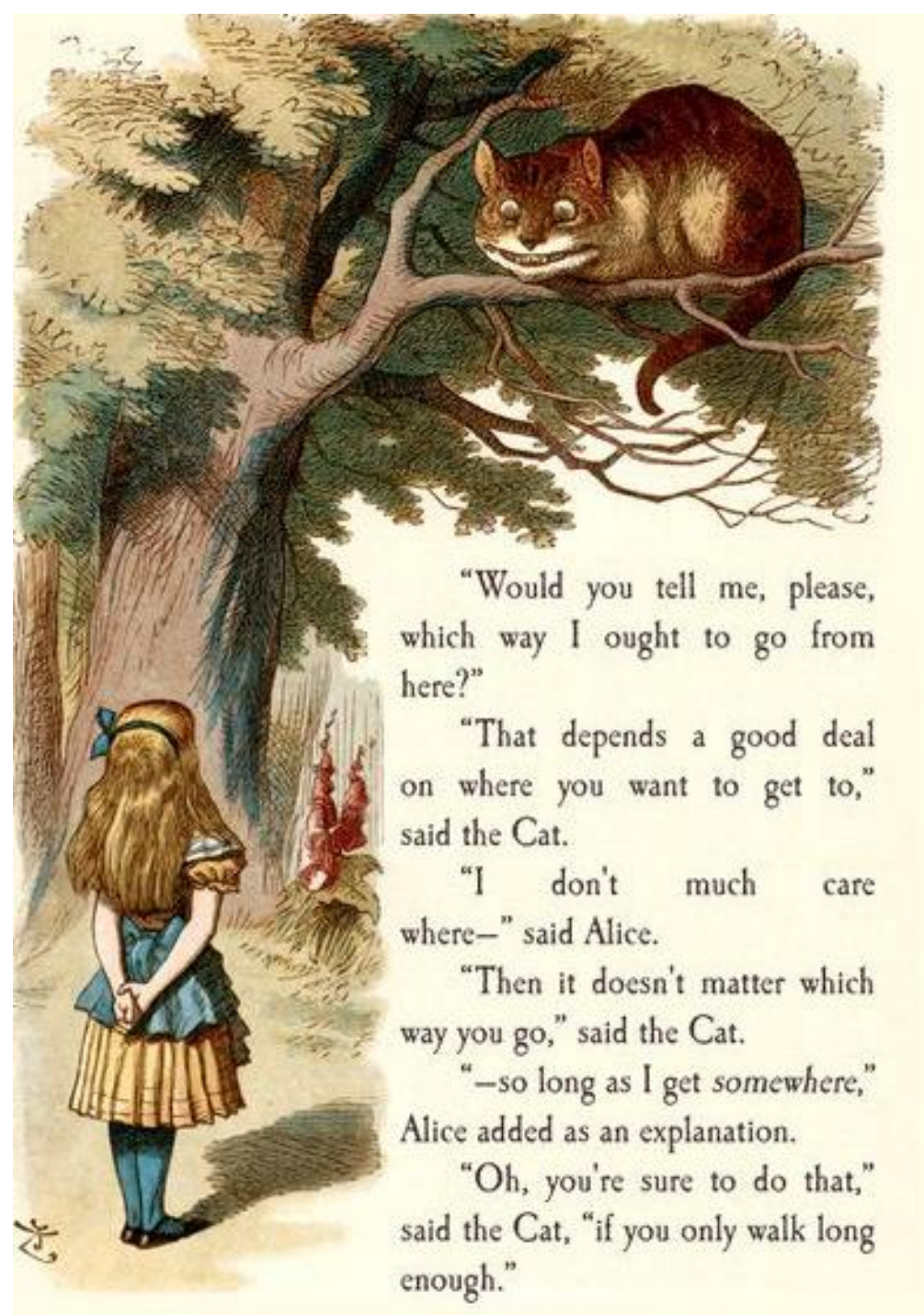
“—so long as I get *somewhere*,” Alice added as an explanation.

“Oh, you're sure to do that,” said the Cat, “if you only walk long enough.”



# The evidence-based science communicator

*Know when you have reached your destination*



“Would you tell me, please, which way I ought to go from here?”

“That depends a good deal on where you want to get to,” said the Cat.

“I don't much care where—” said Alice.

“Then it doesn't matter which way you go,” said the Cat.

“—so long as I get *somewhere*,” Alice added as an explanation.

“Oh, you're sure to do that,” said the Cat, “if you only walk long enough.”



# The evidence-based science communicator

*Understand the **steps** needed to reach your intended outcomes  
(based on evidence / theory)*





# Underpinning role of evaluation



[methodsforchange.org](https://methodsforchange.org)



**METHODS  
FOR CHANGE**

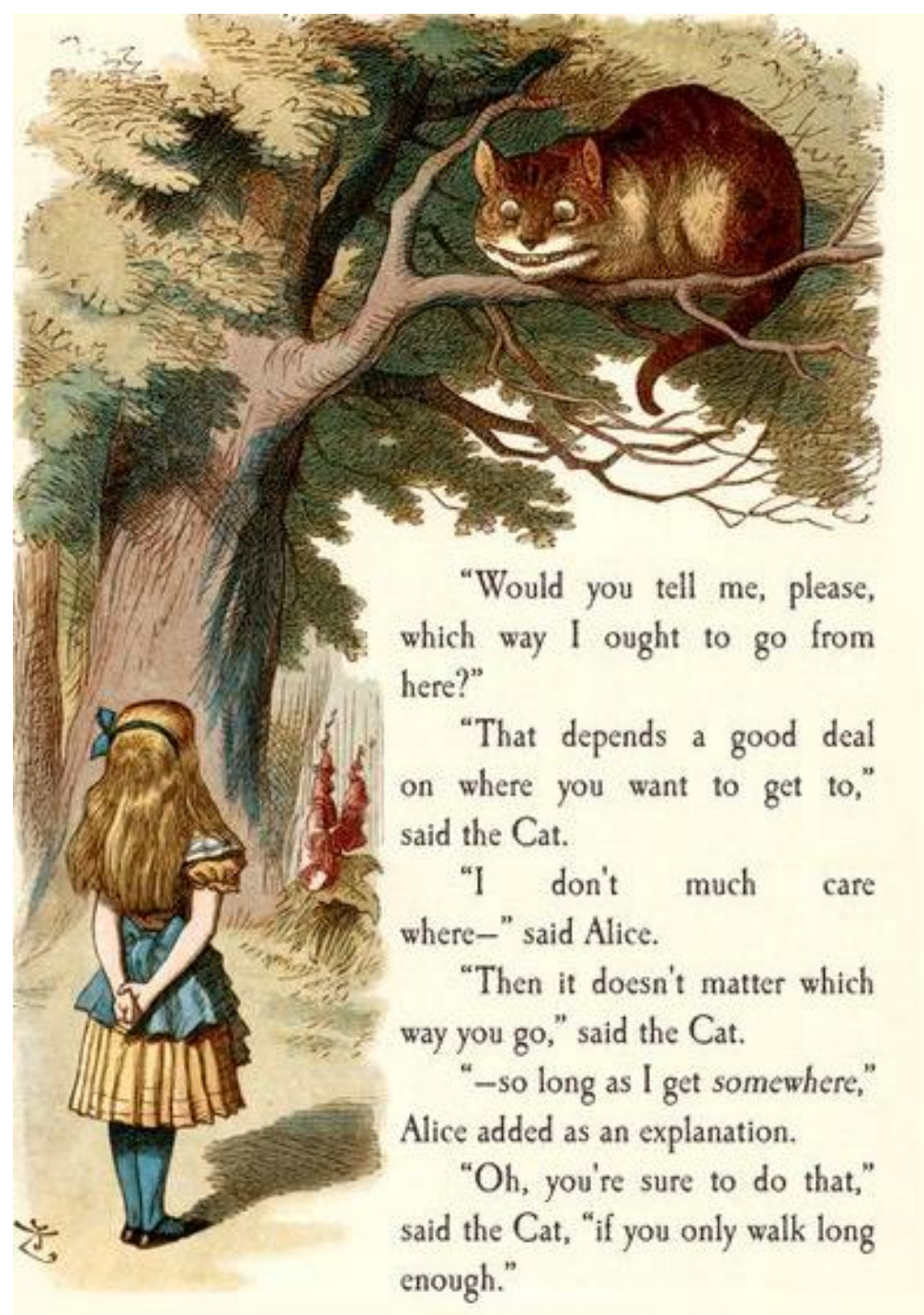
Public Engagement Evaluation Course | Self-paced

Learn cutting edge methods without the time pressure.



# DISCUSS

- *What precisely is the target **destination** for your science communication?*
- *What **outcomes** are you aiming to develop?*
- *What is the difference you are aiming to make?*



"Would you tell me, please, which way I ought to go from here?"

"That depends a good deal on where you want to get to," said the Cat.

"I don't much care where—" said Alice.

"Then it doesn't matter which way you go," said the Cat.

"—so long as I get *somewhere*," Alice added as an explanation.

"Oh, you're sure to do that," said the Cat, "if you only walk long enough."



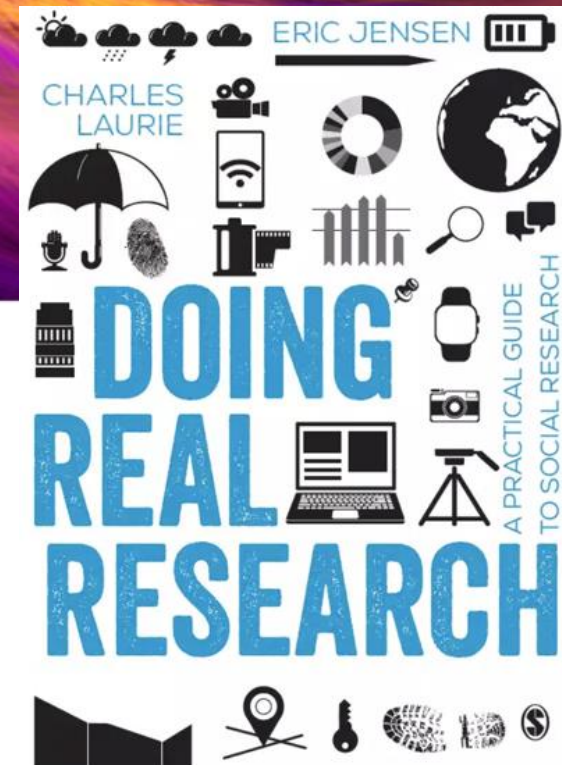
# DISCUSS

- *What specific **steps** are needed to reach your intended outcomes?*





@JensenWarwick



## Science Communication Outcome Evaluation

Dr Eric A. Jensen

[methodsforchange.org](http://methodsforchange.org)

([eric@methodsinnovation.org](mailto:eric@methodsinnovation.org))

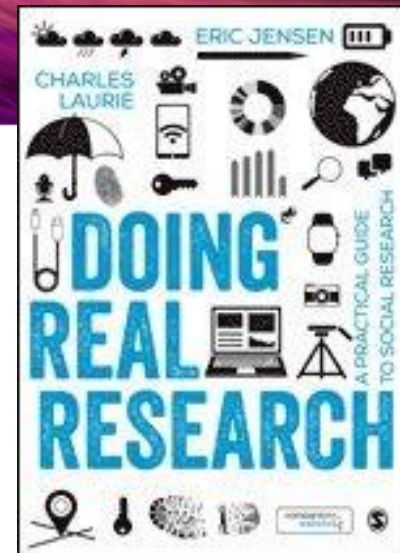
WICK  
UNIVERSITY OF WARWICK



# Science communication evaluation and impact

Dr Eric Jensen

(eric@methodsinnovation.org)





# Context for science communication evaluation



# Common problems with science communication evaluation



# Common Problems in Science Communication Evaluation





# Survey-based Impact Evaluation – Current Approaches

## *Common problems:*

- Oversimplification of impact measurement, e.g. relying on post-visit only self-report
- Proxy reporting



# Over-simplification

- ▶ Many science communication institutions are quick to assume that complex concepts can be accurately evaluated through simple questions
- ▶ Want to know whether a child has learned a lot about science after their day at the science museum? Easy! Just ask them:

*'Did you learn during your visit to the science museum today?': Yes or No?*



# Over-simplification (real example)

- ▶ London's Science Museum's internal guidance for evaluation includes the following flawed survey item:

*'To what extent do you agree or disagree with the following statements?' (Strongly agree to strongly disagree)*

- ▶ 'I have learnt something new today' (National museum of Science and Industry)





# Over-simplification

- ▶ When our hypothetical child above says ‘yes’ to the self-reported learning question, they are most likely telling the institution what it wants to hear.
- ▶ Relates back to issues of **measurement** – this question imposes the unrealistic expectation that respondents can:
  - Accurately assess their pre-visit science knowledge
  - Identify **gains** or **losses** that occurred during the visit
  - Accurately self-report their conclusions on a 5-point scale
- ▶ Actually measuring learning requires (at minimum) direct measurement of visitors’ thinking or attitudes **before and after** the intervention (or an experimental design)



**Over to you!**





---

*Conservation Practice and Policy*

---

# Knowledge Gain and Behavioral Change in Citizen-Science Programs

REBECCA C. JORDAN,\* STEVEN A. GRAY, DAVID V. HOWE, WESLEY R. BROOKS,  
AND JOAN G. EHRENFELD†

Ecology, Evolution, and Natural Resources, 14 College Farm Road, Rutgers University, New Brunswick, NJ 08901-8551, U.S.A.,  
email [jordan@aesop.rutgers.edu](mailto:jordan@aesop.rutgers.edu)





---

<i>Question</i>	<i>Mean pretest (n = 82)</i>	<i>Mean follow-up (n = 33)</i>
To what extent are you knowledgeable about environmental science?	2.29	2.66

---

***Response options:***

- 1 - a lot;**
- 2 - a fair amount;**
- 3 - only a little;**
- 4 - nothing;**



**What is wrong with this?**



To what extent are you knowledgeable about the research and regulatory infrastructure as they relate to environmental issues?

3.54

3.39

***Response options:***

- 1 - great extent;**
- 2 - considerable extent;**
- 3 - moderate extent;**
- 4 - slight extent;**
- 5 - no extent.**



**What is wrong with this?**



# Proxy reporting of impacts





# Parents reporting for children



# Example: Evaluating California Science Center impacts on children

- ▶ Falk and Needham (2011) sought to measure the Science Center's impacts on children by asking parents to report on cognitive and affective outcomes.
  - ▶ First, parents asked to indicate whether their children had gained an increased understanding of 'science or technology' after visiting the Science Center.
  - ▶ Falk and Needham (2011: 5) reported that **'nearly all adults (87%) who indicated that their children had visited the Science Center agreed that the visit increased their children's science or technology understanding, with 45% believing that the experience increased their children's understanding "a lot"'**.
-

# Example: Evaluating California Science Center impacts on children

- ▶ This survey item raises obvious issues surrounding the unreliability of expecting different parents within a sample to judge what counts as “a lot” of learning.
  - ▶ Respondents will likely interpret “*a lot*” of learning in different ways.
  - ▶ Parents are being asked to provide one assessment regardless of the number of children they may have.
    - What if parents feel that one of their children learned “a lot”, while another learned “a little” and a third “nothing” at all? Are parents really likely to be making a considered judgment here?
  - ▶ Asking parents to provide an off-the-cuff assessment of their child’s learning is highly prone to error, let alone the effects of events that may have happened months or years prior.
-



# Parent Feedback

The visitor evaluation survey for the Edinburgh International Science Festival asked adult respondents:

*“What score would the children in your party give this event/activity(s) out of 10?”*



# Parent Feedback

- ▶ How could the answer to this question possibly be accurate if the respondents are just speculating about what the children in their party would say?
  - ▶ This question could apply to multiple children: what are the respondents supposed to do if some children in their party detested the science festival and others loved it?
-

*Headline:*

**Teacher or parent opinion  
cannot be a valid proxy  
indicator of student/child  
impact on thinking,  
attitudes, etc.**





# Teacher Feedback Forms

Some teacher comments from a zoo evaluation that **cannot** be taken as accurate assessments :

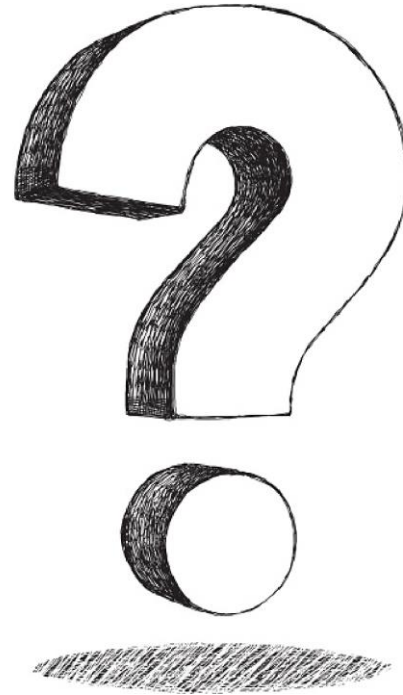
- ▶ *“The kids loved it, and **they didn't really think about how much they were learning as they looked around.**”*
  - ▶ *“I think it's 100% educational as the Zoo is so involved with highlighting the importance of preserving ecosystems (even the cafes); also **watching animals invariably increases understanding of them.**”*
-

# Teacher Feedback Forms

- ▶ All of the above are perceptions of the teacher, not measures of impact on the learners involved



**So *why* do top science  
communication institutions fail to  
conduct effective impact  
evaluation?**





## Reasons for lack of effective evaluation by science communication institutions:

1. Professionals are too pressed with other priorities to take the time to learn how to conduct high quality data collection and analysis.
2. Science communication institutions often do not employ staff with social scientific methodological training / expertise.



## Reasons for lack of effective evaluation by science communication institutions (cont.):

3. Many institutions try to plug this gap in knowledge through employing external consultants.

- These consultants often also lack appropriate social scientific expertise, producing poor quality evaluations (Jensen, 2014)

4. Conflating use of anecdote-gathering **advocacy** exercises focussed on eliciting positive comments with genuine **evaluation**



# Outcome of this situation

- **Quantitative methods:**

Basic flaws in evaluation design, survey design and data analysis.

- **Qualitative methods:**

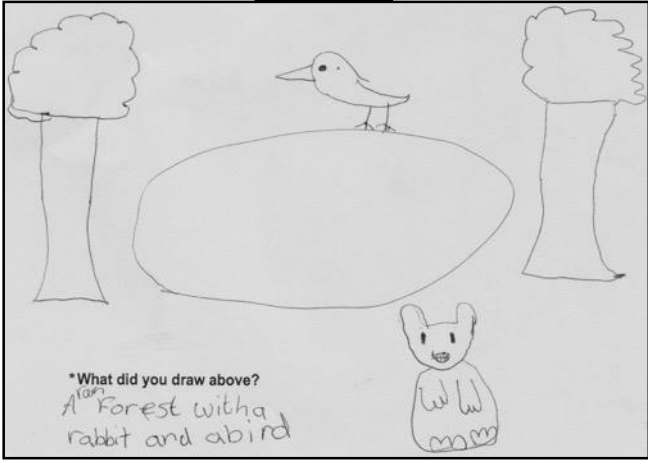
Leading questions, under-developed analysis, etc.



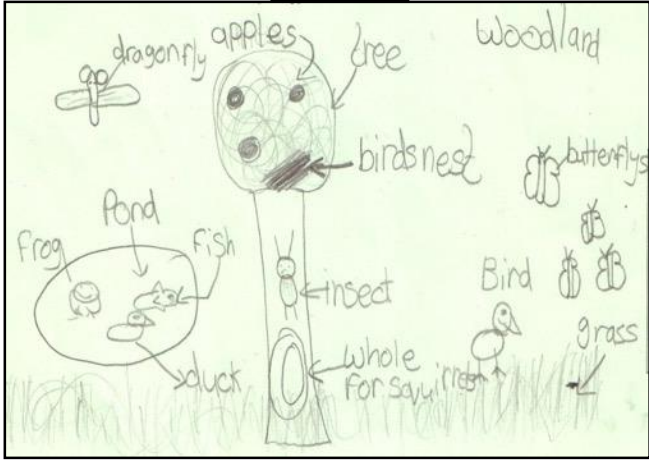
# Impact Evaluation



BEFORE



AFTER



good for children  
 Everyone's friendly  
 activities are fun

Fitzwilliam Museum

It doesn't cost nothing  
 and that's really good





# Impact Evaluation: Defining Impact

- ▶ Impact is the overall net outcomes or results of an activity (intended or unintended)
- ▶ 'Impacts' can be negative or dysfunctional!



## Impacts could include:

- ▶ Development in learning about a specific topic
  - ▶ Attitude change
  - ▶ A greater sense of self-efficacy
  - ▶ Enhanced curiosity or interest in a subject
  - ▶ Improved skills or confidence, etc.
-

# Good Impact Evaluation

- ▶ Is SYSTEMATIC
- ▶ Tells you **how** and **why** particular **aspects** of activity are effective



# ‘What comes to mind when you think of researchers?’ (Ireland)

PRE

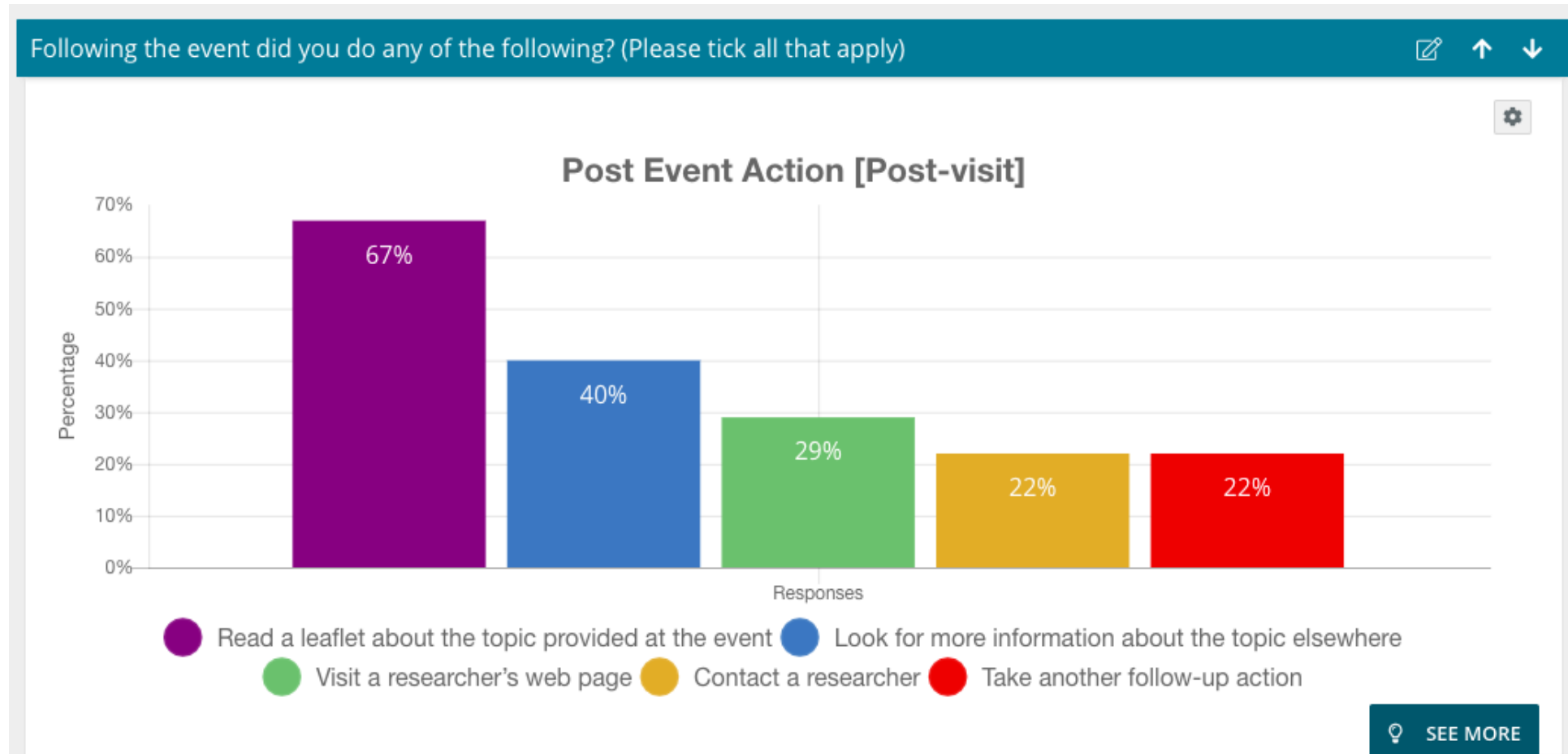
POST



Positive indicators for attendees



# Positive indicators for attendees





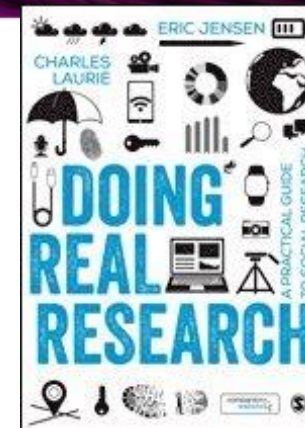
Project acronym:  
**PERFORM**

Project Title:  
**Participatory Engagement with Scientific and Technological Research through Performance**

Grant Agreement No: 665826

This deliverable is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme

# Case example: PERFORM project research





# Big Van

El arte de contar la ciencia

## TRACES



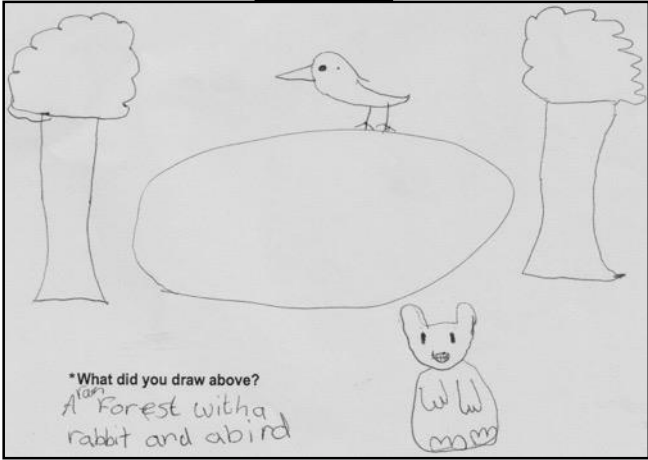
science made simple



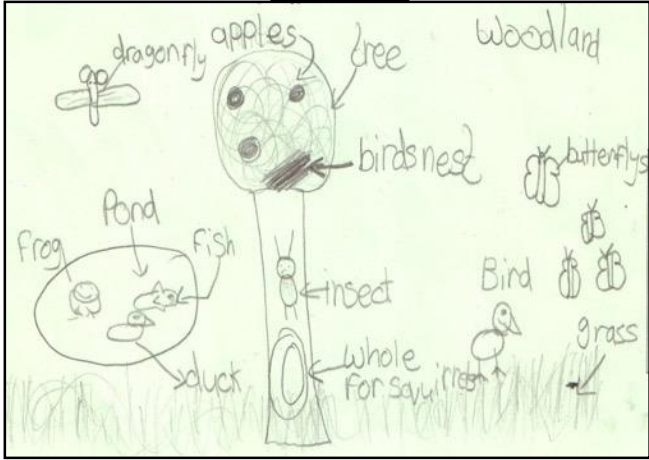
# Impact Evaluation



BEFORE



AFTER



good for children  
Everyones friendly  
activities are fun

Fitzwilliam  
Museum

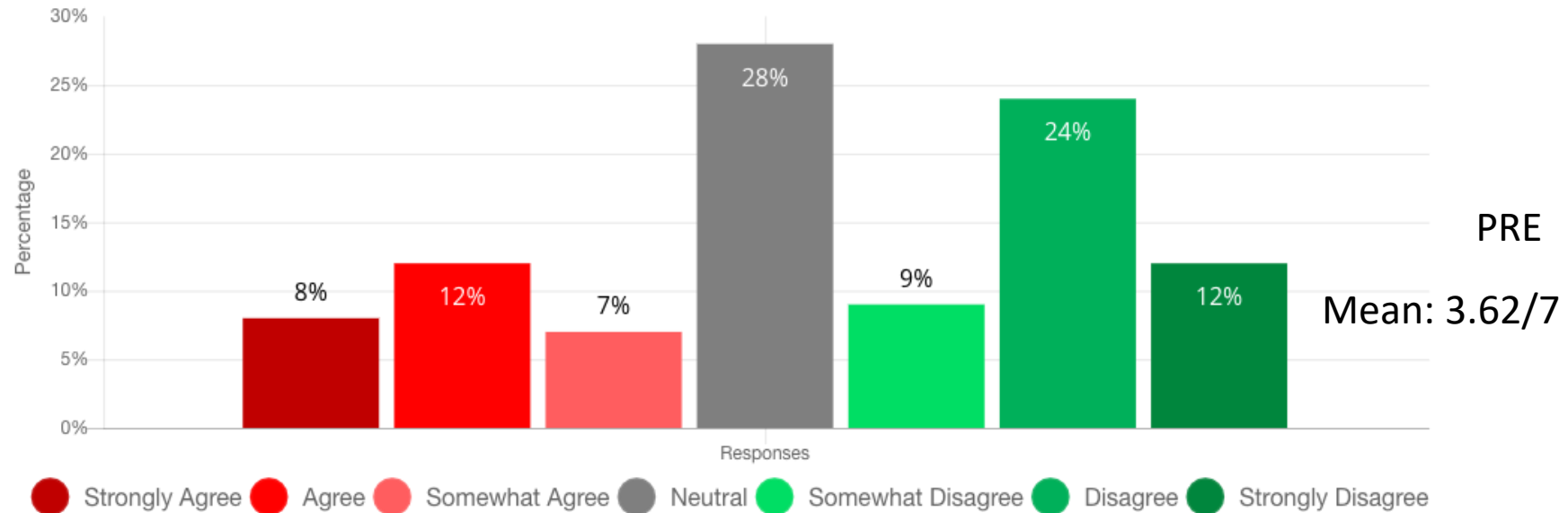
It doesnt cost notthing  
and thats Really good



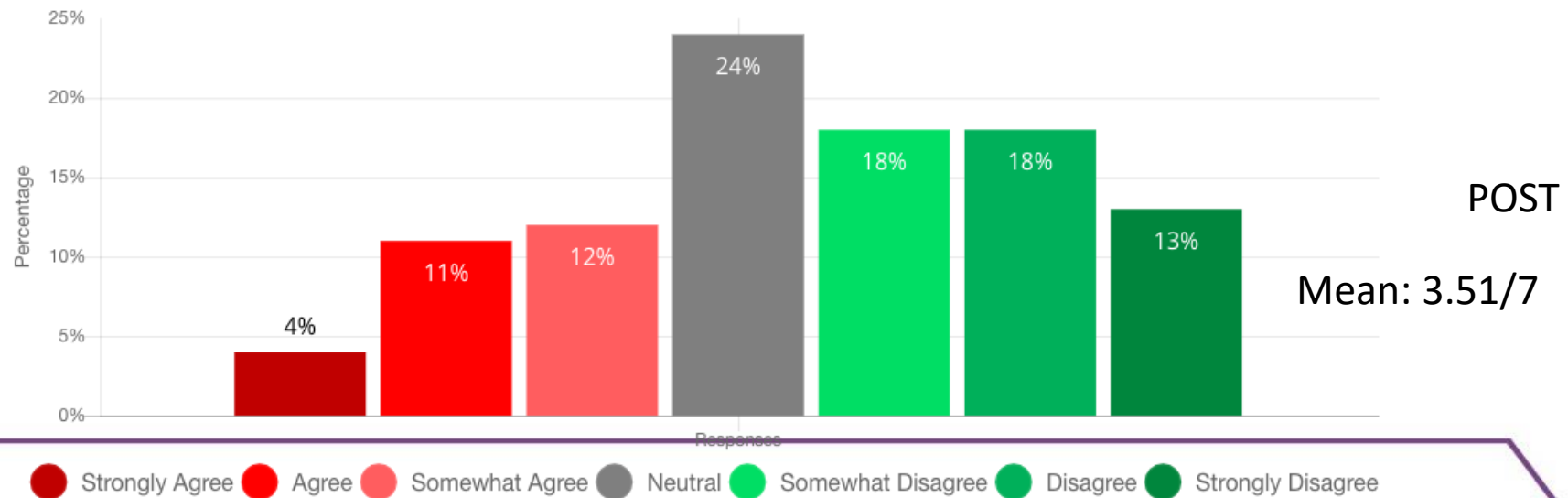


# 'Science is usually boring'

Boredom: Science

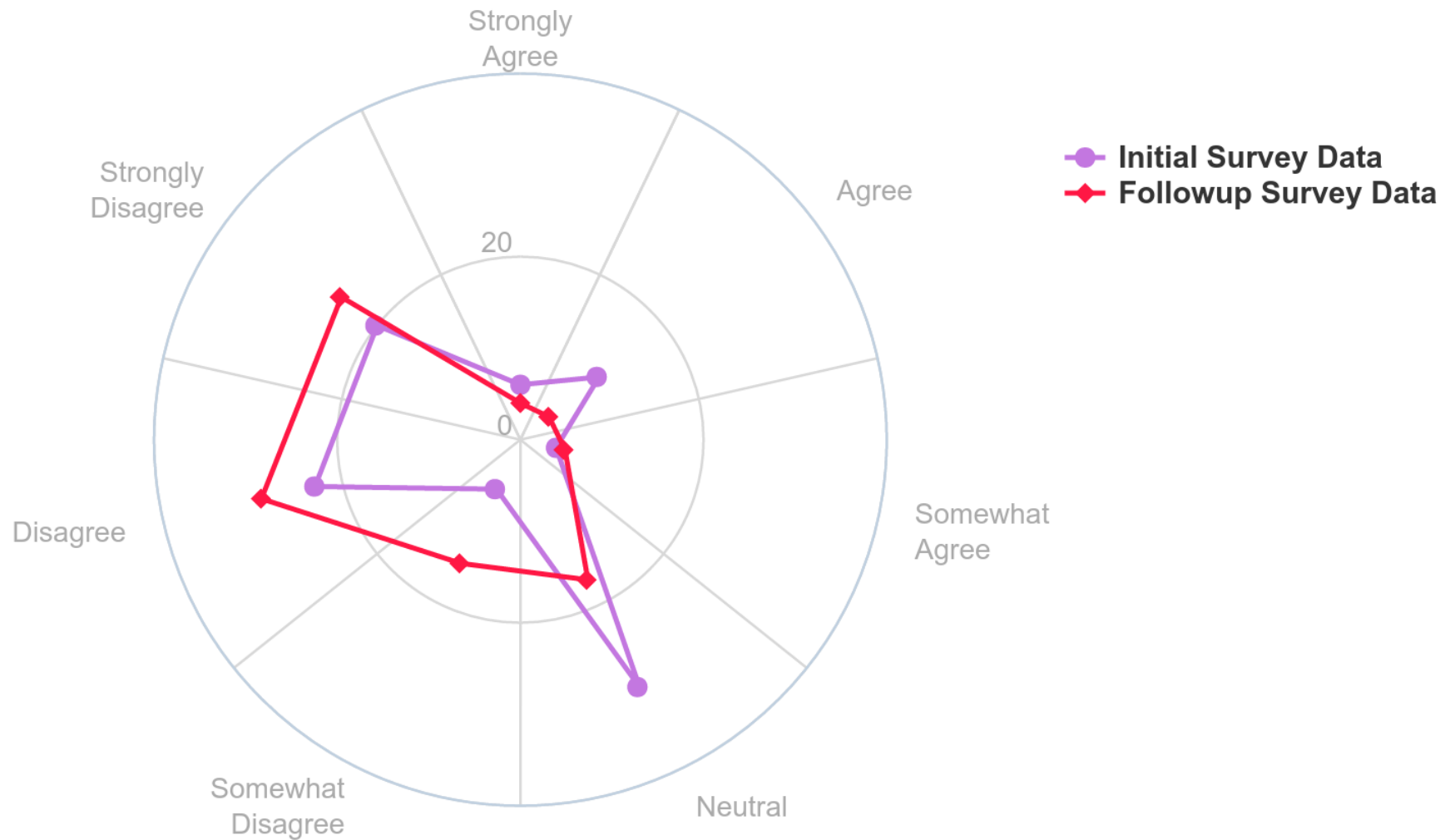


Boredom: Science

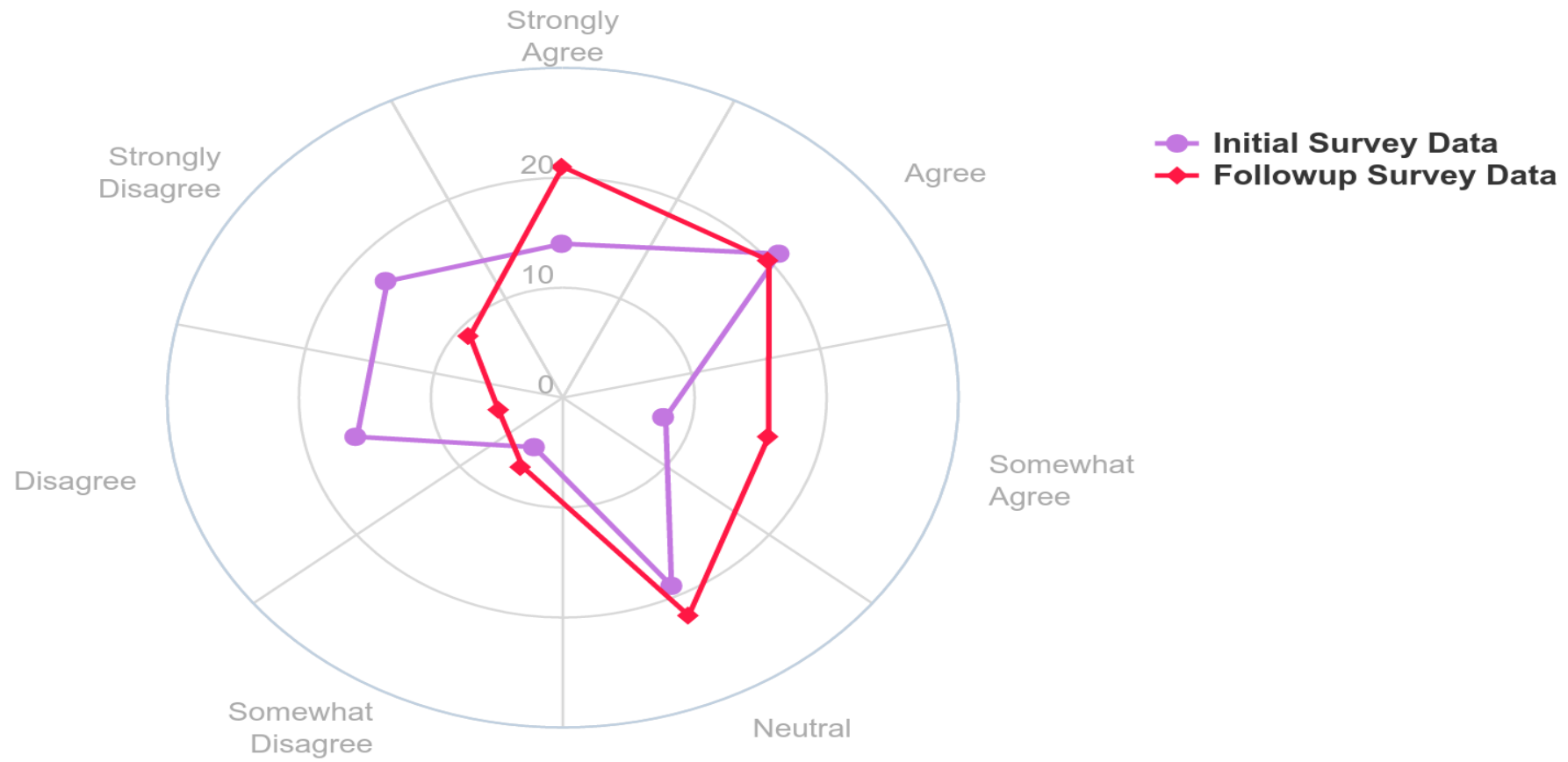


Mean: 1/7 = Strongly disagree

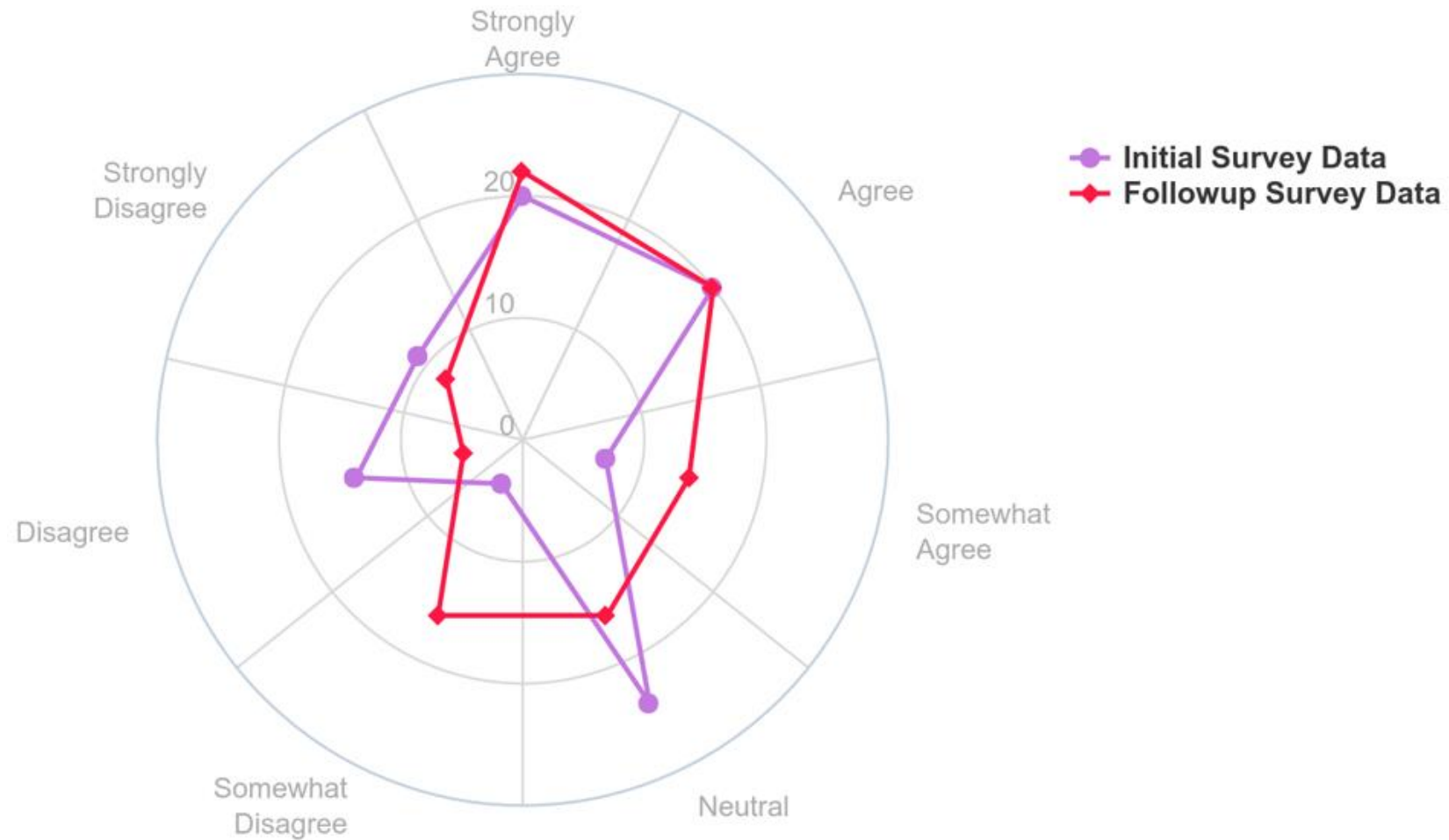
# *‘Science is irrelevant to my life’*



# *‘If I wanted to, I could be a scientist’*



# *“Scientific knowledge is important for my future career”*





# Evaluation of social media-based impacts of science performance events on young people's engagement in science



The Art of Science Learning

The logo for WICK (Warwick Institute of Career Knowledge) features the word 'WICK' in a large, bold, sans-serif font, with 'TY OF WARWICK' in a smaller font below it. A black arrow points downwards from the top of the logo area.

WICK  
TY OF WARWICK

# Evaluation research question

- How do young people engage with performance experiences and use information presented through the performances in subsequent social media-based conversations?

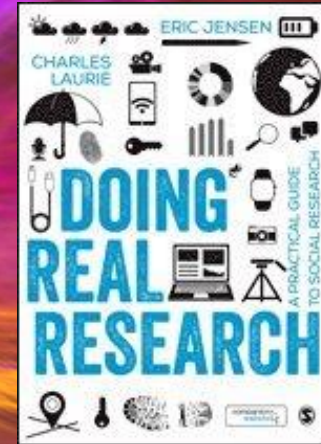






# RESULTS

## Use of social media networks



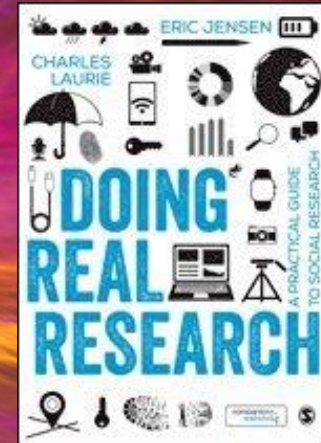


# Results

- ▶ Students taking part in the research overwhelmingly use social media on a daily basis.
- ▶ Around ~90% of them are regular social media users (at least once a day)
- ▶ Remaining ~10% do have social media accounts or have had them in the past.



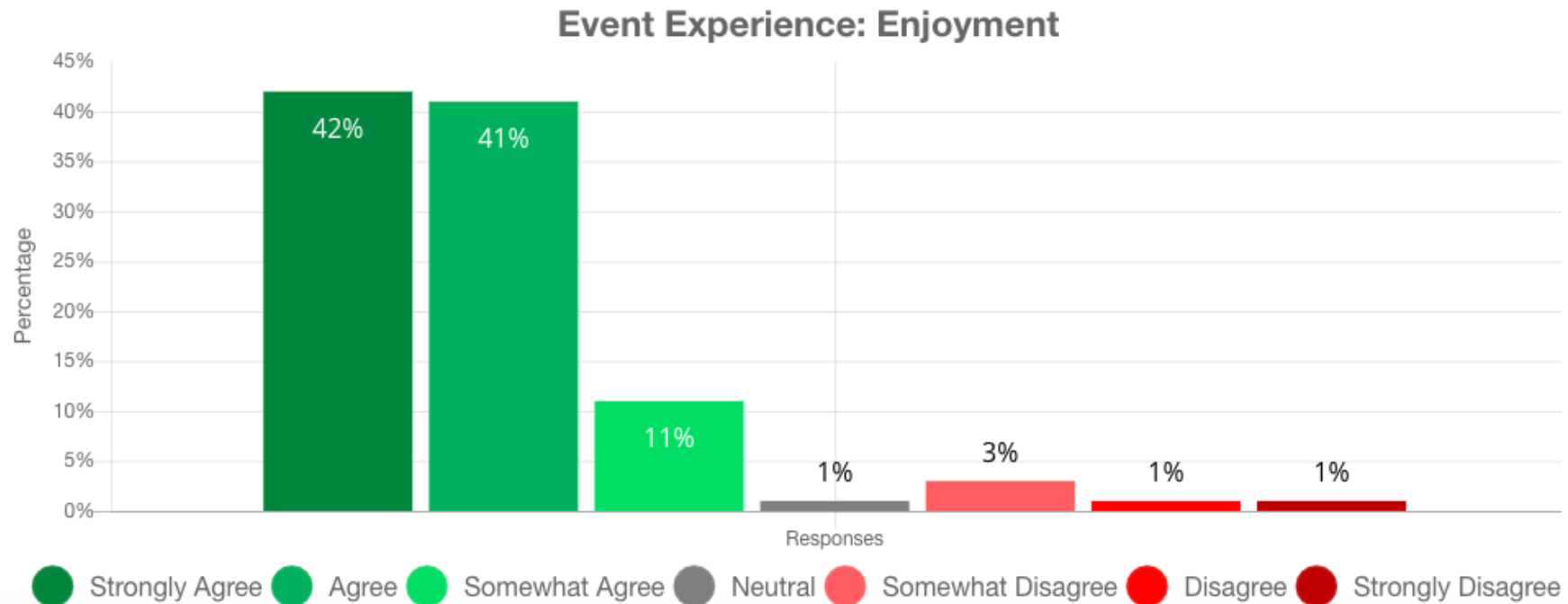
**RESULTS**  
**Sharing of science  
engagement  
experiences through  
social media**



# Results

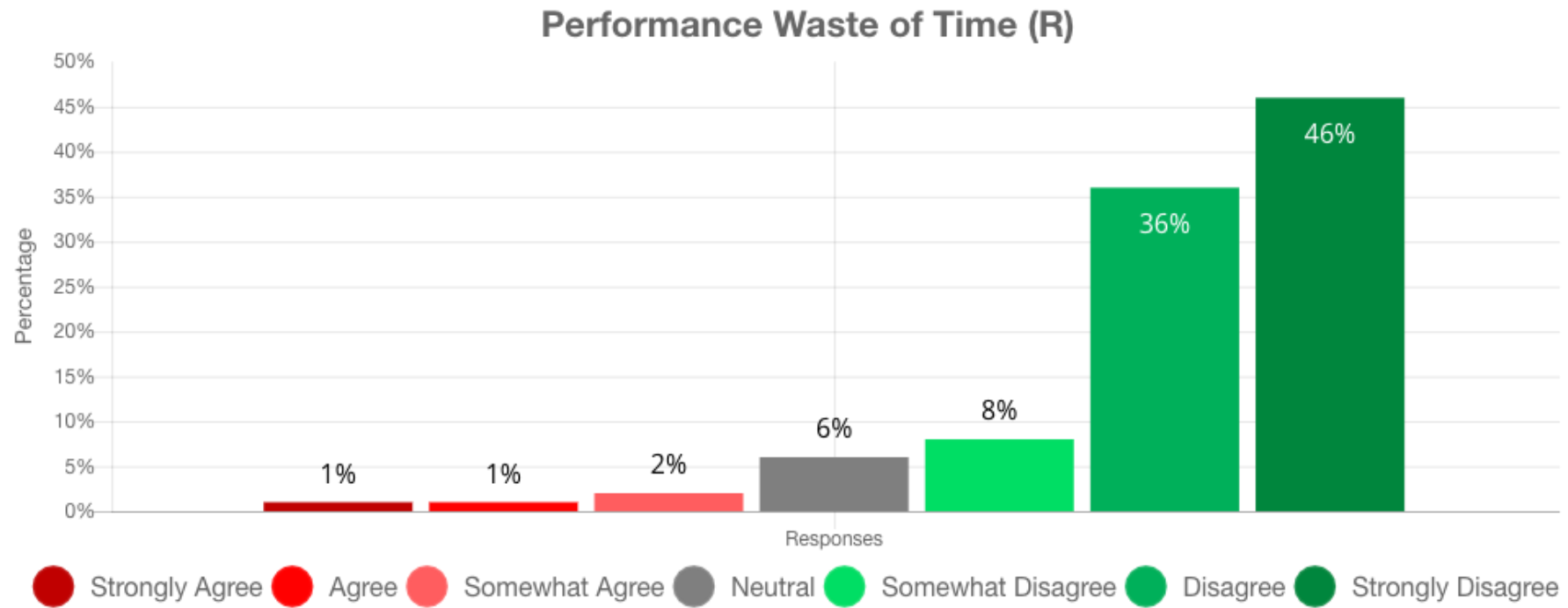
- ▶ Most students **enjoyed** the performances.

“I enjoyed the performance event.”



# Results

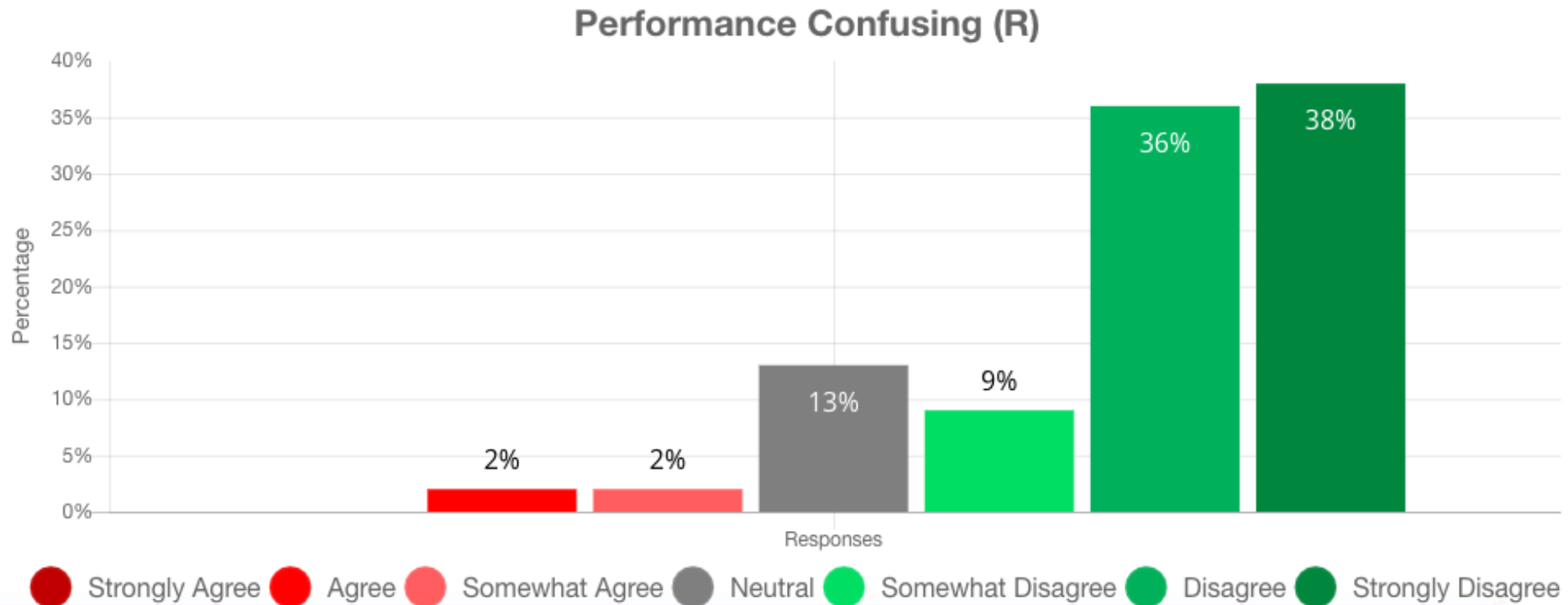
- ▶ Most students felt the performances were a **good use of their time.**





# Results

- ▶ Most students felt the performances were **clear**. (not confusing)



# Results

- ▶ However, in spite of enjoying them, they **did not share** anything of substance about the PERFORM events on social media.
  - A couple of students commented e.g., “We would have shared [about the performances] if we had been told to, but it wasn’t part of the assignments.”
  - One student remembered sharing on Snapchat that she was going to miss a performance — that was about the extent of their social media sharing.

***Why no sharing?***

---

# Results

- ▶ Students feel that some things in life are share-worthy and others are not: ***science / schoolwork is definitely not share-worthy.***
  - ▶ The general feeling is that their social media space is where they go to **escape** from schoolwork and parental oversight.
  - ▶ As one student explained (rough quote from memory), “We need a **place away from school**”.
-

# Results

- ▶ Social media = an age-segregated space, influenced by peer pressure.
  - ▶ Students would be afraid of being **mocked** by their peers if they shared something about the performances.
  - ▶ They would be seen, essentially, as **nerds, too enthusiastic** about a school-related event
    - The topic of ‘science’ was viewed as ‘school-related’.
-



# Implications

- ▶ So, how to get multiplier effect of social media sharing?





The Art of Science Learning

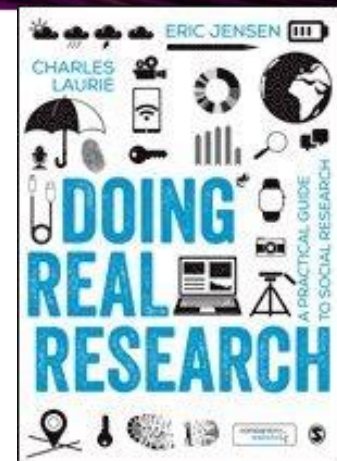
[perform-research.eu](http://perform-research.eu)

[eric@methodsinnovation.org](mailto:eric@methodsinnovation.org)

Learn more about impact evaluation tools:

[methodsinnovation.org](http://methodsinnovation.org)

[practicalevaluation.tips](http://practicalevaluation.tips)





**Tweet: @JensenWarwick**

# **Evaluating long-term science communication impact**

Dr Eric Jensen

(eric@methodsinnovation.org)



**WICK**  
Y OF WARWICK

Evaluation design:  
Main options for outcome measures  
(affects survey question design)

- ▶ Feedback
- ▶ Repeated Measures (e.g. pre/post)
- ▶ Experimental Design
  - *assumes random assignment to treatment and control*



## Example – Repeated Measures Design



## Outcome measures you can use for evaluating impact

- ▶ Closed-ended survey items (e.g. level of agreement scale statements or multiple choice)
  - ▶ Open-ended questions
-

# Open-ended survey questions for impact measurement





# Measuring Biodiversity Literacy in World Zoo and Aquarium Visitors



World Association of  
Zoos and Aquariums  
**WAZA** | *United for  
Conservation*<sup>®</sup>





# UN Decade on Biodiversity

WAZA official partner of United Nations Convention on Biological Diversity (CBD) during Decade on Biodiversity 2011–2020.



World Association of Zoos  
and Aquariums | **WAZA**  
*United for Conservation*



**CBD**



# Aichi Biodiversity Target 1

Target 1: “By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.”



# Research Team

Andrew Moss (Chester Zoo), Eric Jensen (University of Warwick) and Markus Gusset (WAZA Executive Office)

Plus international peer reviewers

30 WAZA member organisations from across the globe

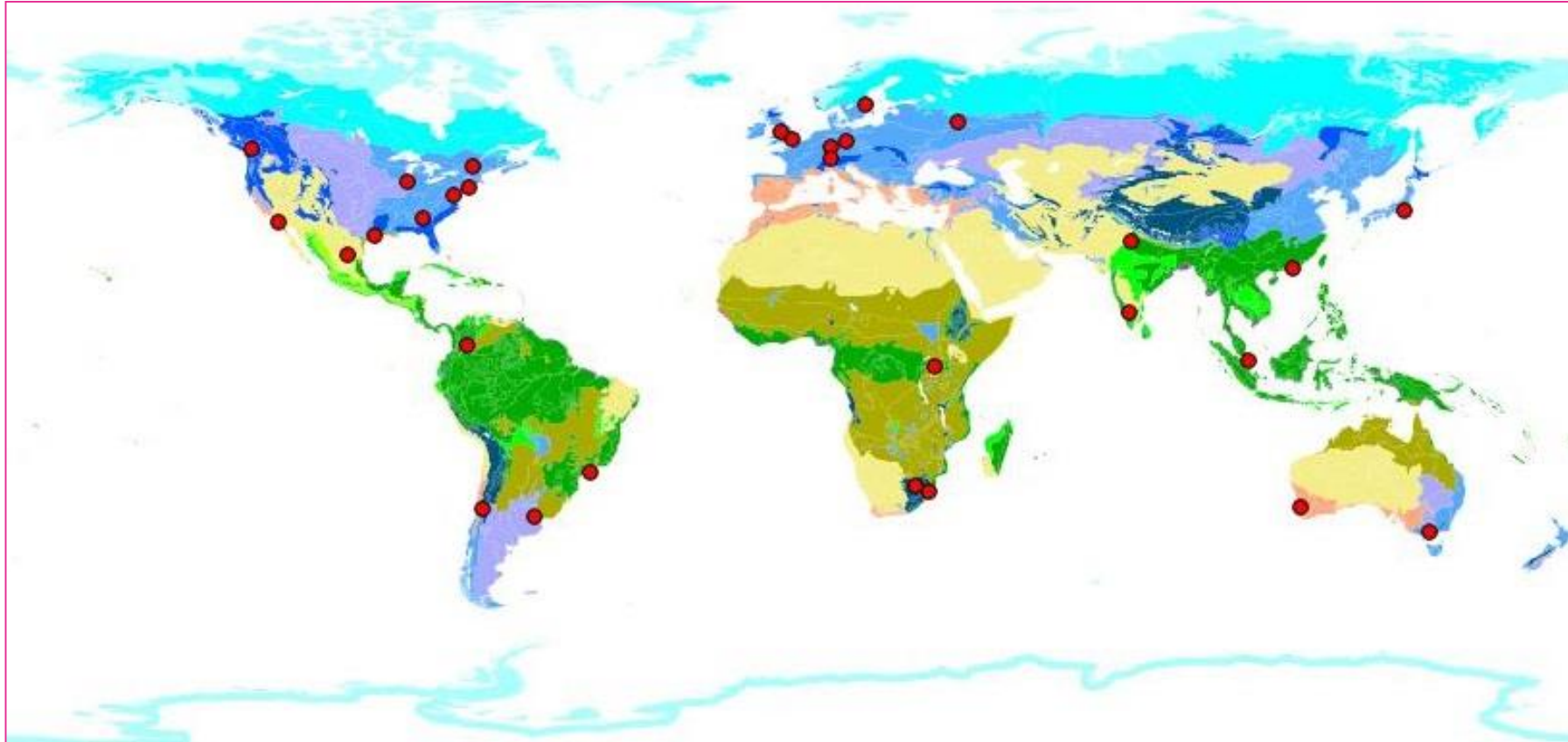


World Association of Zoos  
and Aquariums | **WAZA**  
*United for Conservation*





## Participating institutions







## Research Questions

1. How well do world zoo and aquarium visitors understand the term 'Biodiversity'?
2. Do world zoo and aquarium visitors understand the actions they can take to help protect biodiversity (i.e. pro-conservation actions)?
3. Are zoos and aquariums making a difference with regard to Target 1?

# Data Collection

Pre- and post-visit repeated-measures survey design: same respondents sampled before and after visit (more than 6,000 in total)



# Data Analysis

- Both biodiversity literacy variables measured using matching open-ended questions in both pre- and post-visit surveys
  - Yielded paired qualitative data for each respondent
  - Data processed using robust content analysis framework
  - Both biodiversity literacy variables converted to continuous quantitative data for statistical analysis
  - Scores subjected to inter-rater reliability testing to ensure conversion was accurate
-



## Survey Design

Single-page design with three main components:

1. Basic demographic information.
2. Two main outcome variables, each measured by open-ended questions:
  - Biodiversity Understanding
  - Knowledge of actions to protect Biodiversity
3. A number of potential independent variables also measured.





# Pre-visit Survey

## Visitor Survey

Institution

Date:

Visitor number:

<p>1. Time: <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> AM / PM (circle)</p> <p>2. Is today your first visit to this zoo or aquarium?  <input type="checkbox"/> YES    <input type="checkbox"/> NO    <input type="checkbox"/> NOT SURE</p> <p>3. If this is your first visit, is this your first visit to any zoo or aquarium?  <input type="checkbox"/> YES    <input type="checkbox"/> NO    <input type="checkbox"/> NOT SURE</p> <p>4. How many times do you think you have visited any zoo or aquarium in the last 12 months?            _____ visits</p>	<p>10. Please list anything that comes to mind when you think of 'biodiversity':</p> <p>1.</p> <p>2.</p> <p>3.</p> <p>4.</p> <p>5.</p>
<p>5. Are you a season ticket holder or member?  <input type="checkbox"/> YES    <input type="checkbox"/> NO    <input type="checkbox"/> NOT SURE</p> <p>6. What is your gender?  <input type="checkbox"/> MALE    <input type="checkbox"/> FEMALE</p> <p>7. What is your age?            _____ years</p>	<p>11. If you can think of an action that you could take to help save animal species, please list below: (Or if you cannot think of any actions, tick here <input type="checkbox"/>)</p> <p>1.</p> <p>2.</p> <p>If you listed an action above, have you done it in the last month?  <input type="checkbox"/> NO    <input type="checkbox"/> YES    <input type="checkbox"/> NOT SURE</p>
<p>8. How many years of formal education (in school, college and university) have you had?            _____ years</p> <p>9. Do you live locally or are you visiting?  <input type="checkbox"/> LOCAL    <input type="checkbox"/> VISITOR / TOURIST</p>	<p>12. What prompted your zoo or aquarium visit today (tick all that apply)?</p> <p><input type="checkbox"/> Fun day out    <input type="checkbox"/> Learn about animals  <input type="checkbox"/> See animals    <input type="checkbox"/> Entertainment  <input type="checkbox"/> Family time    <input type="checkbox"/> Other</p> <p>If other, please specify:</p> <p><i>This survey is done under the auspices of the World Association of Zoos and Aquariums (WAZA). For more information, please click on 'Visitor Survey' on <a href="http://www.waza.org">www.waza.org</a>.</i></p> <p><i>Thank you very much for completing this survey!</i></p>



# Post-visit Survey

## Visitor Survey

Institution

Date:

Visitor number:

<p>1. Time: <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> AM / PM (circle)</p> <p>2. How many people are in your group today (including you): _____ people</p> <p>3. During your visit today, did you see or hear any information about 'biodiversity'? <input type="checkbox"/> YES   <input type="checkbox"/> NO   <input type="checkbox"/> NOT SURE</p> <p>4. During your visit today, did you attend any informational animal talk or show? <input type="checkbox"/> YES   <input type="checkbox"/> NO   <input type="checkbox"/> NOT SURE</p> <p>5. During your visit today, did you talk to any zoo or aquarium staff or volunteers? <input type="checkbox"/> YES   <input type="checkbox"/> NO   <input type="checkbox"/> NOT SURE</p> <p>6. During your visit today, did you watch any videos or films? <input type="checkbox"/> YES   <input type="checkbox"/> NO   <input type="checkbox"/> NOT SURE</p> <p>7. During your visit today, did you use a smartphone application to enhance your visiting experience? <input type="checkbox"/> YES   <input type="checkbox"/> NO   <input type="checkbox"/> NOT SURE If YES, please specify the 'app':</p> <p>8. Have you watched any nature shows on television in the last 12 months? <input type="checkbox"/> YES   <input type="checkbox"/> NO   <input type="checkbox"/> NOT SURE</p>	<p>9. Please list anything that comes to mind when you think of 'biodiversity':</p> <p>1.</p> <p>2.</p> <p>3.</p> <p>4.</p> <p>5.</p> <p>10. If you can think of an action that you could take to help save animal species, please list below: (Or if you cannot think of any actions, tick here <input type="checkbox"/>)</p> <p>1.</p> <p>2.</p> <p>If you listed an action above, have you done it in the last month? <input type="checkbox"/> NO   <input type="checkbox"/> YES   <input type="checkbox"/> NOT SURE</p>	<p>11. Which of these describe your experience at the zoo or aquarium today (tick all that apply)?</p> <p><input type="checkbox"/> Had fun day out   <input type="checkbox"/> Learned about animals <input type="checkbox"/> Saw many animals   <input type="checkbox"/> Was entertained <input type="checkbox"/> Had good family time   <input type="checkbox"/> Other</p> <p>If other, please specify:</p> <p>12. Are you part of a conservation, nature or environmental group of any kind? <input type="checkbox"/> YES   <input type="checkbox"/> NO   <input type="checkbox"/> NOT SURE</p> <p>13. 'I would be willing to participate in further research on this topic': <input type="checkbox"/> YES   <input type="checkbox"/> NO If YES, please provide e-mail address:</p>
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# Measuring the outcome variables

- ▶ *To measure biodiversity understanding:* ‘Please list anything that comes to mind when you think of ‘biodiversity’ (space for up to five responses)’.
- ▶ *To measure knowledge of actions to help protect biodiversity:* ‘If you can think of an action that you could take to help save animal species, please list below (space for up to two responses)’.





# Data Processing and Analysis

- Dependent variables were content analysed to produce quantitative data:
  - Biodiversity understanding/literacy - scored along a continuous scale of understanding\*
  - Knowledge of actions to protect biodiversity – were scored along a continuous scale of personal action^

Inter-coder reliability (Cohen's Kappa): \*= 0.82; ^=0.84



# Analysis of biodiversity understanding

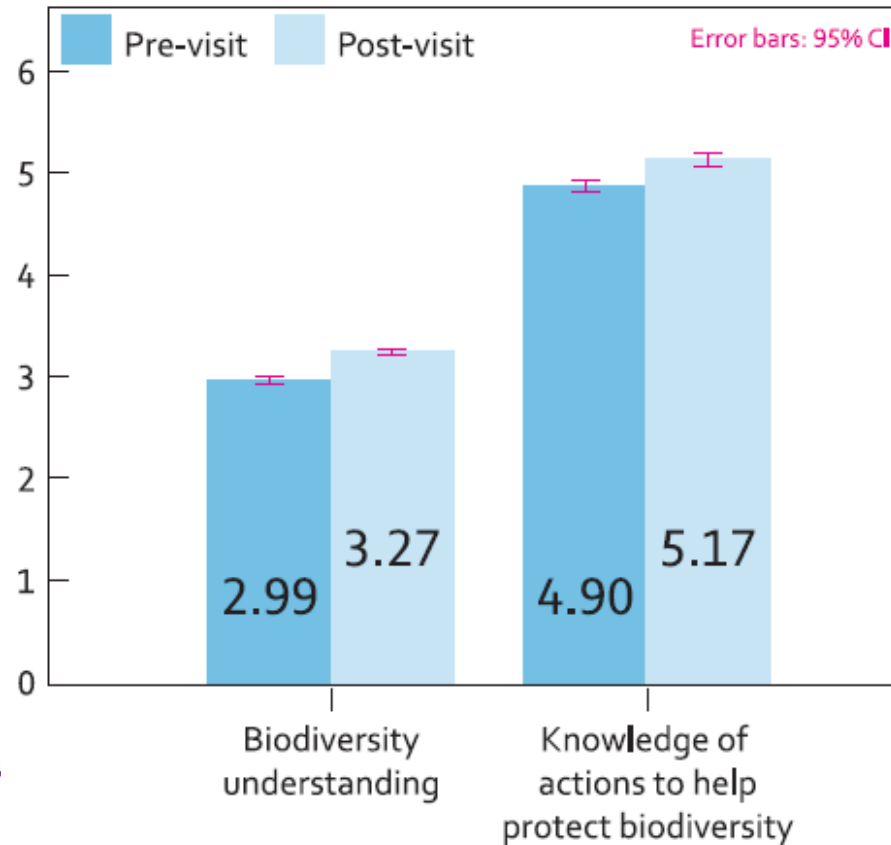
- ▶ 1 - *Inaccurate*: completely inaccurate descriptions (no accurate elements) – e.g. ‘open air’, ‘everything in general’ – and/or too vague to indicate accurate knowledge of any kind – e.g. ‘many things’.
  - ▶ 2 - *Ambivalent*: some evidence of accurate descriptions, some of inaccurate descriptions.
  - ▶ 3 - *Some positive evidence*: mention of something biological (e.g. ‘species’) but no other accurate elements or detail.
  - ▶ 4 - *Positive evidence*: some evidence of accurate descriptions, but (1) only mentioning animals or plants, not both (minimal inaccurate elements) and/or (2) using a vague but accurate description – e.g. ‘lots of life’, ‘many species’, ‘variety of species’.
  - ▶ 5 - *Strongly positive evidence*: strong evidence of accurate descriptions, specifically mentioning both plants and animals (no inaccurate elements) – e.g. ‘variety of animals, fish and insects’, ‘loss of habitat’, ‘shared environment’, ‘wildlife and plant life in balance’.
  - ▶ -99 - *Missing*: no thought-listing data provided; excluded and marked as missing data.
-

# Analysis of conservation 'actions'

- ▶ (0) Action or behavior identified not relevant to conservation.
  - ▶ (1) Vague platitudes about need for change (no specific action or behavior mentioned) – e.g., “save ecosystems”.
  - ▶ (2) Specific identification of pro-biodiversity action or behavior, but is at a general level (not feasible to address as an individual) – e.g., “stop hunting”, “stop Chinese medicine”.
  - ▶ (3) Very specific identification of pro-biodiversity action or behavior that can be done at an individual level – e.g., “drive less to reduce effects of climate change”.
  - ▶ (4) Respondent clearly states a personal action or behavior – e.g., “I recycle my mobile phone for gorillas”.
-

# Headline Results

Significant aggregate increases between pre- and post-visit in biodiversity understanding and knowledge of actions to help protect biodiversity



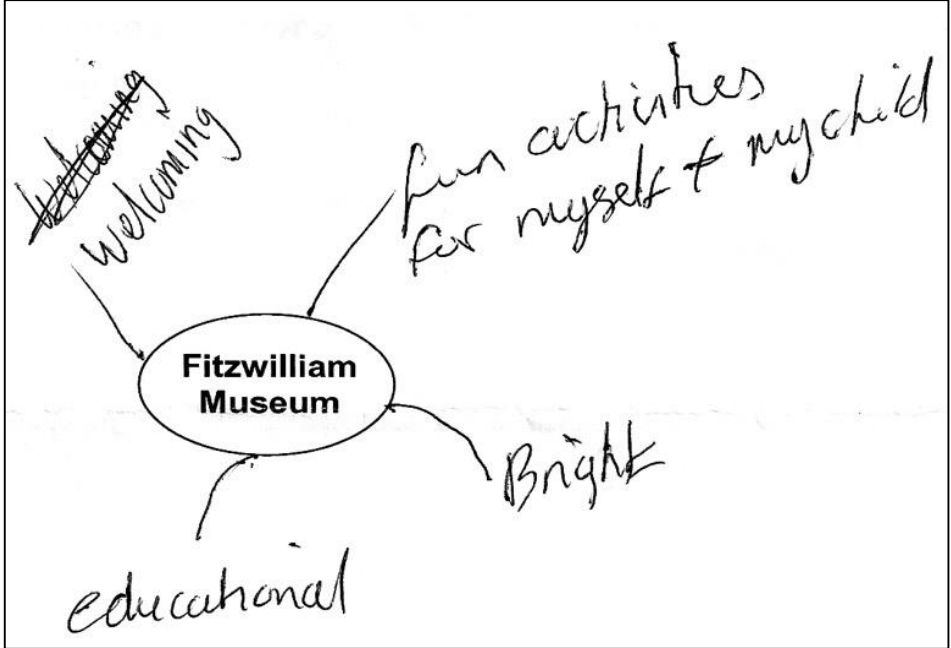
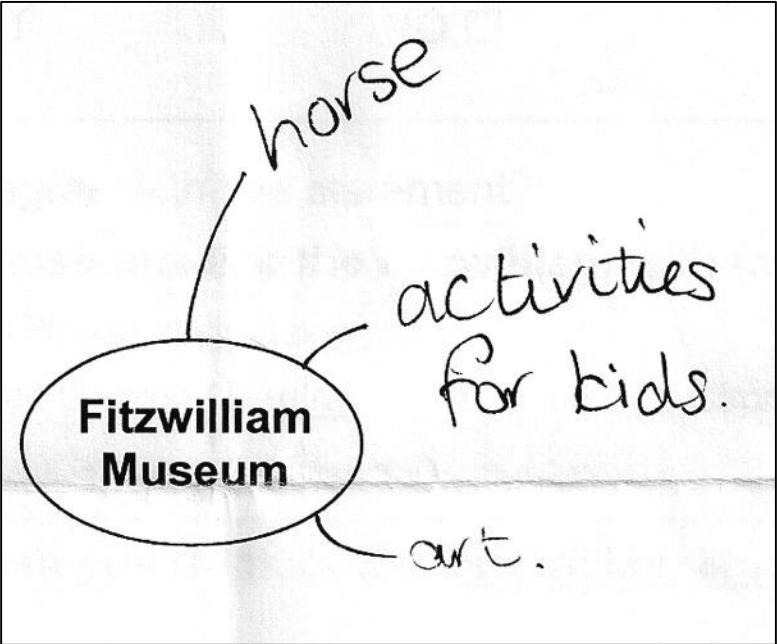
# Headline Results

- Number of respondents demonstrating at least some positive evidence of biodiversity understanding: increase from pre-visit (69.8%) to post-visit (75.1%)
- Number of respondents that could identify a pro-biodiversity action that could be achieved at an individual level: increase from pre-visit (50.5%) to post-visit (58.8%)





# Open-ended survey questions for impact evaluation



# Over to you!

- ▶ Develop at least one open-ended survey question that could be repeated before and after an intervention relevant to your work to evaluate impact
- ▶ If you have time, consider the range of responses you might get and what analytic categories you might use.



# **Closed-ended survey questions for impact evaluation**



# Surveys should be understandable

- ▶ Survey questions and instructions should be clear.
- ▶ **Jargon** and complicated wording should be avoided.
- ▶ Response categories should generally offer a **'don't know' option**:
  - Without a 'don't know' option, respondents may provide inaccurate guesses or select a survey response that does not match their true views.





## QUESTION DESIGN



**How to write your survey**

# Question Types

- ▶ There are a broad range of question types than be used in survey design:
  - Open-ended
  - Classification or demographic
  - Ranked response
  - Multiple choice
    - ‘Select one’ vs. ‘Select all that apply’
  - Likert scale



# Multiple-choice questions: Select one response

- ▶ This question type provides pre-determined response options: Respondents must choose one answer.
- ▶ Key criteria for this question type is that response options should be:
  - Exhaustive: everyone fits into at least one category.
  - Exclusive: everyone fits into only one category.
  - Unambiguous: response categories mean the same to everyone.

# Likert scale questions

- ▶ This question type should be used when the outcome being evaluated has multiple levels:
  - E.g. levels of agreement, concern, confidence etc.
- ▶ The scale should always have a neutral option:
  - E.g. Strongly agree, agree, neutral, disagree, strongly disagree (also a 'don't know'/'no opinion', etc.).



# Avoiding Survey Bias

- ▶ Using a biased survey reduces the reliability and validity of your survey research.
- ▶ You should try to avoid the various forms of bias when designing your survey:
  - Editing, getting feedback and pilot testing are essential to reducing survey bias.



# Survey Design Flaws (Avoid!)

- **Acquiescence Bias:** A bias from respondents' tendency to agree with statements

-Control for this by including reverse wording items on agreement scales (e.g. 'I found the presentation confusing')



“Put me down for whoever comes out ahead in your poll”.

# Survey Design Flaws

Beware of social desirability bias

Phrase questions e.g. about their prior knowledge or visiting experience in a way that respondents can answer truthfully without feeling stigmatized or awkward.

- e.g. *'sure, I read all the information signs'*.



“Let’s see...number of cheeseburgers eaten in a typical month? three...no, I’ll put down four.”

## Further Survey Biases to avoid: Double-barrelled questions



How much do you like  
milk & carrot juice  
in your tea?





# Survey Biases from Self-Report

- ▶ Many surveys ask respondents to 'self-report' information about events, beliefs or attitudes.
- ▶ Self-report allows for direct access to respondents' views.
- ▶ However, self-report can be a source of bias:
  - Report is only ever a representation of the event.
  - If they are asked to report on behalf of someone else.
  - If they are expected to recall unrealistic information.
  - If they are expecting to predict future behaviour.

# Examples

- ▶ Science helps to solve the world's problems.
- ▶ Scientific research simply reflects scientists' personal opinions.
- ▶ Science is not for me.
- ▶ Science is relevant to my life.
- ▶ Science is usually boring.
- ▶ If I wanted to, I could be a scientist.
- ▶ Science is a normal part of the culture in my city.
- ▶ I am able to understand science.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree	Not applicable / No Opinion
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# OVER TO YOU!

1. Design at least three survey questions (closed-ended) to measure an outcome you identified previously
2. Start with a level of agreement scale
3. First prepare on your own, then share for feedback in your group

# Avoiding Sampling Bias

[Step 1](#) **[Step 2: Staff/Data Collectors Only](#)** [Step 3: About You](#) [Step 4: Your Views](#) [Step 5: Observation Questions](#)

If an email address is provided, please type it in and then read it back to the respondent to ensure it is correct.

Are you willing to answer just a couple of questions now and receive a feedback survey by email after the event finishes?

- Yes, willing to participate
- Not willing to participate

Please click on **Next** to continue. From the next page going forward, it is fine if you turn the device to the participant to complete by themselves (if they are comfortable with the technology and you are comfortable with them using the device).

[Previous](#)

[Next](#)

# **Extending to evaluate long-term impact**





**Hold outcome measures steady**

**+**

**Add questions about other things that  
may have affected those outcomes**

For example, 'Have you watched any nature shows on television  
in the last 12 months?'



# Aggregate level results

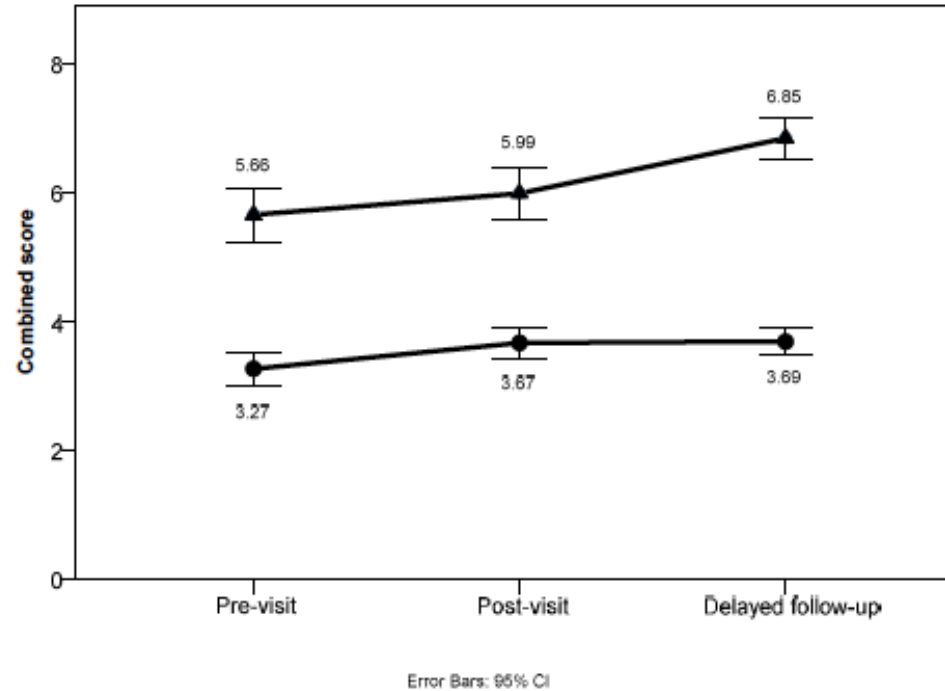


Fig. 1. Comparison of pre-visit, post-visit, and delayed post-visit follow-up survey results for the two dependent variables – biodiversity understanding (●) and knowledge of actions to help protect biodiversity (▲) (combined scores on 10-point scales).

# Over to you!

**What other factors could affect the outcomes you are evaluating over the intervening period?**



**BRIEF REPORT**

# Quantifying long-term impact of zoo and aquarium visits on biodiversity-related learning outcomes

Eric A. Jensen<sup>1</sup> | Andrew Moss<sup>2</sup> | Markus Gusset<sup>3</sup> 

<sup>1</sup>Department of Sociology, University of Warwick, Coventry, United Kingdom

<sup>2</sup>Chester Zoo, Chester, United Kingdom

<sup>3</sup>World Association of Zoos and Aquariums (WAZA) Executive Office, Gland, Switzerland

**Correspondence**

Eric A. Jensen, Department of Sociology, University of Warwick, Coventry CV4 7AL, UK.

Email: e.jensen@warwick.ac.uk

**Funding information**

MAVA Foundation

Zoos and aquariums aim to achieve lasting impact on their public audiences' awareness of biodiversity, its value, and the steps they can take to conserve it. Here, we evaluate the long-term educational impact of visits to zoos and aquariums on biodiversity understanding and knowledge of actions to help protect biodiversity. A minimum of two years after completing a repeated-measures survey before and after visiting a zoo or aquarium, the same participants were invited to take part in a follow-up online survey. Despite the small number of respondents ( $n = 161$ ), our study may still represent the best available quantitative evidence pertaining to zoo and aquarium visits' long-term educational impact. We found that improvements in respondents' biodiversity understanding from pre- to post-visit leveled off, staying unchanged in the

# Automated impact evaluation

methodsinnovation.org jcom.sissa.it/author/eric-jensen

## Post-Visit Views

Thought-listing: Research

**(Combined Responses)**

**Research Relevance:  
Perception**

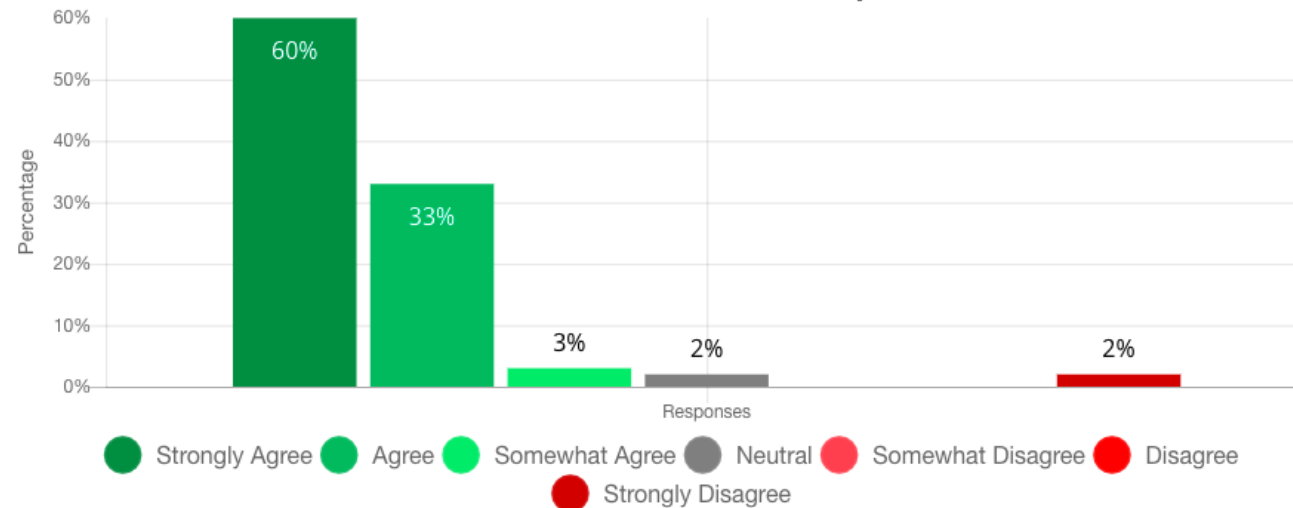
Post Event Action

Post Event Action Explain

'Research affects our daily lives.'



### Research Relevance: Perception



SEE MORE



# GDPR consent

## Welcome!

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This survey is being done for the Space Careers Roadshow to make sure that your visit is as good as possible. As a special thank you, by participating in this survey, you will automatically be entered into a prize draw for a free iPad mini.

We would be very interested to learn from you. Your responses will be kept private and not shared with teachers or your school. This is not a test, and will not be used for school purposes.

Sincerely,  
Space Week Evaluation Team

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This research is being conducted on behalf of CIT Blackrock Castle Observatory by Qualia Analytics ([qualiaanalytics.org](https://www.qualiaanalytics.org)). This research is fully compliant with the UK Data Protection Act of 1998 and EU GDPR standards. Further information about your privacy is available at [sciwise.org/en/privacy](https://www.sciwise.org/en/privacy). If you have any problems with this form, please email [survey@sciwise.org](mailto:survey@sciwise.org).

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Please click the **Next** button below to continue.

### Privacy Agreement

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I give CIT Blackrock Castle Observatory explicit consent to collect personal data related to my survey submission through this form hosted and processed by Qualia Analytics in accordance with its Privacy Policy (<https://www.qualiaanalytics.org/mp/policy/privacy/>) and Security Policy (<https://www.qualiaanalytics.org/mp/policy/security/>).

---



# GDPR consent

## Consent

Do you wish to participate in this evaluation?\*

Yes - I wish to participate in this evaluation

No - I do **not** wish to participate in this evaluation

I confirm my explicit consent to participate in this evaluation

Yes, I confirm my explicit consent ▼

I confirm my explicit consent to be quoted in marketing and advocacy materials (no name attached)

✓ Select  
Yes, I confirm my explicit consent  
No, I don't confirm ▼

Please click **Next** below to continue.



# How to develop accurate impact evaluation with surveys



Jensen

erjensen@warwick.ac.uk

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