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RESEARCH

Farting Jellyfish and Synergistic Opportunities: The Story and Evaluation of Newcastle Science Comic

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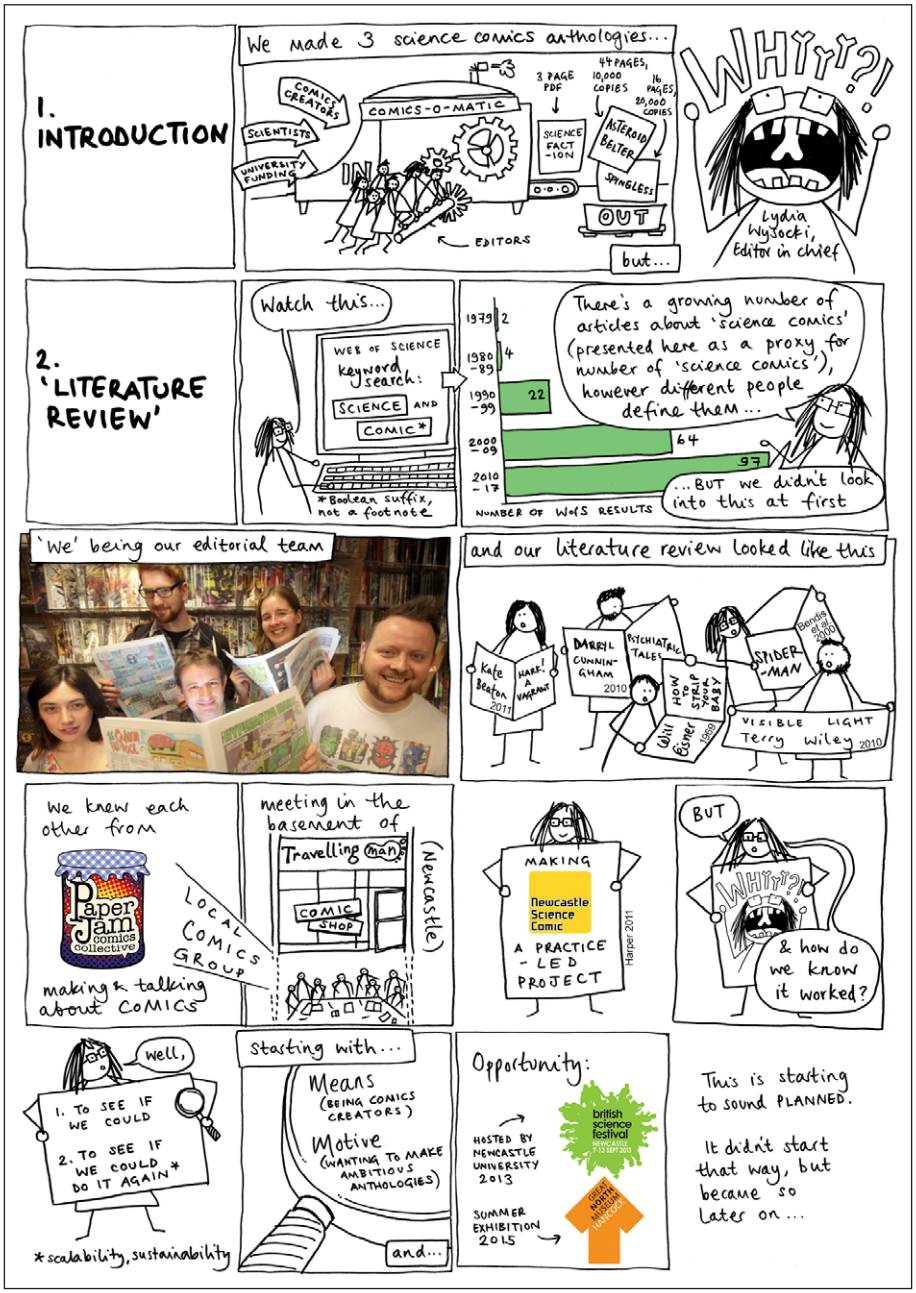
The three Newcastle Science Comic anthologies – *Science FACT-ion, Asteroid Belter*, and *Spineless* – contain 63 pages of original comics by 84 contributors, as collaborations between science researchers and comics creators. They form a total of 30,000 printed copies and three digital editions, all free to read.

This article in comics form (1) tells the story of the Newcastle Science Comic project with insights into the process of making these collaborative comics, which included not only institutional support from Newcastle University 2012–2016 but also individual and collective interest in research-comics collaborations; (2) explores what it means to meaningfully evaluate a science comic, and presents qualitative and quantitative evidence for the success of these anthologies with a focus on readers' responses to the comics; (3) uses the Generic Learning Outcomes (GLOs) framework (Research Centre for Museums and Galleries 2003) to provide a shared language for comics readers, comics creators, and research/heritage institutions to evaluate the success of this applied comics project.

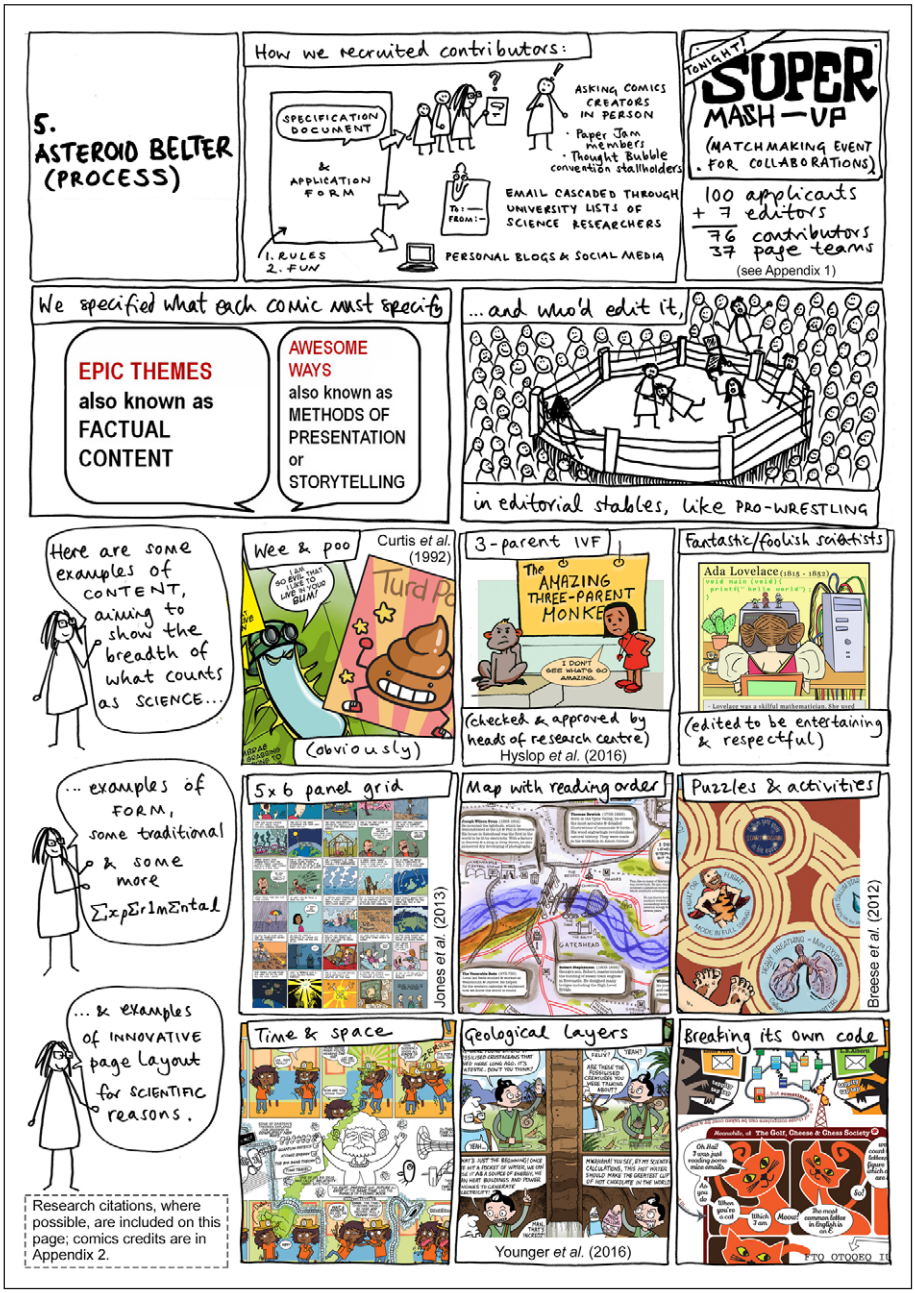
Findings are presented in two stages: first an ad-hoc evaluation of *Asteroid Belter* as a practice-led project, then main findings from a qualitative questionnaire (n = 77) using GLOs to ask readers what they remembered, liked about, and learned from *Spineless*. Responses show readers' interest in the science content and/or the comics form, and in the combination of content and form as science comics.

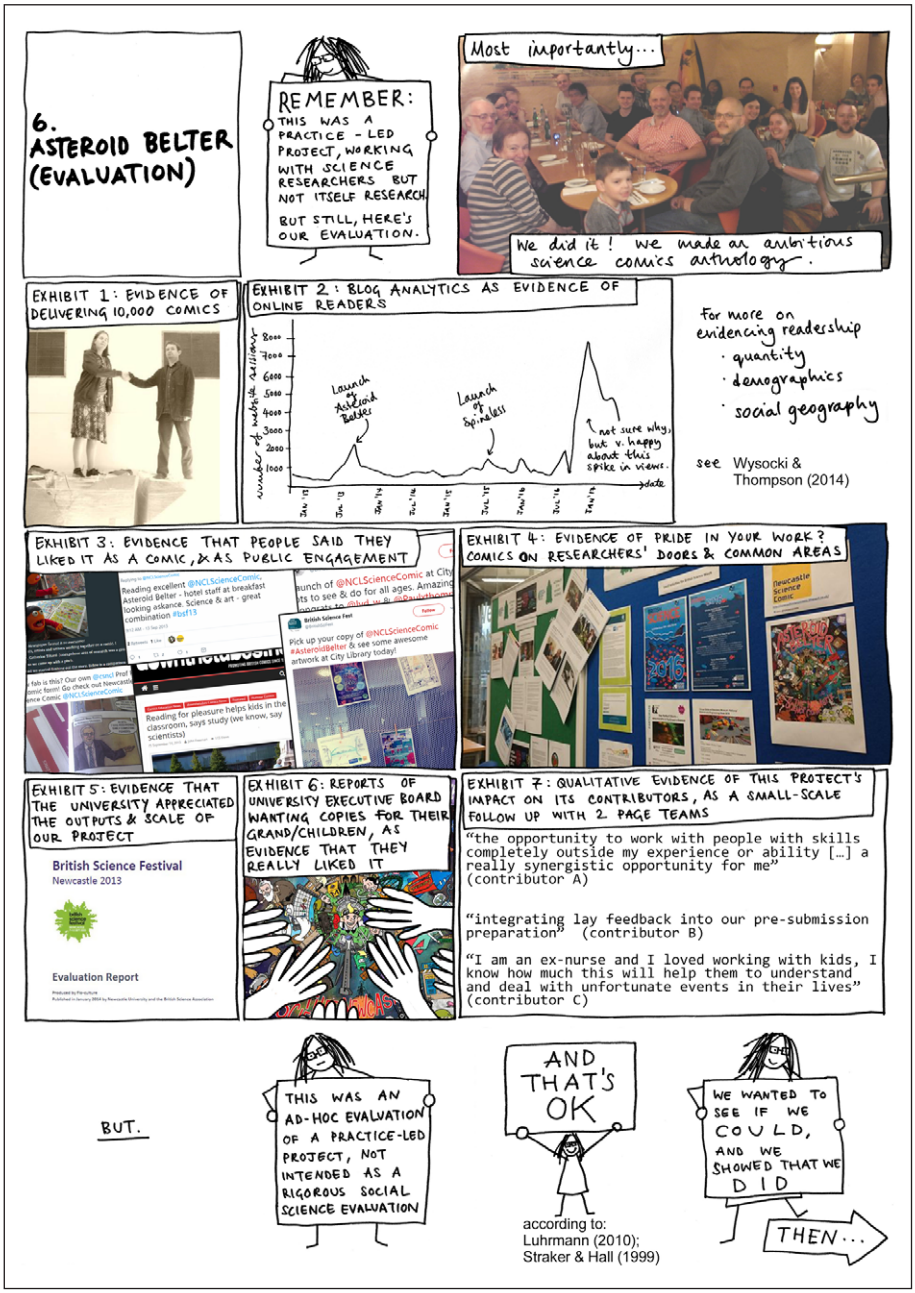
Although other frameworks and other data collection methods might gather richer data, this use of GLOs supported an initial exploration of readers' feedback on science comics using shared and accessible language. This is in keeping with our editorial team's progression from making science comics to see if we could, to a more systematic approach to planning, delivering, and meaningfully evaluating large-scale comics projects for public engagement with science research and in museum contexts.

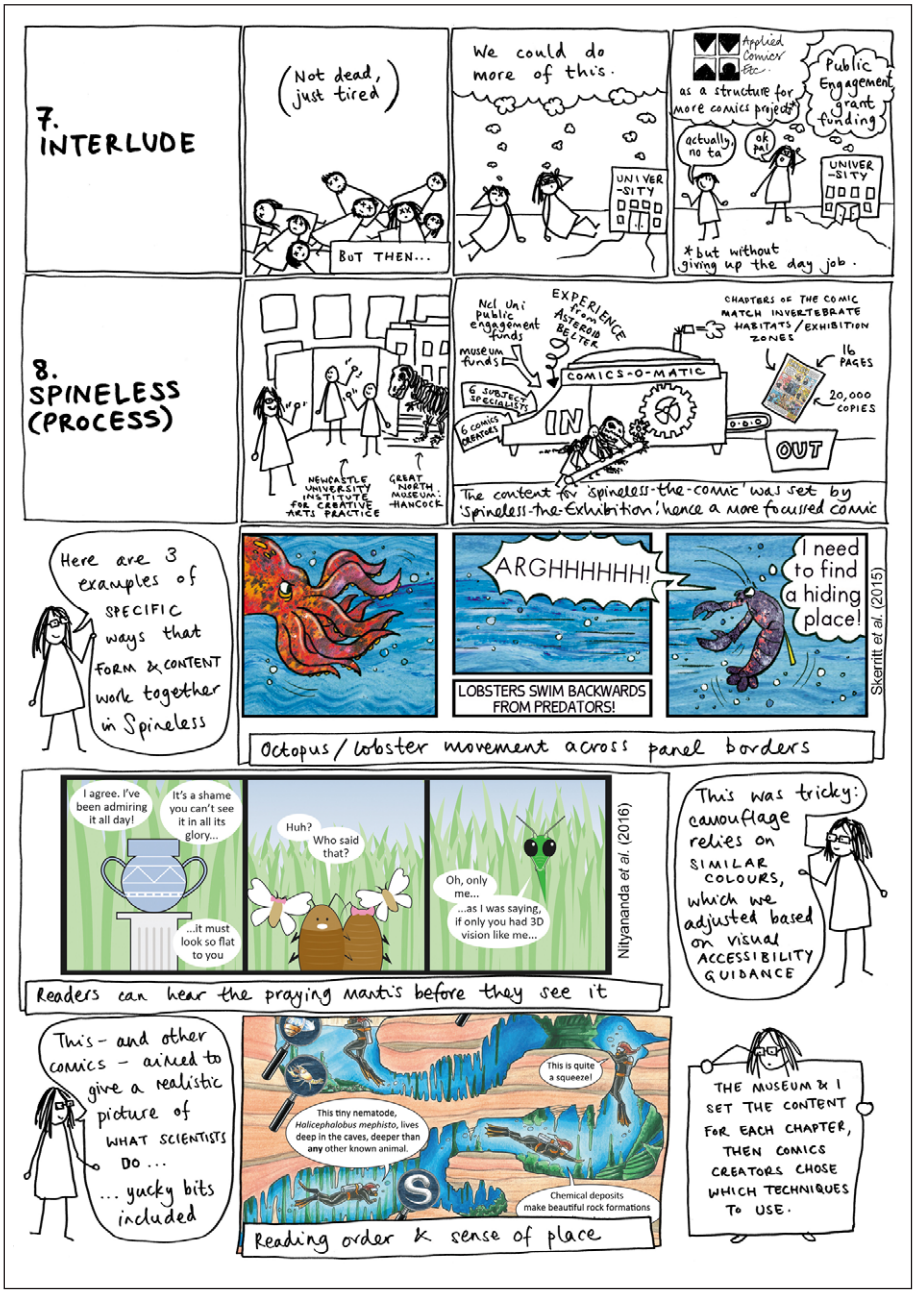
Keywords: applied comics; science comics; GLO generic learning outcomes; research engagement; impact

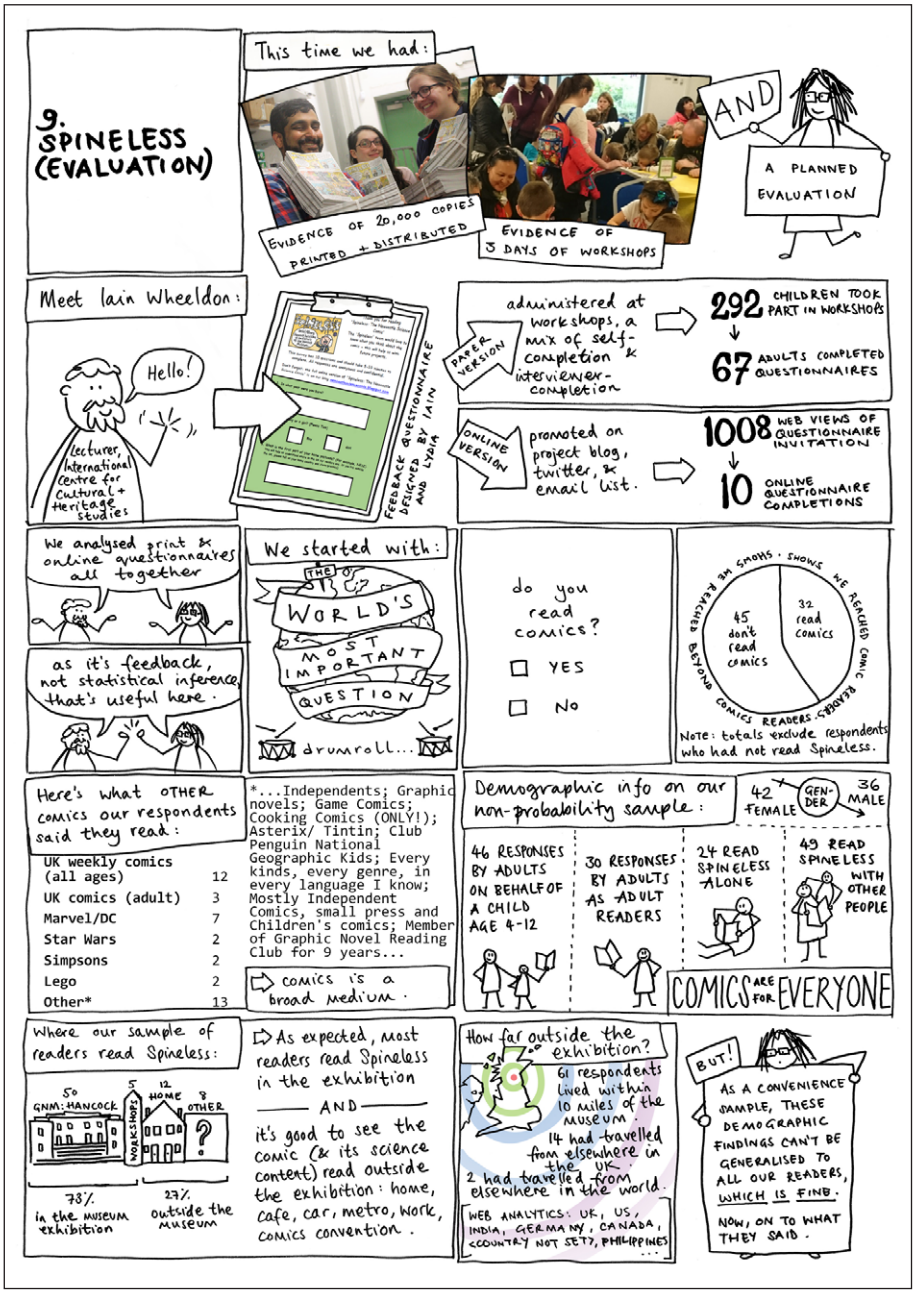

1. INTRODUCTION
We made 3 science comics anthologies...
COMICS CREATORS
SCIENTISTS
UNIVERSITY FUNDING
COMICS-O-MATIC
IN
3 PAGE PDF
SCIENCE FACT-ION
44 PAGES, 10,000 COPIES
ASTEROID BELTER
16 PAGES, 20,000 COPIES
SPANGLES
OUT
EDITORS
but...
WHY?!
Lydia Wysocki, Editor in chief
2. 'LITERATURE REVIEW'
Watch this...
WEB OF SCIENCE keyword search:
SCIENCE AND COMIC*
*Boolean suffix, not a footnote
There's a growing number of articles about 'science comics' (presented here as a proxy for number of 'science comics'), however different people define them...
1979 2
1980-89 4
1990-99 22
2000-09 64
2010-17 97
NUMBER OF WoS RESULTS
...BUT we didn't look into this at first
'We' being our editorial team
and our literature review looked like this
Kate Beaton 2011
HARK! A VAGRANT
DARRYL GUNNINGHAM 2010
PSYCHIATRIC TALES
HOW TO STRIP YOUR BABY
Will Eisner 1990
SPIDER-MAN
Bendis et al 2000
VISIBLE LIGHT Terry Wiley 2010
We knew each other from
Paper Jam comics collective
making & talking about COMICS
LOCAL COMICS GROUP
meeting in the basement of
Travelling man
COMIC SHOP
(Newcastle)
MAKING
Newcastle Science Comic
A PRACTICE-LED PROJECT
Harper 2011
BUT
WHY?!
& how do we know it worked?
well,
1. TO SEE IF WE COULD
2. TO SEE IF WE COULD DO IT AGAIN*
*scalability, sustainability
Starting with...
Means (BEING COMICS CREATORS)
Motive (WANTING TO MAKE AMBITIOUS ANTHOLOGIES)
and...
Opportunity:
HOSTED BY NEWCASTLE UNIVERSITY 2013
british science festival NEWCASTLE 7-13 SEPT 2013
SUMMER EXHIBITION 2015
HULL MARITIME MUSEUM
This is starting to sound PLANNED.
It didn't start that way, but became so later on...

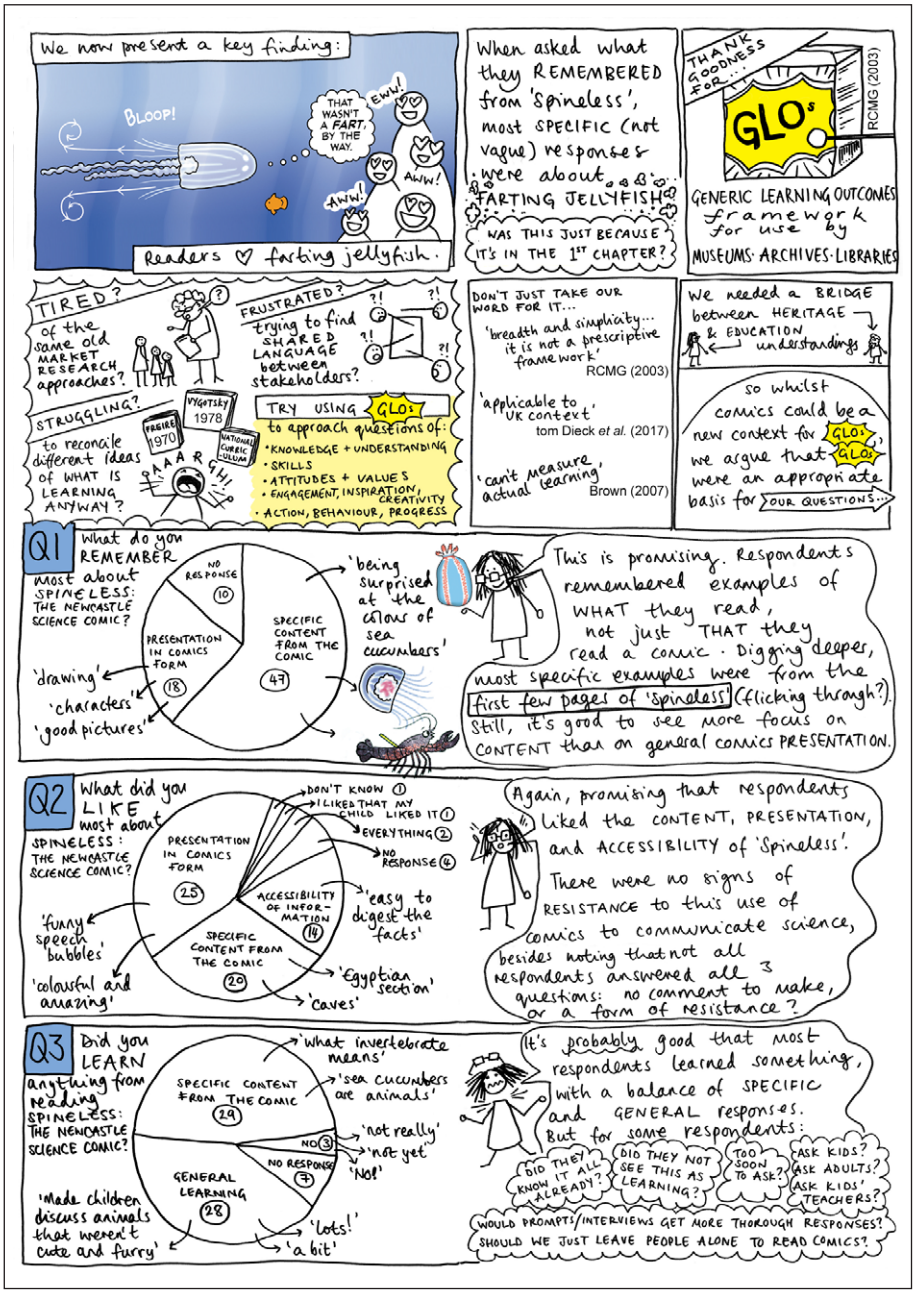

3. PLANNING
Like many great things, this project began with FAILURE
specifically, my failure to get a new job
so here's the plan: I'll meet the ladies for a cup of tea & a chat to see what is in my way
PAGES FROM DIARY COMICS I WAS TOO BUSY TO FINISH
Which led to a reasonably successful coffee & chat about 'doing something with SCIENCE & COMICS' as part of the British Science Festival 2013
PRINCIPLES:
· good comics + real science
· respect comics expertise
· pay artists/writers + editors
THEN
P.T. MANAGING EDITOR
L.M. EDITOR IN CHIEF
Em@ils
FROM: PUBLIC ENGAGEMENT TEAM @ NCL UNI
RE: PROJECT PROPOSAL
THEN
PROJECT OUTLINE PROPOSAL .doc
INDICATIVE BUDGET .XLS
comics creators ???
printing ???
editing ???
Constitution of PROJECT TEAM
BUILDING SOCIETY COMMUNITY ACCOUNT
SHAKE SHAKE
The next Paper Jam meeting resulted in these fun-but-not-entirely-helpful doodles
so on balance,
SPU:S
we set up SPU·S SPECIAL PROJECTS UNIT: SCIENCE as a vehicle to get stuff done (it later became Applied Comics etc.)
4. PILOT
WHAT'S A SCIENCE COMIC?
CAN WE MAKE A GOOD ONE?
CAN WE WORK WITH THEM?
HOW?
COMPILATION OF MANY PIZZA & COFFEE MEETINGS
PERMEABLE BOUNDARY
OFFICIAL UNIVERSITY OFFICE MEETINGS
BETTER DO A... PILOT PROJECT
about the similarities & differences between SCIENCE FACT & SCIENCE FICTION
BEGIN PILOT: SCIENCE FACT-ION
3 part structure based on English as a foreign language lesson planning:
1. PRESENT
2. CONTROLLED PRACTICE
3. FREE PRACTICE
COMIC BY ANDY WAUGH discussing what's scifi, what's scifact
WORKSHEET BY TERRY WILEY to discuss examples and decide if they're FACT or FICTION
CHALLENGE BY 'CUTTLEFISH' to invent something that doesn't exist now, but will be in every home by the year 2050
Outputs:
• 3 page PDF + notes for teachers
• emailed to North East schools as part of pre-BSF2013 outreach
110 entries
6 winners published in Asteroid Belter'
PILOT: COMPLETE


5. ASTEROID BELTER (PROCESS)
How we recruited contributors:
SPECIFICATION DOCUMENT
& APPLICATION FORM
1. RULES 2. FUN
ASKING COMICS CREATORS IN PERSON
· Paper Jam members
· Thought Bubble convention stallholders
EMAIL CASCADED THROUGH UNIVERSITY LISTS OF SCIENCE RESEARCHERS
PERSONAL BLOGS & SOCIAL MEDIA
TONIGHT! SUPER MASH-UP
(MATCHMAKING EVENT FOR COLLABORATIONS)
100 applicants
+ 7 editors
76 contributors
37 page teams
(see Appendix 1)
We specified what each comic must specify
EPIC THEMES also known as FACTUAL CONTENT
AWESOME WAYS also known as METHODS OF PRESENTATION or STORYTELLING
...and who'd edit it,
in editorial stables, like PRO-WRESTLING
Here are some examples of CONTENT, aiming to show the breadth of what counts as SCIENCE...
Wee & poo
Curtis et al. (1992)
(obviously)
3-parent IVF
The AMAZING THREE-PARENT MONKEY
I DON'T SEE WHAT'S SO AMAZING.
(checked & approved by heads of research centre)
Hyslop et al. (2016)
Fantastic/foolish scientists
Ada Lovelace (1815 - 1852)
(edited to be entertaining & respectful)
... examples of FORM, some traditional & some more ΣxpΣrImΣntal
5x6 panel grid
Jones et al. (2013)
Map with reading order
GATESHEAD
Puzzles & activities
Breese et al. (2012)
... & examples of INNOVATIVE page layout for SCIENTIFIC reasons.
Time & space
Geological layers
Younger et al. (2016)
Breaking its own code
The Golf, Cheese & Chess Society
Research citations, where possible, are included on this page; comics credits are in Appendix 2.

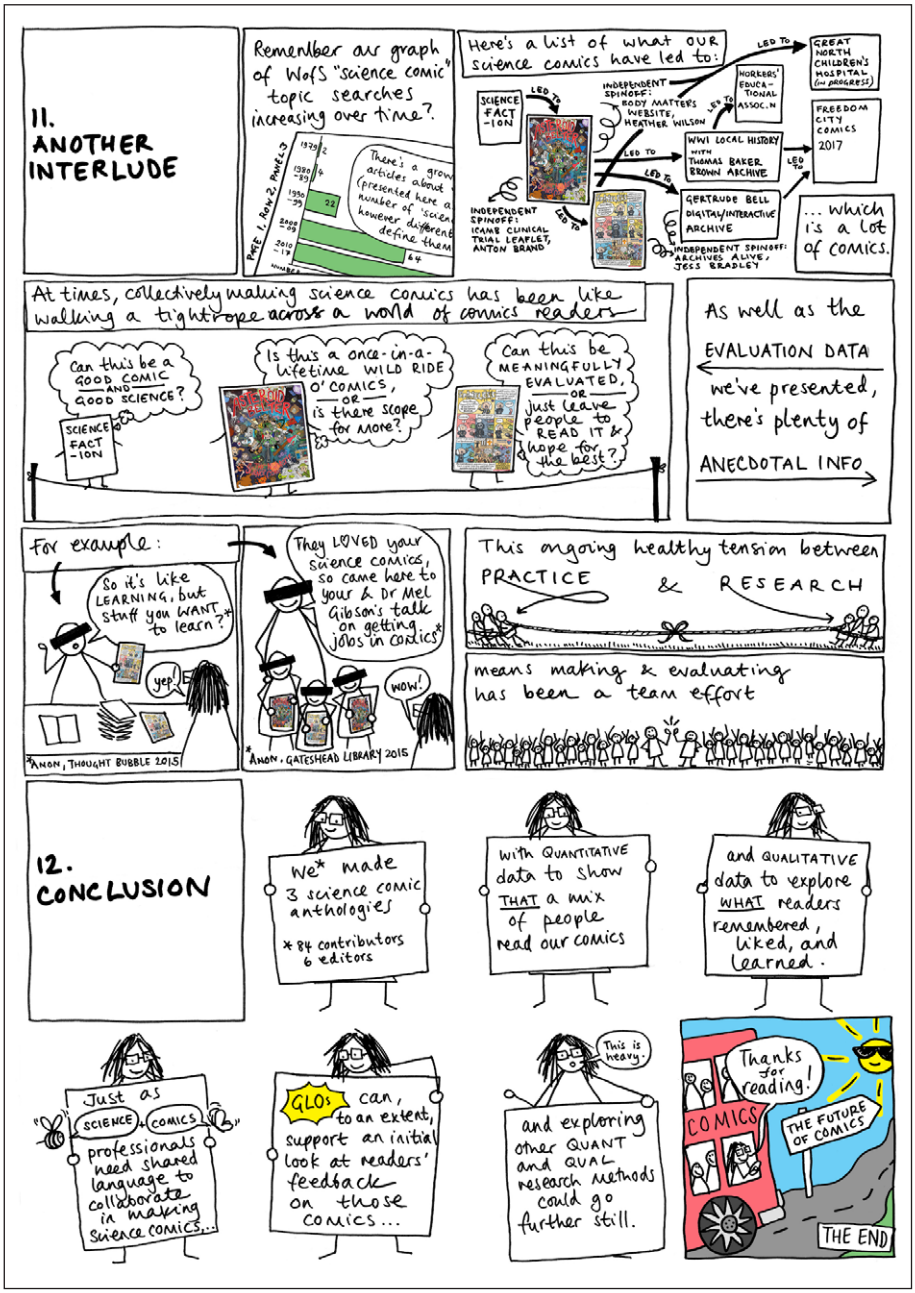

6. ASTEROID BELTER (EVALUATION)
REMEMBER: THIS WAS A PRACTICE-LED PROJECT, WORKING WITH SCIENCE RESEARCHERS BUT NOT ITSELF RESEARCH
BUT STILL, HERE'S OUR EVALUATION.
Most importantly...
We did it! we made an ambitious science comics anthology.
EXHIBIT 1: EVIDENCE OF DELIVERING 10,000 COMICS
EXHIBIT 2: BLOG ANALYTICS AS EVIDENCE OF ONLINE READERS
Launch of Asteroid Belter
Launch of Spindles!
not sure why, but v. happy about this spike in views.
date
For more on evidencing readership
· quantity
· demographics
· social geography
see Wysocki & Thompson (2014)
EXHIBIT 3: EVIDENCE THAT PEOPLE SAID THEY LIKED IT AS A COMIC, & AS PUBLIC ENGAGEMENT
EXHIBIT 4: EVIDENCE OF PRIDE IN YOUR WORK? COMICS ON RESEARCHERS' DOORS & COMMON AREAS
EXHIBIT 5: EVIDENCE THAT THE UNIVERSITY APPRECIATED THE OUTPUTS & SCALE OF OUR PROJECT
British Science Festival
Newcastle 2013
Evaluation Report
EXHIBIT 6: REPORTS OF UNIVERSITY EXECUTIVE BOARD WANTING COPIES FOR THEIR GRAND/CHILDREN, AS EVIDENCE THAT THEY REALLY LIKED IT
EXHIBIT 7: QUALITATIVE EVIDENCE OF THIS PROJECT'S IMPACT ON ITS CONTRIBUTORS, AS A SMALL-SCALE FOLLOW UP WITH 2 PAGE TEAMS
"the opportunity to work with people with skills completely outside my experience or ability […] a really synergistic opportunity for me" (contributor A)
"integrating lay feedback into our pre-submission preparation" (contributor B)
"I am an ex-nurse and I loved working with kids, I know how much this will help them to understand and deal with unfortunate events in their lives" (contributor C)
BUT.
THIS WAS AN AD-HOC EVALUATION OF A PRACTICE-LED PROJECT, NOT INTENDED AS A RIGOROUS SOCIAL SCIENCE EVALUATION
AND THAT'S OK
according to: Luhrmann (2010); Straker & Hall (1999)
WE WANTED TO SEE IF WE COULD, AND WE SHOWED THAT WE DID
THEN...


7. INTERLUDE
(Not dead, just tired)
BUT THEN...
We could do more of this.
UNIVER-SITY
Applied Comics Etc.
Public Engagement grant funding
as a structure for more comics projects
actually, no ta
ok pal
UNIVER-SITY
*but without giving up the day job.
8. SPINELESS (PROCESS)
NEWCASTLE UNIVERSITY INSTITUTE FOR CREATIVE ARTS PRACTICE
GREAT NORTH MUSEUM: HANCOCK
Ncl Uni Public engagement funds
museum funds
EXPERIENCE from ASTEROID BELTER
6 SUBJECT SPECIALISTS
6 COMICS CREATORS
COMICS-O-MATIC
IN
OUT
CHAPTERS OF THE COMIC MATCH INVERTEBRATE HABITATS/EXHIBITION ZONES
16 PAGES
20,000 COPIES
The content for 'spineless-the-comic' was set by 'spineless-the-Exhibition', hence a more focussed comic
Here are 3 examples of SPECIFIC ways that FORM & CONTENT work together in Spineless
ARGHHHHHH!
I need to find a hiding place!
LOBSTERS SWIM BACKWARDS FROM PREDATORS!
Skerritt et al. (2015)
Octopus/lobster movement across panel borders
I agree. I've been admiring it all day!
It's a shame you can't see it in all its glory...
...it must look so flat to you
Huh?
Who said that?
Oh, only me...
...as I was saying, if only you had 3D vision like me...
Nityananda et al. (2016)
Readers can hear the praying mantis before they see it
This was tricky: camouflage relies on SIMILAR COLOURS, which we adjusted based on visual ACCESSIBILITY GUIDANCE
This - and other comics - aimed to give a realistic picture of WHAT SCIENTISTS DO ... ... yucky bits included
This is quite a squeeze!
This tiny nematode, Halicephalobus mephisto, lives deep in the caves, deeper than any other known animal.
Chemical deposits make beautiful rock formations
Reading order & sense of place
THE MUSEUM & I SET THE CONTENT FOR EACH CHAPTER, THEN COMICS CREATORS CHOSE WHICH TECHNIQUES TO USE.


9. SPINELESS (EVALUATION)
This time we had:
EVIDENCE OF 20,000 COPIES PRINTED + DISTRIBUTED
EVIDENCE OF 3 DAYS OF WORKSHOPS
AND
A PLANNED EVALUATION
Meet Iain Wheeldon:
Hello!
Lecturer, International Centre for Cultural + Heritage Studies
FEEDBACK QUESTIONNAIRE DESIGNED BY IAIN AND LYDIA
PAPER VERSION
administered at workshops, a mix of self-completion & interviewer-completion
292 CHILDREN TOOK PART IN WORKSHOPS
67 ADULTS COMPLETED QUESTIONNAIRES
ONLINE VERSION
promoted on project blog, twitter, & email list.
1008 WEB VIEWS OF QUESTIONNAIRE INVITATION
10 ONLINE QUESTIONNAIRE COMPLETIONS
We analysed print & online questionnaires all together
as it's feedback, not statistical inference, that's useful here.
We started with:
THE WORLD'S MOST IMPORTANT QUESTION
drumroll...
do you read comics?
YES
No
45 don't read comics
32 read comics
SHOWS WE REACHED COMIC READERS
SHOWS WE REACHED NON-COMICS READERS
Note: totals exclude respondents who had not read Spineless.
Here's what OTHER comics our respondents said they read:
UK weekly comics (all ages) 12
UK comics (adult) 3
Marvel/DC 7
Star Wars 2
Simpsons 2
Lego 2
Other* 13
*...Independents; Graphic novels; Game Comics; Cooking Comics (ONLY!); Asterix/ Tintin; Club Penguin National Geographic Kids; Every kinds, every genre, in every language I know; Mostly Independent Comics, small press and Children's comics; Member of Graphic Novel Reading Club for 9 years...
comics is a broad medium.
Demographic info on our non-probability sample:
42 FEMALE
GENDER
36 MALE
46 RESPONSES BY ADULTS ON BEHALF OF A CHILD AGE 4-12
30 RESPONSES BY ADULTS AS ADULT READERS
24 READ SPINELESS ALONE
49 READ SPINELESS WITH OTHER PEOPLE
COMICS ARE FOR EVERYONE
Where our sample of readers read Spineless:
50 GNM: HANCOCK
5 WORKSHOPS
12 HOME
8 OTHER
73% in the museum exhibition
27% outside the museum
As expected, most readers read Spineless in the exhibition
AND
it's good to see the comic (& its science content) read outside the exhibition: home, cafe, car, metro, work, comics convention.
How far outside the exhibition?
61 respondents lived within 10 miles of the museum.
14 had travelled from elsewhere in the UK.
2 had travelled from elsewhere in the world.
WEB ANALYTICS: UK, US, INDIA, GERMANY, CANADA, <COUNTRY NOT SET>, PHILIPPINES ...
BUT!
AS A CONVENIENCE SAMPLE, THESE DEMOGRAPHIC FINDINGS CAN'T BE GENERALISED TO ALL OUR READERS, WHICH IS FINE.
NOW, ON TO WHAT THEY SAID.


We now present a key finding:
BLOOP!
THAT WASN'T A FART BY THE WAY.
EWW!
AWW!
AWW!
Readers ♡ farting jellyfish.
When asked what they REMEMBERED from 'Spineless', most SPECIFIC (not vague) responses were about... FARTING JELLYFISH
WAS THIS JUST BECAUSE IT'S IN THE 1ST CHAPTER?
THANK GOODNESS FOR...
GLOs
RCMG (2003)
GENERIC LEARNING OUTCOMES framework for use by MUSEUMS·ARCHIVES·LIBRARIES
TIRED? of the same old MARKET RESEARCH approaches?
FRUSTRATED? trying to find SHARED LANGUAGE between stakeholders?
STRUGGLING? to reconcile different ideas of WHAT IS LEARNING ANYWAY?
VYGOTSKY 1978
FREIRE 1970
NATIONAL CURRIC CULUM
AAARGH!
TRY USING GLOs to approach questions of:
• KNOWLEDGE + UNDERSTANDING
• SKILLS
• ATTITUDES + VALUES
• ENGAGEMENT, INSPIRATION, CREATIVITY
• ACTION, BEHAVIOUR, PROGRESS
DON'T JUST TAKE OUR WORD FOR IT...
'breadth and simplicity... it is not a prescriptive framework' RCMG (2003)
'applicable to UK context' tom Dieck et al. (2017)
'can't measure actual learning' Brown (2007)
We needed a BRIDGE between HERITAGE & EDUCATION understandings
so whilst comics could be a new context for GLOs, we argue that GLOs were an appropriate basis for OUR QUESTIONS...
Q1 What do you REMEMBER most about SPINELESS: THE NEWCASTLE SCIENCE COMIC?
NO RESPONSE 10
PRESENTATION IN COMICS FORM 18
SPECIFIC CONTENT FROM THE COMIC 47
'drawing'
'characters'
'good pictures'
'being surprised at the colour of sea cucumbers'
This is promising. Respondents remembered examples of WHAT they read, not just THAT they read a comic. Digging deeper, most specific examples were from the first few pages of 'Spineless' (flicking through?). Still, it's good to see more focus on CONTENT than on general comics PRESENTATION.
Q2 What did you LIKE most about SPINELESS: THE NEWCASTLE SCIENCE COMIC?
DON'T KNOW 1
I LIKED THAT MY CHILD LIKED IT 1
EVERYTHING 2
NO RESPONSE 4
PRESENTATION IN COMICS FORM 25
ACCESSIBILITY OF INFORMATION 14
SPECIFIC CONTENT FROM THE COMIC 20
'easy to digest the facts'
'funny speech bubbles'
'colourful and amazing'
'Egyptian section'
'caves'
Again, promising that respondents liked the CONTENT, PRESENTATION, and ACCESSIBILITY of 'Spineless'. There were no signs of RESISTANCE to this use of comics to communicate science, besides noting that not all respondents answered all 3 questions: no comment to make, or a form of resistance?
Q3 Did you LEARN anything from reading SPINELESS: THE NEWCASTLE SCIENCE COMIC?
SPECIFIC CONTENT FROM THE COMIC 29
GENERAL LEARNING 28
NO 3
NO RESPONSE 7
'what invertebrate means'
'sea cucumbers are animals'
'not really'
'not yet'
'No!'
'lots!'
'a bit'
'made children discuss animals that weren't cute and furry'
It's probably good that most respondents learned something, with a balance of SPECIFIC and GENERAL responses. But for some respondents:
DID THEY ALREADY KNOW IT ALL?
DID THEY NOT SEE THIS AS LEARNING?
TOO SOON TO ASK?
ASK KIDS?
ASK ADULTS?
ASK KIDS' TEACHERS?
WOULD PROMPTS/INTERVIEWS GET MORE THOROUGH RESPONSES?
SHOULD WE JUST LEAVE PEOPLE ALONE TO READ COMICS?


10. DISCUSSION OF OUR USE OF GENERIC LEARNING OUTCOMES IN THIS EVALUATION
Let me just screw my head back on after all that thinking
Ok, so...
1st I'll present what GLOs helped us show,
then consider the LIMITATIONS of GLOs here,
remembering that all this is specific to our project evaluation
CONTEXT
GLOs helped break one BIG question
DID YOU LIKE THIS COMIC?
into smaller questions we could use in gathering feedback
WHAT DID YOU REMEMBER?
WHAT DID YOU LIKE?
WHAT DID YOU LEARN?
We saw a range of responses, giving us REASONABLE CONFIDENCE* in our data,
* still not looking for statistical confidence intervals, but about QUANTITATIVE analysis of QUALITATIVE data
so yes, GLOs helped us to gather meaningful data from readers
GLOs not only served as a bridge between HERITAGE & EDUCATION understandings of WHAT we were evaluating...
BRIDGE OF SHARED UNDERSTANDING
but did so using language also accessible to READERS & MUSEUM STAFF outside academia
& YOU READER OF THIS ARTICLE
GO TEAM!
WHOOP!
... which is central to this project's focus on public engagement
see also: Mahony & Stephansen (2017)
BUT.
Anecdotally, researcher-completed questionnaires mostly yielded fuller responses than self-completions
though not always
Hang on a sec...
Zzzzz
Mam, look
so whilst GLOs in questionnaires were worth trying,
BEEP! BIP BIP
the same (or other) frameworks as interview prompts might help gather richer data
NOM NOM
Flewitt et al. (2009)
FICTIONALISED WORKSHOP SCENE, REPRESENTING 3 DAYS OF CHAOTIC FUN
Looking at our range of responses,
SHOWN ON PREVIOUS PAGE
Q1 Q2 Q3
whilst we're still confident we have meaningful data,
we also suspect that even with a CRITIQUE of GLOs, this approach only scratches the surface of understanding 2 main areas:
1. WHAT READERS GAINED FROM THIS COMIC, AS LEARNING OR AS SOMETHING ELSE
2. WHAT COMICS CAN OFFER TO PUBLIC ENGAGEMENT WITH RESEARCH, & IN MUSEUM CONTEXTS
THIS IS A STRONG START IN EVALUATING APPLIED COMICS PROJECTS
& EDUCATIONAL RESEARCH METHODS COULD HELP TAKE THIS EVEN FURTHER
COMICS for SPECIFIC PURPOSES


11. ANOTHER INTERLUDE
Remember our graph of WoFS "science comic" topic searches increasing over time?
Here's a list of what OUR science comics have led to:
SCIENCE FACT-ION
INDEPENDENT SPINOFF: BODY MATTERS WEBSITE, HEATHER WILSON
NORKERS' EDUCATIONAL ASSOC.N
GREAT NORTH CHILDREN'S HOSPITAL (in progress)
FREEDOM CITY COMICS 2017
WWI LOCAL HISTORY with THOMAS BAKER BROWN ARCHIVE
GERTRUDE BELL DIGITAL/INTERACTIVE ARCHIVE
INDEPENDENT SPINOFF: ARCHIVES ALIVE, JESS BRADLEY
INDEPENDENT SPINOFF: ICANE CLINICAL TRIAL LEAFLET, ANTON BRAND
... which is a lot of COMICS.
At times, collectively making science comics has been like walking a tightrope across a world of comics readers
Can this be a GOOD COMIC AND GOOD SCIENCE?
Is this a once-in-a-lifetime WILD RIDE O' COMICS, —OR— is there scope for more?
Can this be MEANINGFULLY EVALUATED, —OR— just leave people to READ IT & hope for the best?
As well as the EVALUATION DATA we've presented, there's plenty of ANECDOTAL INFO
For example:
So it's like LEARNING, but stuff you WANT to learn?*
yep!
*ANON, THOUGHT BUBBLE 2015
They LOVED your science comics, so came here to your & Dr Mel Gibson's talk on getting jobs in comics*
WOW!
*ANON, GATESHEAD LIBRARY 2015
This ongoing healthy tension between PRACTICE & RESEARCH
means making & evaluating has been a team effort
12. CONCLUSION
We* made 3 science comic anthologies
* 84 contributors 6 editors
With QUANTITATIVE data to show THAT a mix of people read our comics
and QUALITATIVE data to explore WHAT readers remembered, liked, and learned.
Just as SCIENCE + COMICS professionals need shared language to collaborate in making science comics...
GLOs can, to an extent, support an initial look at readers' feedback on those comics...
This is heavy.
and exploring other QUANT and QUAL research methods could go further still.
Thanks for reading!
COMICS
THE FUTURE OF COMICS
THE END

Additional Files

The additional files for this article can be found as follows:

- **Appendix 1.** Names of all Newcastle Science Comic contributors and editors. DOI: https://doi.org/10.16995/cg.119.s1
- **Appendix 2.** List of Newcastle Science Comic extracts included in this article. DOI: https://doi.org/10.16995/cg.119.s1

Editorial Note

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Competing Interests

The author has no competing interests to declare.

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