

China Plate Theatre and One Tenth Human present

WE'RE STUCK! by Sarah Punshon

**commissioned by Shoreditch Town Hall and Z-arts
originally developed in collaboration with Maths on Toast**

PROJECT REPORT, MAY 2016

by Sarah Punshon (One Tenth Human), Alexandra Fitzsimmons (Maths on Toast) and
China Plate Theatre



“Best school trip ever” - Year 4 pupil

“Really great performers and ideas. Such a fantastic experience using a space so cleverly. The actors were fantastic and so committed to their roles. Really fabulous production.” Parent

“The problems were so cleverly introduced. It was incredibly fun and funny.” Parent

“Really hope there are more things planned for kids like this.” Parent

“It was like being in Doctor Who” Child

“Just thank you. We couldn't stop talking about how privileged we are to be able to enjoy such world-class theatre.” Parent

“It carried an important message about it being acceptable and beneficial to get things wrong, a concept which they often struggle with.” Parent

“Brilliant!!! Keep touring and tell me about your next tour in London so I can share with my friends!” Parent

“I didn't like it, I LOVED it” Year 4 pupil

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INTRODUCTION

Project Outline

We're Stuck! is an interactive theatrical adventure for children aged 8-11 and their accompanying adults. At 70 minutes long, it takes audiences through six different spaces as they explore “Volcano Industries”, a top-secret Artificial Intelligence research facility that develops cutting-edge robots controlled by neuron-computer hybrid systems. The audience are cast as “Professors”, who have to help “Dr Dikita Dey”, “Dr Bernard Fenugreek” and “Dr Ernest Volcano” overcome the evil plans of the head of the institute, “Dr Astrid Volcano”.

The show was developed by theatre-maker Sarah Punshon with a team of creative and scientific collaborators. After an initial development phase in 2014, we secured funding from the Wellcome Trust, Arts Council England, Shoreditch Town Hall, Z-arts and Manchester Science Festival to develop the full show via school and family workshops in London and Manchester during autumn 2015, and produce it at four different venues in London and the Northwest, 16 March – 16 April 2016. See Credits & Thanks, below, for full performance details and credits.

We secured additional funding to help create wrap-around educational resources to support the production. A 16 page, full-colour A5 “Volcano Industries Recruitment Pack” was developed via school and family workshops, and distributed to every child who attended the show, containing additional original games, maths activities and further reading on the real neuroscience behind our fiction. It included an invitation to cut out and complete a pre-printed postcard for “Dr Volcano”. We also produced and tested teachers' classroom resources, available online.

Project Headline Figures

We ran four family workshops and four schools workshops, reaching 296 participants. Over 36 performances we reached exactly 1,000 audience members with the finished show. This was an average of 67% capacity across the tour. Through venue led activities and audience development projects we estimate to have reached a live secondary audience of approximately 900 young people. We also reached a secondary audience of approx. 7,000 people through the dissemination of various interviews and feature articles.

The project cost £88,514 in total. An additional £9,170 was raised by Maths On Toast from The Mercers' Company for an enhanced wrap-around educational package: “Recruitment Packs” were distributed to every child who attended. Around 5% of these children sent messages to Dr Volcano after the show.

EVALUATION & LEARNING

Scientific collaboration & communication

Initial objectives:

- To embed cutting edge research on maths learning, visuo-spatial cognition and neuroplasticity into the theatrical experience.

Process

Early on, Sarah met with all five of our scientific advisors in person, discussing their work and investigating its relevance to our objectives. Together with her designer and games designer, she also visited the Brain Embodiment Laboratory at University of Reading, meeting with Professor Slawomir Nasuto and his team of researchers to discuss their work with rat neurons.

During R&D weeks in the autumn, Professor Michael Thomas and Professor Matt Nolan joined the company for the family workshops in Manchester, followed by a Q&A with the performers; Professor Andy Tolmie and Dr Emily Farran observed schools workshops in London, and discussed their observations with the team afterwards.

Throughout December, January and February, Professor Thomas, Professor Nolan and Dr Farran were able to read and feed back on various drafts of the script, and in March Professor Thomas attended a dress rehearsal and gave notes afterwards.

During the run, Professor Thomas and Dr Farran each joined us for a post-show Q&A session with audience members, where they faced questions, which ranged from the brain and how we know how it works, to Artificial Intelligence and what will happen with robots in the future. These came both from children and their parents, suggesting the audience was well engaged with the ideas.

Challenges

Time, space, plot and our powers of assimilation and invention all placed limits on what made it into the show. Many fascinating ideas were explored, and not all of them could be squeezed into one show: constrained as we were by the length of a school day and the attention span of an eight year old. For instance, one particular game, Bernard-bot's Navigational Error, which was popular with our advisors and drew strongly on Dr Farran's research around mathematical language, was regretfully cut from the show at a late stage, after the first previews, when it became apparent that the show was ten minutes too long.

Physical proximity meant that our London advisors were more closely and consistently involved than Professor Nolan (Edinburgh) and Dr Cohen-Kadosh (Oxford). After our initial very useful research visit, Dr Cohen-Kadosh was unable to be more fully involved, due to heavy commitments elsewhere. However, Professor Nolan was able to attend a Manchester day, and subsequently was hugely helpful reading draft scripts and pointing Sarah towards useful research.

Successful Collaboration

The project was a genuine collaboration: the show would not, could not, have existed without the input of our scientific advisors. The team, particularly Sarah, learned a huge amount about the brain and maths learning. Many key plot points came from these discussions: the idea that Dr Dikita Dey should be a neuroscientist; the emphasis on how the characters learn and change their attitudes to learning during the show; the concept of robots controlled by cerebral organoids.

The games, as we had intended, were heavily inspired by our advisors' research: particularly the emphasis on rotation and spatial visualisation, use of positional language, and how important gesture became within the show. Dr Farran and Professor Tolmie provided detailed input on language use with children during activities, which was hugely reassuring (when they pointed out things we were doing well) and helpful (when they pointed out aspects we could improve).

“I was impressed with how your performers led the two-dimensional activities: they used all the right language, and their interactions with the kids were spot-on.” *Professor Andrew Tolmie, Birkbeck College*

Often, we were amazed by what we learned. At the Q&A in Manchester, for instance, we were all astonished to discover how quickly our brains can grow new connections – a fact which made it into the finished script. Our advisors' rigorous questioning and detailed feedback also pushed Sarah into exploring the emotional landscape of the characters with more depth and nuance – a slightly unexpected benefit of involving senior scientists in a theatrical project.

“It was lovely, seeing the scientists' eagerness for creatively sharing their world with us. I learnt about neurons, and the endless re-sculptability of the brain.” *Seiriol Davies, “Dr Ernest Volcano”*

“Had an absolute blast doing the Manchester week and enjoyed everything immensely (learned a lot, too).” *Robin Simpson, one of our R&D performer-devisors*

Our advisors enjoyed the process of collaborating with us, and felt the exchange had not just been one-way:

“It was a massively stimulating and enriching experience... Personally, many insightful questions from Sarah (and later on the members of the team) were helpful in making me reflect on my own research, its wider relevance, and how to communicate this.” *Professor Matt Nolan, University of Edinburgh*

“The project has shown me the importance, if not necessity, of using multiple avenues to communicate key ideas about brain function and education to children. Theatre is a powerful medium to achieve this, especially the immersive, interactive experience provided by the We're Stuck production.” *Professor Michael Thomas, Centre for Educational Neuroscience*

Success

We're proud of how well we integrated research into the performance.

"I thought it was excellent and so engaging. The kids absolutely loved it and so did I... the children lapped up the challenge, which is great."

Professor Emily Farran, Birkbeck College

"the show was remarkably successful at making abstract scientific ideas fun and entertaining for a young audience.... I was thrilled to see how engaged the children were... Working with Sarah felt like a very effective way to contribute to scientific communication to the wider public."

Professor Matt Nolan, University of Edinburgh

See "Audience Impact" (below) for more detailed evaluation of the impact on our audiences.

Artistic process, practice and quality

Initial objectives:

- To create a piece of theatre that is exciting, funny, accessible, and empowering.
- To tap into the swirling pools of strong emotion so many of us carry around maths, mistakes, and being clever.
- To develop a theatrical language which combines elements of game-play, clowning and dramatic story telling to playfully grapple with complex subjects.

We're Stuck! marks a new development in Sarah's artistic practice: for the first time, working as lead artist with a team of devisors, writing the script as well as directing. It was also the first time Sarah had worked directly with a producing company. As producers, China Plate supported the financial and project management of the project, creating the space for Sarah to realise this ambitious project, whilst also offering solutions and problem solving throughout the project's development.

"The experience was thrilling, if sometimes terrifying. It was wonderful to work with such a high calibre of collaborators. We're proud of the quality of what we created together." *Sarah Punshon, Director*

"It's brilliant! I loved it." *Michelle Walker, The Hat Fair*

"The whole setting, scenery, props and especially the actors were excellent. We totally didn't expect it to be so much fun. Genuinely laughed out loud a lot and left feeling really glad we'd been. The children in the audience got really stuck in and it was great to see them so enthused and unafraid to shout out. Elise loved it. An absolute triumph." *Elise's Guardians*

The show was referred to by many children and adults as "funny" (a fact frequently remarked on with some surprise, given that they'd come to a show involving maths).

The high quality of the performances was also frequently commented on, including by theatre professionals and critics:

“thanks to the warmth, energy and inventiveness of the performers, it's extremely exciting” *The Londonist*

“I thought your actors were all ace, particularly the woman playing Dikita – brilliant job as the moral heart of the story – and Dr Volcano was hilarious.”
Sam Howey Nunn, freelance theatre producer

“Clare Dunn... is an electric fizz of ornate gesticulation, rubbery as the human, clipped and stiff as the machine [...] Seiriol Davies... made me cry with laughter, [and brings] a quick-wittedness that means he can respond in a snip to everything the audience throw at him, as energetically at the end of the show as he does at the beginning.” *Maddie Costa, Exeunt Magazine*

We were pleased with the balance we struck between game-play and dramatic story telling. Many audience members commented positively on the interactive structure.

“I loved that you involved the children in a very real way. I thought the number of different rooms was a brilliant way to ensure wriggling bodies remained completely focused. The problems were so cleverly introduced. It was incredibly fun and funny.” *Parent comment*

“Treating the kids as proper people and getting them fully engaged.”
Parent comment in answer to “what did you value most about the show?”

It was clear that children felt a great responsibility to solve the problems and save the day, with excitement building as the plot progressed. Occasionally the show was even a little too exciting for one or two younger members of the audience, who had to be given time-out or leave the show entirely at particularly scary moments.

“It all becomes surprisingly high-stakes for the kids: my smallest, admittedly only seven, so younger than the recommended age range, had a meltdown at the potential dangers.” *Maddie Costa, Exeunt Magazine*

“I asked him how scared he actually was and he said: I thought 'am I going to get out of here alive' (!)”
Sam Howey Nunn, freelance theatre producer, of her 10 year old.

For most of our target 8-11 year old audience, however, we seemed to have pitched the level of excitement about right: we followed up a comment that the show was “scary” with one quieter child, asking “bad scary or good scary?”, and she said, “just a little bit scary”.

“My year 3 daughter seemed terrified. When I suggested she left she laughed, and said 'I'm just getting into the atmosphere of it mum' would love to see more shows like this.” *Parent comment*

Maths on Toast staff member (and ex-primary school teacher) Francesca Piacentini observed two performances in order to evaluate audience response:

Engagement:

From the outset all of the children were fully engaged with ‘magnet eyes’ to the stage, or wherever the action was unfolding, and this was maintained throughout (for 70 mins). When you bear in mind the average focused attention span of children under 12 and how they frequently require a change of activities, this is worth noting as an indication of the overall success of the show as being enjoyable and engaging.

Audience Participation:

The large majority of the children were keen to offer contributions. Although eager to be heard there was little in the way of children talking over one another or interrupting. They listened well and responded to the input of other children, who were in most cases unknown to them. Although adults accompanied the children and there was a structure to ‘contain’ their involvement, there was still room for them to get ‘silly’, but they didn’t. This suggests that the children had really taken on the role of professors, had connected with the characters and felt that they were part of a team working together to solve the problem.

The audience participation elements in the show were excellently by the performers during the performance. Rules were subtly outlined from the beginning that encouraged sharing, listening and respect of the space.

The show was accessible to a broader age range than we originally thought, with many six and seven year olds and some twelve and thirteen year olds enjoying taking part. We were delighted that a broad demographic range of children saw the show – see Marketing and Demographic Reach below.

“The way the children were encouraged to participate, and the range of levels it could be accessed on. How thrilling and actively scary parts of it were. The adrenaline made it exciting for the kids, and that made maths exciting.”

Parent

“Making my son laugh so much and seeing him enjoy something other than sports.”

Parent, in answer to the question, “What did you value most about the show?”

“The show was just brilliant and so engaging – my girls who are very critical said it is their favourite show at Z-arts.”

Zoe Pickering, Children's Theatre Programme Manager, Z-arts



Audience Impact

We had big ambitions for the audience experience which went well beyond the enjoyment, entertainment, energy and humour described above.

The aims for the show included:

- To create a show that provokes discussion, builds confidence and perhaps even changes beliefs around maths, learning and the brain.

Our post-show resources also aimed to:

- Increase children's enthusiasm for hard problems
- Support parents/ teachers to praise struggle and strategy

We gathered information to assess whether we had met these outcomes in a number of ways. During the development phase, we carried out observations and asked audiences (in schools and in public places) for feedback. During the show, we assessed the audience's experience through observation by educational and theatre professionals, as well as our team of advisors. We also spoke to groups attending the show, before and after. Finally, we sent out a questionnaire to audiences following the show, which attracted 28 responses, many in some depth.

Learning about the brain

“The production had stimulated a lot of thoughts on learning and the brain, as well as what computers and robots could do. There was enthusiasm both among the children and the parents. The children plucked up the courage to ask lots of questions of the 'scary neuroscientist'. It was clear to me that both the curiosity and the imagination of the children in the audience had been fired by their experience.” *Professor Michael Thomas, Centre for Educational Neuroscience*

In an activity before two of the Manchester development workshops, we asked audiences: “Lisa is struggling with a hard maths problem. What do you think is happening in her brain?”. Their response was to be written or drawn inside an outline of a head, with a brain outlined inside that. The 38 responses included images of mathematical symbols and problems (numbers, axes, + x etc.), question marks, ‘fireworks’, cogs, small people, images that we could not interpret and the occasional blank. Only one person gave a biological answer: a suggestion of inner and outer layers of the brain and the phrase ‘cerebellum becomes engaged’ from Joey, 9. Nobody mentioned neurons or brain cells, suggesting that the majority of this audience had no particular sense of the inside of the brain before the workshop.

In our follow-up survey after the finished show, 15 respondents (the majority) told us that they or their children had learned something about brains or brain cells:

“They talked about brain cells all weekend!! The show really engaged them and piqued their interest in how the brain works.” *Parent, post-show survey*

“My children became fascinated by the fact that cells mean and do different things and by the idea that cells could be stored or replaced.”

Parent, post-show survey

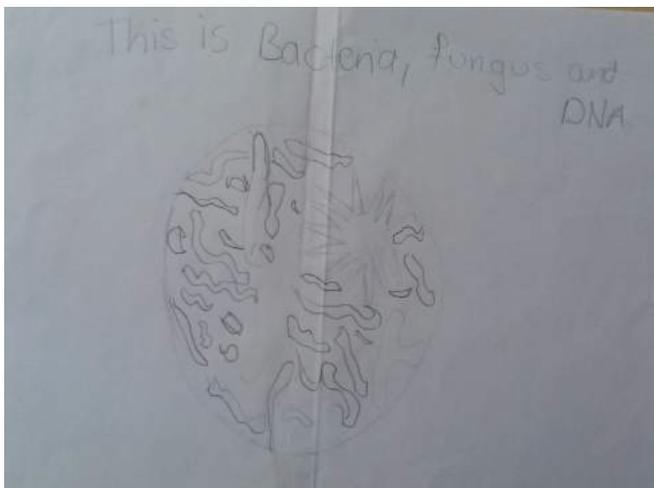
Talking to children as they emerged from the show also supported the sense that people had learned about the brain:

“We have brain cells, more than a hundred of them in our heads, and it’s all squishy”.

Year 4 child, verbal comment

One child sent us in a picture of DNA in a petri dish, clearly inspired by the “cerebral organoids” in the show.

Responses to the survey also suggested that this new knowledge about the brain was supporting beliefs about learning and ability – the idea that your brain can grow:



“Your brain adapts so that you can learn more and there is something beginning with 'n' that I can't remember”

Elise, aged 12, quoted by parents in post-show survey

“They talked about neurons a lot. And that new connections can be made.”

Parent, post-show survey

“Yes, the idea that they can be a living culture, that working your brain causes new connections and pathways to form, and that using your brain helps it improve.” *Parent, post-show survey*

Although four people told us they hadn’t learned anything about brains, one of those said this was because he was already quite expert due to his son’s enthusiasm for the topic.

Confidence and beliefs about learning, maths, mistakes and being stuck

“We really enjoyed the show - it was very ingenious to go into all those different spaces for unexpected challenges and happenings - and of course I loved the message about maths! Many congratulations to everyone involved.”

Anne Haworth, Chair of General Council, Association of Teachers of Mathematics

96% of our survey respondents (sample size: 28) identified that there was maths in the show. Although there was disagreement within the responses about exactly which elements were mathematical, this nonetheless indicates a very strong general sense that the show was about maths – and given that this same group also enjoyed the show, a connection forged or supported between maths and enjoyment.



Comments also supported that we were representing maths in a positive light.

‘They were all really engaged, a lot of them don’t really like maths, there are about 5 in the class that really love it but today I noticed how they were all engaged.’ *Teacher, verbal comment*

“My children love maths anyway, but I think constantly re-enforcing the positive and incredibly important aspect of math in our everyday lives is crucial to the future problem-solvers we expect them to be.” *Parent, post-show survey*

“... The adrenaline made it exciting for the kids, and that made maths exciting.” *Parent, post-show survey*

“They had a great time and it helped consolidate their current understanding in a fun and practical way.” *Parent, post-show survey*

We were particularly pleased to note a comment about maths as diverse, as well as useful:

“...Time will tell I suppose, but the kids loved the vitality of the show and seemed to engage well with the concept that Maths could be fun and useful to solve problems. And that it's diverse...” *Parent, post-show survey*

One comment shows we influenced aspirations. One girl was inspired to explore electronics – a field where maths is valuable, and not a field traditionally marketed to girls – by the show:

“Lola loved guessing the door code and using coordinates. But the most important thing was it opened her eyes to computers, robots and electronics. She now wants an electronic set!” *Parent, post-show survey*

In our survey, we also asked our audience: “In all honesty, do you think the show had any impact on yours or your children's confidence or enthusiasm when it comes to maths?”. and we had 18 positive answers. Discussion ranged from straightforward enjoyment:

“Both my kids (aged 11 & 8) really enjoyed the show and were enthused to talk about the maths and problem solving on the way home.”
Parent, post-show survey

to the supportive nature of the interaction:

“Being at a stage where she is beginning to feel confident that she can do maths her confidence was greatly reinforced by the interactions in the show.”
Parent, post-show survey

“I'm not sure - they both love maths already. They were happy because they knew some of the things already like x and y axis and that this was recognised and praised by the actors.” *Parent, post-show survey*

People carried on playing our games after the show:

“We played the guess the number game all the way home... loved it. We have sent the information to our maths teacher friends in Australia! Thanks for a great show.” *Parent, post-show survey*

One child was so motivated by the show that her parents identified she had afterwards made significant progress in maths:

“Yes. Definitely. She spotted the problem solving, and thought that the people were 'cool' and 'fun' improving her perception of maths. She has voluntarily sought and completed a daily maths task since the visit, and passed her 'times machine' to enter the school 'super group' after being stuck on the same level for a few months” *Parent, post-show survey*

We saw particularly strong evidence that attitudes to making mistakes and to being stuck were influenced by the show. Parents and children emerging from the show consistently commented that they liked the show’s messaging around making mistakes

“I liked the idea that you have to make mistakes to learn.”
Parent, verbal comment

“Especially in maths I don’t always succeed at first so often I have to try two or three times” *Child, verbal comment*

and this was supported by our survey:

“Hopefully - the message about having to keep trying/trial and error/not giving up the first time you get something wrong is important (my youngest - aged 7 - struggles with this at the moment as she doesn't like making mistakes).”
Parent, post-show survey

“It carried an important message about it being acceptable and beneficial to get things wrong, a concept which they often struggle with.”
Parent, post-show survey

“Yes because you could shout out any answers you thought it was and you didn't have to care about getting the answers wrong' (Elise)”
Parent, post-show survey

One child, asked whether any part of the show would help with maths, described one of the problem-solving scenes, with appreciation of the level of challenge:

“The part when we had to figure out what was the right one to turn off the lasers.... if we are doing something in maths it’s often easier”
Child, verbal comment

We were also able to follow children’s engagement with tricky problems through their feedback on the “Recruitment Pack” we provided after the show. Thirty-six children responded to our feedback mechanism. In this context, we asked children what activity they had found hardest in the booklet, how long they’d spent trying to do it, and what they find most useful to do when stuck on a problem. The time frames in the answers were especially interesting, with children declaring that they had spent as long as two weeks on a problem. Only seven children gave time spans less than an hour.

This shows pride in spending a lot of time on a problem, indicating a value for perseverance.

Suggestions for what to do when stuck showed that children were aware that persisting requires effort and may involve strong emotions. They included:

'Let my brain and heart tell me what to do'

'Try different methods'

'Calm down and do it later'

'Try and try again'

Children's responses from the Postcard to Dr Volcano activity

Name: Professor Ayza
Age: 7 Girl/Boy: girl
Address (so we can reply): [redacted]
Postcode: EN9 [redacted]
I visited Volcano Industries on (date): 26/03/2016
In this pack, I most enjoyed having a go at: Dancing like volcanobot
The trickiest bit was: Having to look for the right + coordinate
and I spent 30 days/hours/minutes trying to figure it out.
When I get stuck on a hard problem, I find it most useful to: Try and figure out another way to do the activity.

Marketing and Demographic Reach

We were delighted with our diverse audiences, and that in London we succeeded in smashing our box office targets. Overall we reached 67% capacity across 36 performances in four different venues.

Our press team at Mobius managed to get extensive preview and review coverage for the show, we were particularly impressed with the results due to the short run and the challenge of promoting theatre for young people in the press. They secured show previews in high profile publications including The Guardian and Time Out, as well as reviews from The Times, Exeunt and Londonist. Please see press report attached for full details. Based on the circulation of the top publications the show was featured in we can estimate that our readership of this press coverage stands at over 800K people.

Shoreditch Town Hall school shows sold-out to a c.80% BAME audience, and family shows reached 86% capacity. Burnley Arts Centre achieved 93% audience capacity, however schools in the area proved difficult to engage due to the Easter holidays and the venue being without a marketing officer for a number of months. Burnley reduced ticket prices to encourage booking. The Boo, Waterfoot made particular effort to engage the participants of 'Different Moons', an artist led project that, through the Apna Centre, aims to record the stories of individuals from India, Pakistan and Bangladesh who settled in Rossendale after the war. Users of the Apna took advantage of a discounted ticket price and made up 30% of the family audience. Z-arts, on the other hand, struggled to hit audience targets. This was mainly due to the varied Easter holiday dates across Manchester; however, too much focus had possibly been placed on maths and science content in initial marketing. Z-arts felt the final show could have been more effectively marketed as a high-quality, funny, exciting adventure.

During the development of the show we worked closely with our venues to develop a comprehensive marketing plan that promoted the scientific and mathematical content as well as the dramatic experience. Mobius PR were committed to raising the profile of the production through the national press and secured a number of high quality preview features (Timeout Easter Tips, Mathematics Teaching Magazine, Lyn Gardner's Theatre tips) and reviewers to attend throughout the London run (Londonist, The Times, Exeunt, First News) – please see reviews and full press report attached. We ensured production images were taken at the earliest opportunity and created short video trailers for each venue to help promote the high production values and adventure side of the show.

Shoreditch Town Hall is in the early days of building up a family/school audience through its programming, particularly outside of the Christmas season. We worked closely with the marketing team to target local schools, youth centres, after school clubs and parenting forums to reach out to those audiences. It was a streamlined campaign that focussed on the local schools and residents living in very close proximity to the theatre. School shows sold out, including two classes from Jubilee Primary (who hosted development workshops in November), and four classes from Nelson Primary School in Newham. The public performances reached an average capacity of 86%, which far exceeded the 50% we had originally aimed for in our financial target.

28% of children at Jubilee Primary School and 14% of children at Nelson Primary School are eligible for Free School Meals (a poverty measure – data source: Edubase). This means that on average, the proportion of children at each school performance who

were eligible for free school meals is likely to be about 19%, above the national average of 16% (DfE, "Schools, pupils and their characteristics" 2015). The marketing department have commented that the primary school audiences were made up of approximately 80% BAME children, which is reflective of the demographic data available for the school postcodes showing their local populations being made up of nearly 70% Indian, Pakistani and Bangladeshi residents (ONS).

The audience demographic for the Shoreditch Town Hall family performances was more difficult to quantify as 40% of bookings did not provide a postcode and the remaining 60% was made up of 69 different postcodes, 97% of which were London postcodes, with 3% from Essex. However, 23.5% of bookings made use of the Hackney residents' discount, so we know we were reaching the local audience as well as the broader London market.

Z-arts ran an extensive and thorough marketing campaign involving a large number of themed activities, fun days and events run in partnership with local organisations. The development workshops held there in October were presented in partnership with Manchester Science Festival who continued to support and promote the final performances. The education team also ran a number of activities designed by both them and our partners Maths on Toast at the Manchester University Science and Engineering Fair that reached nearly 900 participants over three days. Z-arts were incredibly happy with the production overall and were disappointed that their audience figures did not reflect the quality of the work.

Z-arts are committed as a venue to increasing their cultural reach and ensuring that their audience reflects the diverse makeup of their surrounding area; after English the second most spoken language in Manchester is Somali, closely followed by Arabic (Manchester City Council). The venue has been engaging with local community groups, leaders and artists to diversify their activities and reach beyond their current audiences.

The booking patterns in Manchester show incredibly varied postcodes. The highest percentage of bookings came from two postcode areas: 11.5% from SK4, where the vast majority of residents are white (88%) and working class/non-working (46.7%); a further 11% came from M16 where over 60% of residents come from a non-white ethnic background, with equal numbers (approx. 28%) classing themselves as both upper middle class and working/non-working class in the same postal area (Z-arts sales reports and ONS). Whilst we do not have exact demographic data for the performances, the postcode data implies that the show appealed to an ethnically and socially diverse audience.

We monitored gender at early workshops at Z-arts, and in a sample of 55 children, 67% were female. This is not an uncommon balance for theatre, but for children's events on topics like maths and robots the balance tends to be the other way. This finding supports indications from our earlier development phase that theatre may bring girls to maths in a way other activities do not. In general, across the audiences, there was a good mix of girls and boys at performances – perhaps the 'robots' message was coming across strongly, and supporting bringing more boys into theatres! We have no data on gender at the final shows, but will look into ways to collect this information for future performances.

We asked the same group of families about when they had last been to the theatre and when they had last done maths for fun. Both questions showed huge variety. Children

reported having been to the theatre most recently “last year” and “last Christmas” as well as “yesterday” and “last week”. They reported having done maths for fun “never”, “?” and “ha ha” as well as “last week” and “at school”. Fiona, 39, reported that she had last been to the theatre “yesterday” but had “never” done maths for fun before, while Kate, over 18, reported doing maths for fun “yesterday” with her last theatre trip “last year”. This indicates that mixing theatre, maths, neuroscience and robots can bring audiences to experiences they’ve never had in the context of experiences that are comfortable and familiar.



Summary

Overall the development and creation of *We're Stuck!* has been an exceptionally rewarding process. The collaboration between our scientific advisors and the creative team was highly successful and resulted in a theatrical production that was truly inspired by the science and research behind the story. Young audiences were transported into Volcano Industries and opened their minds to the challenges and tasks they encountered. They were willing to make mistakes, get stuck and risk total failure in the name of saving Bernard and the world from killer robots.

By creating a promenade, interactive adventure, audiences were invited to immerse themselves in the story and given a highly meaningful experience in return. *We're Stuck!* was a visual feast with high production values, which were consistently noted by our peers, partners and audiences.

The production appealed to family and school audiences in equal measure, which was incredibly important to our aims. Feedback from both our scientific advisors and audiences suggests that the show not only engaged the children with exciting scientific and mathematical concepts but also encouraged struggle and bravery in making mistakes.

We're Stuck! has the power to make a big impact on children from highly diverse backgrounds, and ought to be experienced by as wide a range of audiences as possible.

It's been a wonderful journey and we are excited about the potential for future touring that this initial run has opened up.



Credits and Thanks

We're Stuck!

Written and directed by Sarah Punshon

Performed by Daniel Bye, Seiriol Davies, Claire Dunn and Avita Jay

Devised by the company with Hannah Boyde, Nadia Emam, Abbi Greenland, Robin Simpson and Balvinder Sopal.

Designed by Joanna Scotcher

Lighting design by Joshua Pharo

Sound design by Elena Peña

Games design by Sophie Sampson

Produced by China Plate

Production manager: Chris Whitfield

Stage manager: Jennifer Hunting

Scientific Advisors:

Professor Matt Nolan, Professor of Neural Circuits and Computation, University of Edinburgh

Professor Michael Thomas, Professor of Cognitive Neuroscience at Birkbeck, University of London / Director of the University of London Centre for Educational Neuroscience

Professor Andrew Tolmie, Chair of Psychology and Human Development, UCL Institute of Education, University College London

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