



Science **Communication**

The **key** to unlock complexity
for **understanding**

Marie McEntee, School of Environment




Approach

Audience

+
Accessibility

Assessment

+
Activities



My approach: Writing framed as
Communication

One-Way Transmission Model



One-Way Knowledge Deficit Model



Source: Why does the best sleep come in a boring lecture?

One-Way Tailored Approach



Two-Way Constructed Model



SCIGEN 101 dialogue session



Sea Science Curious Minds Tertiary Outreach

Writing is **not** easy



Science Communication Challenges

1

Challenge of **complexity**

2

Challenge to be **heard**

3

Challenge of **hearts & minds**

A landscape photograph of a field at sunset. The sky is filled with soft, colorful clouds in shades of pink, orange, and blue. In the foreground, there is a field of tall grass. On the left side, there are several trees, and on the right side, there is a single tree. A semi-transparent white rectangular box is overlaid on the center of the image, containing the text "Overcoming the Challenges".

Overcoming the Challenges

Know your Audience

SCIENCE COMMUNICATION IN AN AGE OF RISK

A Case Study of Two Biosecurity Incursions

Marie McEntee

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Arts in Film, Television and Media Studies,
The University of Auckland, 2005.

Thesis

41,000 words / 168 pages
250 references
1 Year



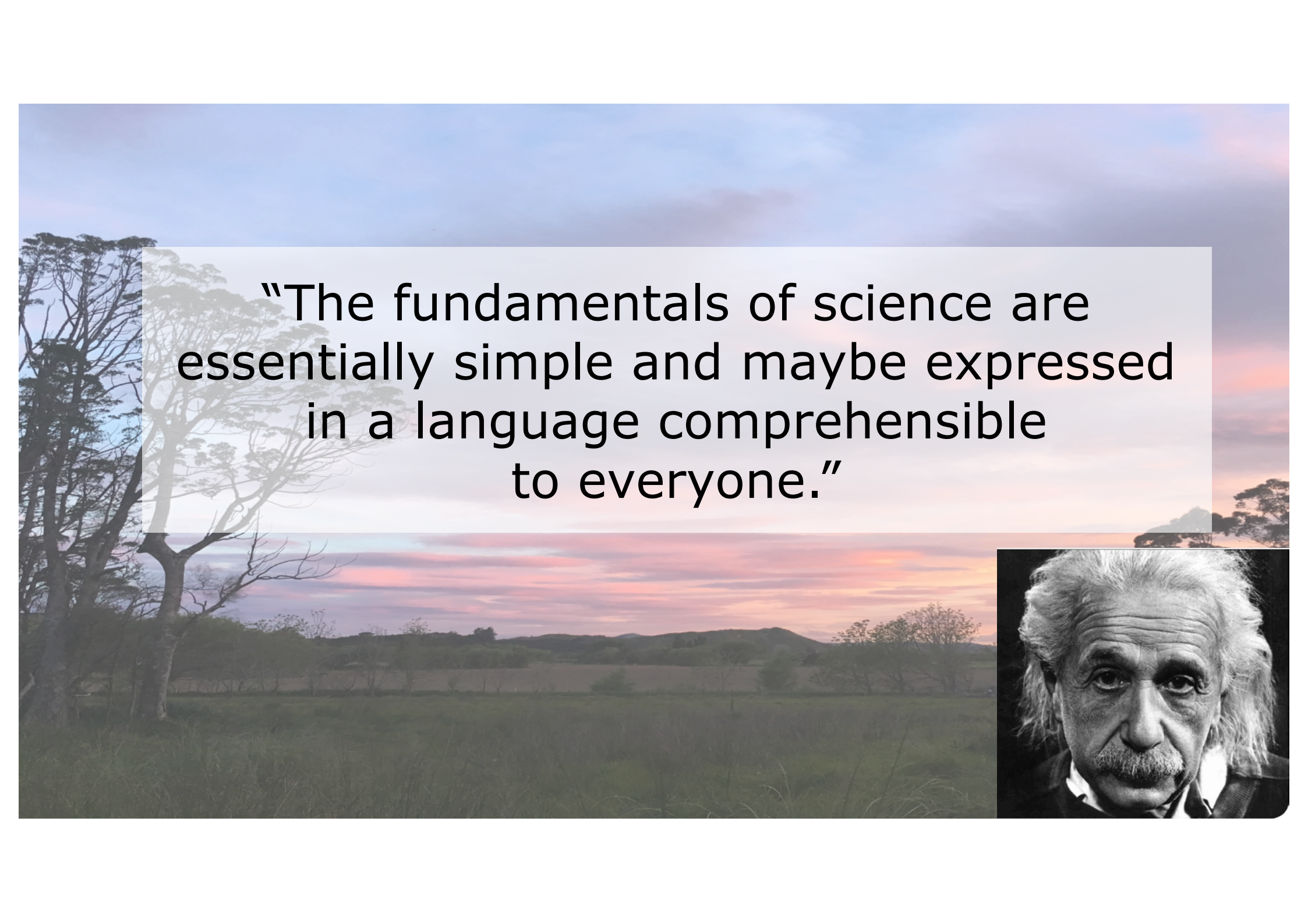
Journal Article

5000 words / 8 pages
24 references
12 weeks

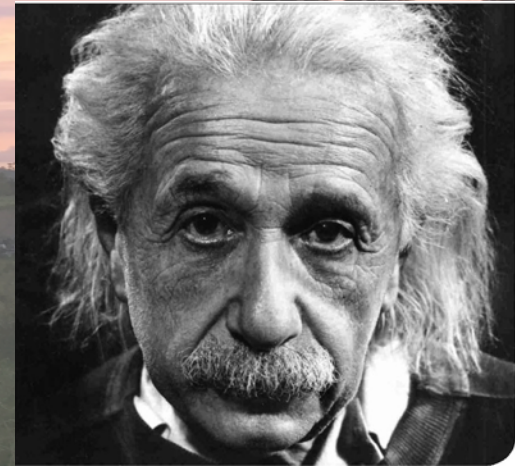


Op-ed

650 words / ¼ page
No references
1 day



"The fundamentals of science are essentially simple and maybe expressed in a language comprehensible to everyone."



Accessibility

baib/zns-neurol/zns-neurol/zns03007/zns3838-07a | tarbutta | S=7 | 9/17/07 | 13:43 | 4/Color Figure(s): 2,4,5,6,7,8 | Art: 3268820 | Input-Y(Y)

The Journal of Neuroscience, September 26, 2007 • 27(39):44–49 • 1

Behavioral/Systems/Cognitive

Paradoxical Facilitatory Effect of Low-Dose Alcohol Consumption on Memory Mediated by NMDA Receptors

Maggie L. Kalev-Zylinska¹ and Matthew J. During^{1,2}

¹Department of Molecular Medicine and Pathology, Faculty of Medical and Health Sciences, The University of Auckland, 1142 Auckland, New Zealand, and ²Molecular Virology, Immunology, and Medical Genetics, The Ohio State University, Columbus, Ohio 43210

Epidemiological studies have suggested a negative correlation between alcohol intake and Alzheimer's disease. *In vitro*, ethanol negatively modulates NMDA receptor function. We hypothesized that chronic moderate alcohol intake leads to improved memory via adaptive responses in the expression of NMDA receptors and downstream signaling. We fed liquid diets containing no, moderate, or high amounts of ethanol to control and matched rats with hippocampal knock-down of the NR1 subunit. Rats with increased hippocampal NR1 expression were also generated to determine whether they had a phenotype similar to that of ethanol-fed animals. We found that moderate ethanol intake improved memory, increased NR1 expression, and changed some aspects of neurotrophin signaling. NR1 knock-down prevented ethanol's facilitatory effects, whereas hippocampal NR1 overexpression mimicked the effect of chronic low-dose ethanol intake on memory. In contrast, high-dose ethanol reduced neurogenesis, inhibited NR2B expression, and impaired visual memory. In conclusion, adaptive changes in hippocampal NMDA receptor expression may contribute to the positive effects of ethanol on cognition.

Key words: ethanol; moderate drinking; memory; NMDA receptor; NR1 knock-down; NR1 overexpression

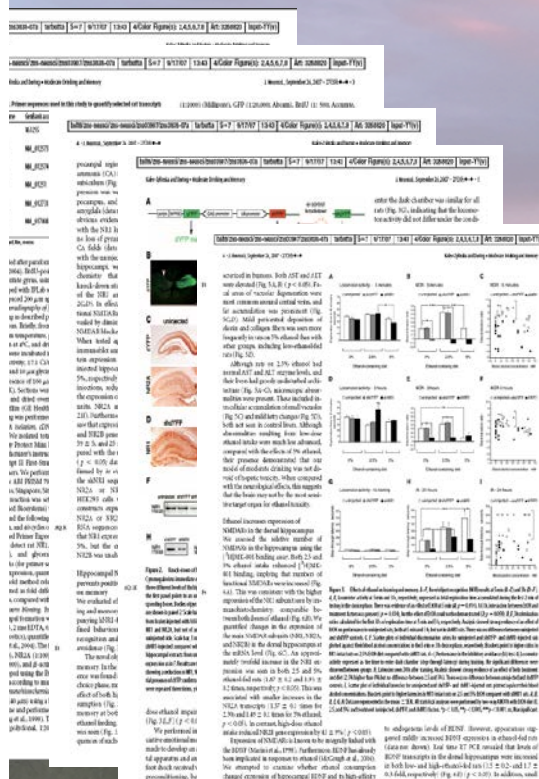
Introduction

In contrast to the cognitive impairment associated with acute alcohol intoxication, moderate long-term drinking may paradoxically improve cognition in humans compared with abstinence (Orgogozo et al., 1997; Ruitenberg et al., 2002; Truelsen et al., 2002; Stampfer et al., 2005; McDougall et al., 2006). In addition, human experiments performed on young socially drinking men demonstrated enhanced retrograde recall of visual and emotional stimuli (Parker et al., 1981; Hewitt et al., 1996; Bruce and Phil, 1997). Despite alcohol being extensively studied and widely used, the biological processes underlying its beneficial effects on memory remain unknown.

The NMDA receptor (NMDAR) is crucial for learning and memory and represents an important target for ethanol in the brain (Ronald et al., 2001). Although ethanol does not directly interfere with the ligand-binding sites on the NMDAR, it interferes with glycine signaling and acts as a noncompetitive antagonist of the receptor (Loving et al., 1989; Wright et al., 1996; Smothers and Woodward, 2006). In response to sustained ethanol administration, compensatory increases in the expression of NMDARs, including the NR1 subunit, have been demonstrated in animal studies in a number of brain regions, including the

hippocampus, cortex, and amygdala (Gulya et al., 1991; Trevisan et al., 1994; Roberto et al., 2006), although evidence to the contrary is also present (Tremwel et al., 1994; Carter et al., 1995; Rudolph et al., 1997). Differences are likely to be related to the dose and duration of ethanol administration, strain and age of rats, and the brain region studied (for review, see Kumar and Ticku, 2000). It remains unclear whether the changes in NMDAR subunit expression are involved in the behavioral consequences of ethanol consumption. Furthermore, animal studies into the effects of chronic low-level ethanol intake on learning and memory and on underlying neuronal changes are limited.

Here, by performing studies in rats, we examined how a model of moderate drinking influences cognition. We defined moderate drinking according to the criteria used for humans, as producing no impairing blood alcohol levels <20 mM (Eckardt et al., 1998). Based on previous reports, we hypothesized that a low-level ethanol intake could enhance memory for visual and emotional stimuli and that this requires NMDAR function. To test this hypothesis, we administered low and higher amounts of ethanol to rats, both unmanipulated and after knocking down the NR1 subunit in the hippocampus using RNA interference. We investigated effects on memory by testing performance in the novel object recognition and inhibitory avoidance tasks. These tasks examine recognition and emotional memory, respectively and both are hippocampal and NMDAR-dependent (Mason, 1999; Broadbent et al., 2004; de Lima et al., 2005). In contrast to the recognition memory, which involves large hippocampal networks, emotional memory is predominantly controlled by the ventral hippocampus and amygdala (Cahill et al., 1996; Kjelstrup et al., 2002); however, dorsal hippocampus also contributes (Melik et al., 2006). In addition, we examined here a few selected



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Copyright © 2007 Society for Neuroscience 0270-6474/07/270044-06\$15.00/0



CHIEF: Dr. Maggie Kalev-Zylinska and Professor Matthew J. During hope their research will help find treatments for memory disorders. PHOTO: PAUL ENFANT

Alcohol has memory hangover

Too much drinking reinforces negative memories, say university researchers

By David King

Science reporter

A glass or two of wine a day may just make the night a little less sharp, but drinking to forget could make things worse.
A new Auckland University study found moderate levels of alcohol consumption could enhance memory.
But high levels of alcohol decrease the ability of new brain cells to develop and mature, and impair memory – except in animals of biological interest, when necessary to be learned.
“Low levels of alcohol provided neutral memories, such as remembering objects,” said researcher Dr. Maggie Kalev-Zylinska.
“However, contrary to popular belief, we also found that excessive levels of alcohol reduced recognition of

highly emotional stimuli, meaning the memory of “drinking to forget” is not truly to be forgotten. Our work suggests that heavy drinking actually reinforces negative memories.”
The results of the study by Dr. Kalev-Zylinska and Professor Matthew J. During are published in the latest *Journal of Neuroscience*.
Professor During said they were not only aware how moderate levels of alcohol aided in improving memory, but believed it was through its interaction with NMDA receptors in the brain.
“Alcohol interacts with that particular protein in the brain and disrupts and alters its function in a way that actually infuses a little bit of stress in the brain.”
“It was a process similar to the strengthening of muscles by stretching

DRINKING TO REMEMBER

A moderately level of alcohol consumption offers some benefits, but a hangover is not.
High levels of alcohol disrupts the pattern by influencing additional parts of the brain.
Professor During said a moderate level of alcohol varies among individuals.
“We’re basically saying the level of drinking is the threshold.”
The study, conducted on rats, looks at important key for extending future treatments for memory disorders such as Alzheimer’s and other dementias, and improves recovery prospects for those who have had a stroke.
Dr. Kalev-Zylinska and Professor During are now looking at therapies such as anti-oxidants. “Drugs that inhibit oxidative stress in the brain may be a way to improve memory,” she said.
“It’s probably because there’s a little negative effect

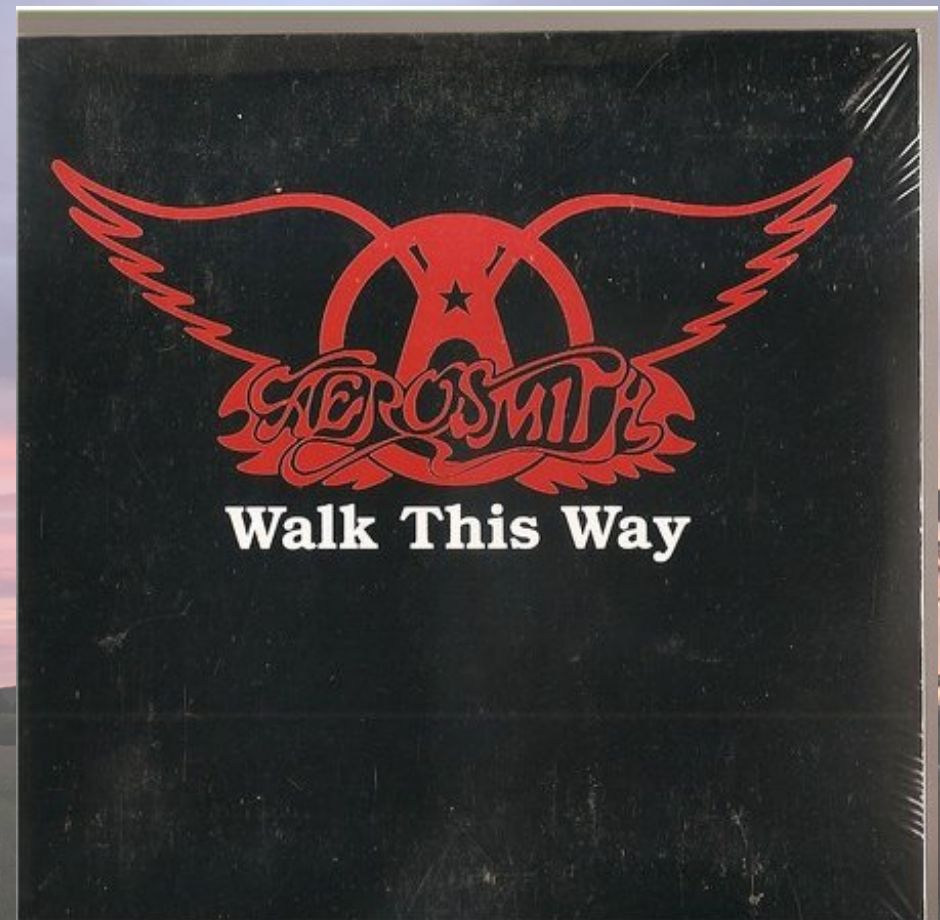
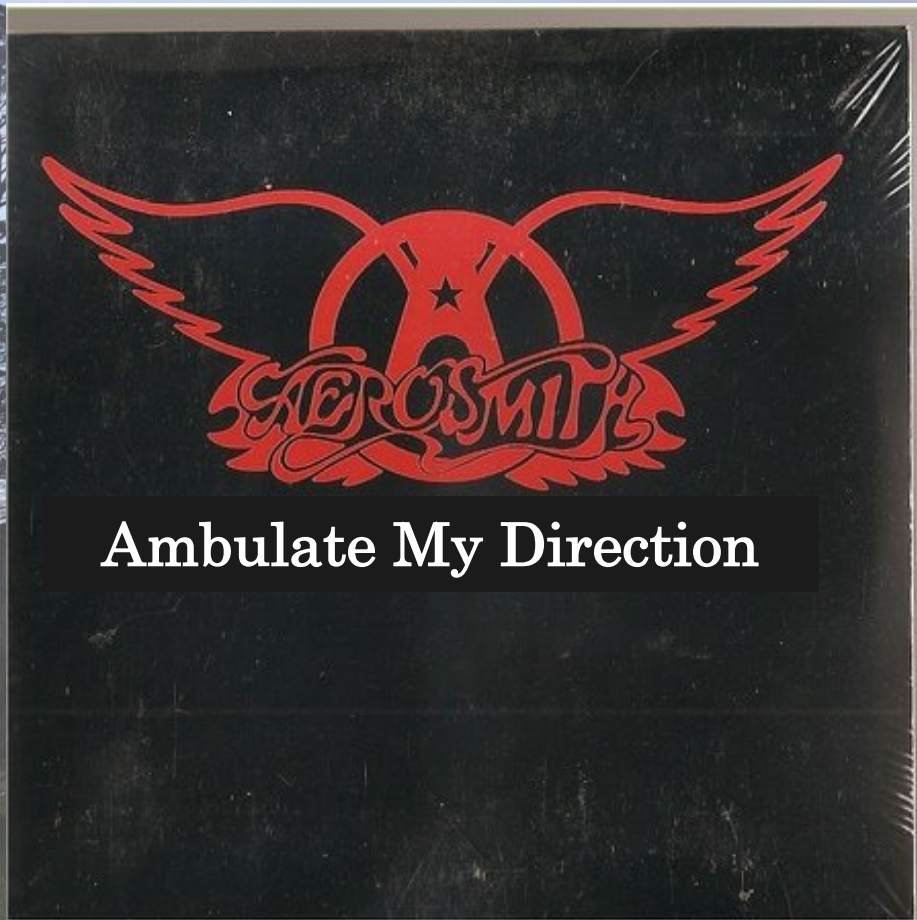
constant in having too good a memory ... you just imagine [remembering] every time you eat and you never get bored, never forgets anything, you’d get paranoid. It’s too terrifying so you shut down and you can’t function in society.”
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Accessibility of Language

“Interpretation of water chemistry behaviour on the basis of these relationships presents a simplistic overview which reflects either an increase in concentration commensurate with a decrease in soil moisture levels in relation to soil water samples, or an increased dilution effect as a result of higher precipitation volumes diluting accumulated windblown dust.”

Source: An Editor's Farewell

Accessibility of **Language**



Source: Izil, T. (n.d). The power of simple words.

Keep the message **simple**




Tell Stories

“I stood up in the square to talk about taxes, and no one listened, so I started to tell a story of the fox and the goose and within moments all eyes were on me and all ears were listening.”

Cicero

Simplicity & Story-telling



A landscape photograph showing a sunset or sunrise over a field. The sky is filled with soft, colorful clouds in shades of pink, orange, and blue. In the foreground, there is a field of tall grass. On the left side, there are several trees, and on the right side, there is a single tree. The overall scene is peaceful and serene.

Building Student Confidence in Writing



Writing using different **formats**

Experiences from teaching SCIGEN & Curious Minds Outreach Project

Pose a Question - Access, Analyse, Interpret literature

More Smart with Mozart

The Mozart Effect describes a phenomenon where the ability to accomplish a certain task can be enhanced when listening to music by the classical composer Mozart (Jenkins, 2001). It is suggested that this paradigm is especially evident in learning (Jaušovec, Jaušovec & Gerlič, 2006). Any element that enhances learning is particularly valuable to students, most of who are constantly required to learn new material quickly and accurately. By using published literature on the Mozart's Effect from the fields of neuroscience and psychology this work aims to reveal whether listening to Mozart's music enhances learning by students. While there are various kinds of information, behaviours and skills that can be learnt, studies indicate the Mozart Effect is explicitly apparent in the learning of spatial skills (Jaušovec, Jaušovec & Gerlič, 2006). A clinical trial shows students exposed to Mozart's music during the learning of spatial skills scored 8-9 spatial IQ points more in spatial reasoning tests than when they were not listening to Mozart while learning (Rauscher, Shaw & Ky, 1993). To learn spatial skills particular regions of the brain are activated (Jenkins, 2001). Studies show these brain regions are activated significantly further when listening to Mozart in comparison to both silence and other music types (Bodner, Muftuler & Shaw, 2001). However there is controversy involved with the Mozart Effect as nearly an equivalent amount of studies challenge the theory. The predominant rebuttal claims that the enhancement of learning is not specifically due to Mozart's music and instead can be an effect of listening to any upbeat and enjoyable music (Thompson, Schellenberg & Husain, 2001). Studies investigating this idea have not been consistent enough to determine that the Mozart Effect in learning is unapparent (Jones & Estell, 2007). In conclusion listening to Mozart's music doesn't enhance the learning of all knowledge, instead is specific to enhancing the learning of spatial skills by students, through additional activation of involved brain regions.

Key words: Mozart's Effect, Learning, Students, Spatial skills

Condensed mediums e.g. An abstract

References

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Exemplar from SCIGEN 101

...and **Communicate**

Oral presentation & PowerPoint

Exemplar of slides for student talk from SCIGEN 101



The Mozart Effect

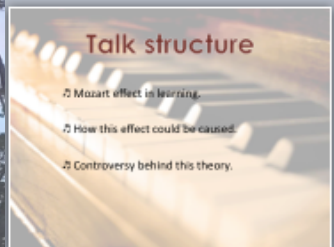
- The improved performance of a certain task caused by listening to music by Mozart.
- This effect is said to be present in many tasks, one in particular is learning.
- Mozart effect in learning would be beneficial especially to students.
- If the Mozart effect could improve learning the result could be better test performance.

(Dedrick, 2011)



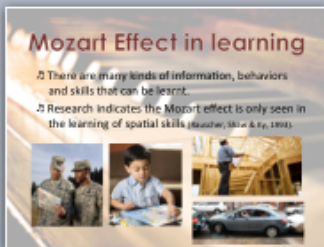
More smart with Mozart?

Does listening to music by Mozart improve learning by students?



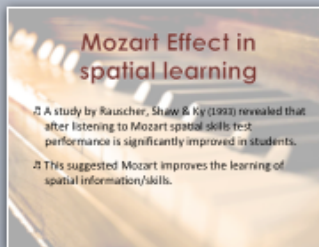
Talk structure

- Mozart effect in learning.
- How this effect could be caused.
- Controversy behind this theory.



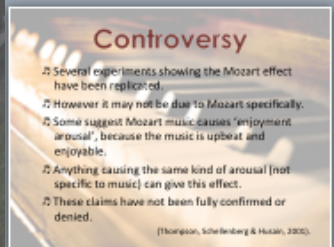
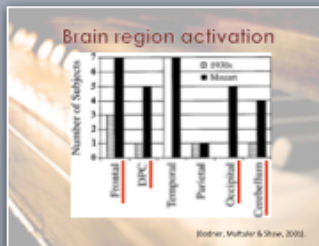
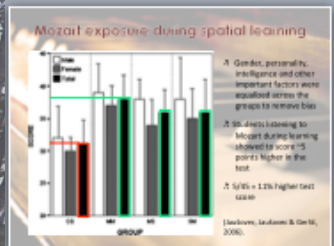
Mozart Effect in learning

- There are many kinds of information, behaviors and skills that can be learnt.
- Research indicates the Mozart effect is only seen in the learning of spatial skills (Rauscher, Shaw & Ky, 1993).



Mozart Effect in spatial learning

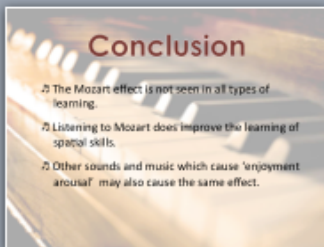
- A study by Rauscher, Shaw & Ky (1993) revealed that after listening to Mozart spatial skills test performance is significantly improved in students.
- This suggested Mozart improves the learning of spatial information/skills.



Controversy

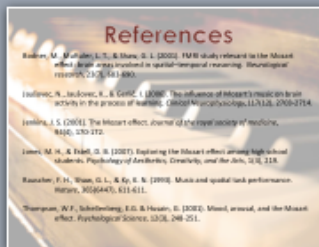
- Several experiments showing the Mozart effect have been replicated.
- However it may not be due to Mozart specifically.
- Some suggest Mozart music causes 'enjoyment arousal', because the music is upbeat and enjoyable.
- Anything causing the same kind of arousal (not specific to music) can give this effect.
- These claims have not been fully confirmed or denied.

(Thompson, Schenck & Huxton, 2002)



Conclusion

- The Mozart effect is not seen in all types of learning.
- Listening to Mozart does improve the learning of spatial skills.
- Other sounds and music which cause 'enjoyment arousal' may also cause the same effect.



References

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Academic Poster

Balancing the visual & the written

Student poses question, presents defensible argument based on sound published evidence that is well referenced



Introduction

The Mozart effect is a phenomena which advocates that listening to music by Mozart while performing a certain task, improves ones ability to perform the task (1). This effect is said to be present in a range of tasks one in particular is the action learning. This "improvement" in learning refers to many things such as the speed of learning, the difficulty of learning or even the amount of detail able to be learnt. In general any improvement to learning is seen as a better result if one was tested on, or had to perform, what they had learnt (2). This would be hugely beneficial to students who are learning and being tested on a regular basis.

Mozart effect in spatial learning

Learning is a variable task, we can learn different kinds of information, behaviors and skills. Original studies indicated that the Mozart Effect is only apparent in the learning of spatial skills (2). These are skills that allow one to navigate objects within space (see Fig.1).



Fig 1. Examples of tasks that require use of spatial skills. Engineering or architecture of a house, reading a map, solving a puzzle.

Listening to Mozart while learning has been shown to give significantly better performance in spatial skills tests taken by students (See Fig 2). These findings suggest that Mozart improves the learning of spatial information which allow students to get better test scores (3).

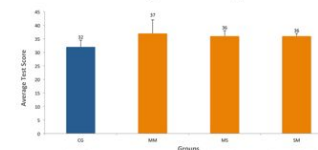
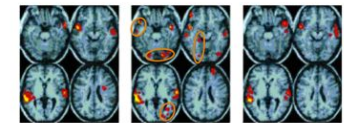


Fig 2. Average number of correct responses given in spatial test by respondents (psychology students) of four groups. Each group varied in exposure to music by Mozart when learning the same spatial skills (SM exposed during learning, MS exposed prior to learning, MM exposed prior and during, CG never exposed). CG group (blue) showed significantly lower score in comparison to all groups exposed to Mozart (Orange). A 5 point difference in average score is seen between CG and MM, that is an 11% greater test score for the full Mozart exposed group. This difference is suggested to be due to an effect by the Music as other variable factors were equalized i.e. no gender, personality, IQ bias. (n=56).

Sourced data from data in (4)

Biology behind the Mozart effect

In order to confirm that Mozart is improving learning and also understand the mechanism behind how it acts, investigations looked at where learning occurs -The brain (4). To learn spatial skills particular regions of the brain are activated. Studies show these brain regions are activated significantly when listening to Mozart (See Fig.3). The activation of these regions by Mozart in addition to the activation occurring naturally when undertaking spatial learning is suggested to give an "over activation" of these regions which cause the improvement in spatial learning (4).



1930s Piano Mozart Beethoven

Fig 3. fMRI scans at 4 angles of the brain in 1 individual. Red and yellow highlight areas of brain activation in subject during listening to 3 music types; 1930s piano, Mozart and Beethoven. All three show overlap of activation however Mozart induced significant additional areas (circled orange) which match known regions associated with spatial learning (4).


Controversy

Arguments are present around whether the Mozart effect may not be specific to Mozart (5). Some suggests Mozart causes 'enjoyment arousal', a brain stimulation caused by upbeat and enjoyable stimuli such as Mozart music. Hence anything causing the same kind of arousal (not specific to music) can give this effect. However studies do not consistently show Mozart causing all components of enjoyment arousal e.g. mood heightening not always seen (5).


Conclusion and Outcomes

- Listening to Mozart's music doesn't improve the learning of all knowledge, instead can only improve the learning of spatial skills by students.
- This effect likely occurs through over activation of brain regions involved in spatial learning. Other stimuli which cause 'enjoyment arousal' may also cause similar effects.
- Quantitative data on Mozart music causing enjoyment arousal would have helped further understand the mechanisms through which the effect occurs.
- Now it can be asked how the Mozart effect's improvement in learning compares to other techniques known to help in learning spatial skills.

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Assessment to expose the **imagination**



“An active imagination is a primary requirement if one has to deal with paradox, uncertainty and complexity.”

Brown, Deane, Harris & Russell, (2010). Towards a Just and Sustainable Future. In. V. Brown; J. Harris & J. Russell. *Tackling Wicked Problems* (pp3-15). London. U.K. Earthscan

Creative

Assessment

Exemplar of student poster from SCIGEN 101

THE TRUTH THE WHOLE TRUTH AND NOTHING BUT WHAT I THINK I REMEMBER

*How the type and style of questioning
affect eyewitness accuracy.*

Introduction

Synthetic techniques are often the most convincing and crucial of all pieces of evidence presented in the course of a criminal trial by jury. The accuracy of these techniques are therefore extremely important if the legal system is to succeed in convicting the right person and achieving justice. Unfortunately, inaccuracies of such justice are not uncommon. Many factors can affect a witness's ability to remember, such as stress, anxiety, and the time that has passed since the event. This raises the question of the reliability of memory, and how it is possible for someone to remember something they never actually saw. More specifically, using published literature from psychology, this work will examine how the type and style of questioning affects the accuracy of eyewitness techniques.

Model of human memory

To understand how the accuracy of memory can be affected, it is first necessary to understand how human memory really works. Many academics, including Bartlett (1975), have concluded that, contrary to popular belief, memory does not operate like a video recording of our lives, which can simply be played back at any given time. Instead, information we commit to memory is constantly being encoded and re-encoded inside the brain. As a result, memories are constantly updated by exposure to new information, however this also makes them highly susceptible to distortions.

Wording of question

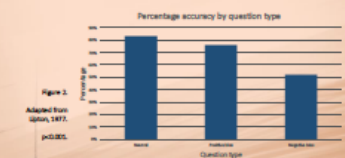
Elizabeth Loftus was one of the earlier researchers to show the simple way in which the wording of questions can affect memory. In Loftus and Zanni (1975), for example, subjects were shown a video of a car accident. They were then asked one of two questions: "Did you see a broken headlight?" or "Did you see the broken headlight?" Though the questions differed only by a single word, results from two separate experiments both showed that subjects asked about "the broken headlight" were more likely to report they had seen it, even though it was not in fact present in the video (see Figure 1).



Note: significance levels are calculated as these data were taken from a larger table which included data for "yes", "no", and "I don't know" answers. Significance level from a Mann-Whitney U test of the overall difference between "yes" and "no" subjects, using only those subjects who answered, was $p < 0.02$, where $p < 0.05$.

Type of question

It has also been found that the type of question affects the accuracy of answers given. After showing subjects a short video, Loftus (1977) discovered that neutral and open-ended questions yielded significantly more accurate answers than leading questions that asked about a specific item. Furthermore, and perhaps unsurprisingly, leading questions that asked about items actually present in the video (positive bias) yielded significantly higher accuracy than leading questions which asked about items not present in the video (negative bias) (see Figure 2).



Adapted from Loftus, 1977, p.102-103.

Style of question

Loftus, Weisbuch, Houtart, and Isbell (2006) studied the effect of deeper-style questioning on eyewitness accuracy. Questions consisted of three different styles: a control, questions asked in a deeper style, and deeper-style questions with negative feedback. For every "yes" answer given, it was found that deeper-style questioning alone did not produce significantly different results, however accuracy significantly decreased for questions that required a "yes" answer when negative feedback was provided (see Figure 3).



Conclusion

There are multiple ways in which the type and style of questioning can affect the accuracy of eyewitness techniques. From these studies, it can generally be seen that accuracy is higher when the question posed is more open and neutral, without suggesting the presence of a particular item, and where subjects receive no feedback as to the reliability of their answers.

These conclusions are certainly not exhaustive, and there may be many other ways in which the type and style of questioning affect eyewitness testimony. For example, more data could be collected on how the accuracy of answers is affected by the irrelevance of questioning, or the medium through which they are asked (oral or written).

Really, it is perhaps most relevant if further research is done into the correlation between confidence and accuracy of eyewitness testimony, and their effect on the likelihood of a jury or trial judge. These results, in combination with the findings above, may guide changes in practical policy in the criminal justice system so that the reliability of human memory for larger cases (violent people to be convicted of crimes they did not commit).

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Loftus, A. D. (1978). *The Psychology of Eyewitness Testimony*. New York: The Free Press.

Creativity can draw
in an audience...

Exemplar of student poster from SCIGEN 101

Can Exercise Make You Smart?

the effect of exercise on the brain

Introduction

Exercise has many benefits for the body. This study examines if exercise has any effects on the brain and if so, what these effects are.

The Study

Exercise is shown to up-regulate (increase the number of receptors on a cell to a protein) three particular proteins. (Colcombe & Kramer, 2003; Cotman & Berchold, 2002; Cotman, Berchold & Christie, 2007; Ma, 2008; Trejo, Camo & Torres-Alamán, 2009).

Brain-derived neurotrophic factor

BDNF is a type of protein from the family known as neurotrophins.

This means that it assists in neurogenesis (the production of new neurons) and the survival of older neurons. It is commonly found in the neurons in the brain and the periphery.

(the group of nerves around the brain and spinal cord).

After exercise, BDNF is up-regulated which means that the neurons in the brain and periphery take in more BDNF – inducing an increased rate of neurogenesis and helping the older neurons survive. (Cotman & Berchold, 2002; Hillman, Erickson & Kramer, 2008; Ma, 2008; Raichlen & Pulk, 2012).

Insulin-like growth factor

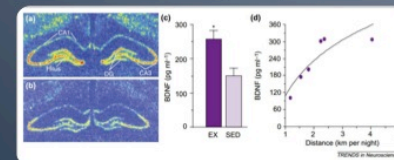
IGF-1 is similar in structure to insulin. It is important for the growth of children and the anabolic (muscle building) effects in adults. It is one of the proteins that are up-regulated after exercise. IGF-1 is rapidly up-regulated in the periphery within an hour of exercise, and after a few days of sustained exercise it is up-regulated in cells all over the brain. When in the brain and periphery, IGF-1 induces neurogenesis, increasing the rate at which new neurons are produced even further. (Cotman & Berchold, 2002; Hillman, Erickson & Kramer, 2008).

Vascular endothelial growth factor

VEGF is found in all cells in the body, and is also up-regulated in the brain after exercise. It is a stimulator of angiogenesis, the formation of new blood vessels. The formation of new blood vessels allows more blood and therefore oxygen to the brain – both are essential for improved brain function. (Colcombe & Kramer, 2003; Cotman & Berchold, 2002; Ma, 2008; Trejo, Camo & Torres-Alamán, 2009).

The Results

Several studies were completed with rats as test subjects. The following is a series of data taken from the journal of neuroscience which has displayed the information visually. It shows the levels of BDNF in the brain and its correlation to exercising and sedentary rats.



(Cotman & Berchold, 2002)

Interpretation of Results

- Pictures (a) and (b) show the hippocampus (memory part of the brain) in rats. The pictures show the density of the receptors to BDNF on the hippocampal cells.
- Photo (a) is taken after 7 days of consistent exercise, where as photo (b) is taken after 7 days of no exercise. These photos clearly show that exercise increases the density of BDNF receptors in the hippocampal cells.
- Graph (c) shows the level of BDNF in the brain after 5 days, in both exercising and sedentary rats.
- This graph shows a correlation between exercise and BDNF levels, where the exercising rats have approximately 73% more BDNF in their brain than the sedentary rats. This is about 260 pg/ml and 150 pg/ml, respectively.
- Graph (d) shows the correlation between the distance run and the level of BDNF in the brain. It clearly shows that the more exercise performed daily, the higher the amount of BDNF that is present. This extends up to 360 pg/ml of BDNF for 4km run in one day.

This data shows that exercise is very likely to have a direct correlation to memory improvement. The next question to ask would be "is there a limit to how much exercise is beneficial to improving memory". Although this data is very accurate for rats, other data that shows the same effect on a human brain would be very beneficial, as well as data showing the up-regulation of IGF-1 and VEGF.

Conclusion

From the graph provided, it is easy to see that exercise directly up-regulates BDNF in the brain. As there is also a link to an up-regulation of IGF-1 and VEGF, the levels of these proteins will also be up-regulated along with BDNF. They will increase in a similar fashion to BDNF.

Multiple studies have proven that exercise increases the up-regulation of BDNF, IGF-1 and VEGF. This was discovered through tests on rats and is highly likely to relate to humans too. Science proves that the up-regulation of these three proteins induces both neurogenesis and angiogenesis. The induction of neurogenesis leads to the production of new neurons. The induction of angiogenesis provides more blood and oxygen to the brain.

Overall as a result from exercise the brain gets an increase in new neurons, oxygen and blood flow to it. This influences the structure and activity of the brain in a positive way – resulting in a better functioning brain. So in conclusion, exercise can make you smarter!

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Is that food making me female?

Xeno-what?

Estrogens are natural hormones in our bodies that control many functions, with the best known role being the development of female characteristics.

Some chemicals released into the environment from industries, sewage and other human activities can also act in a similar way to estrogens. These are called xenoestrogens.

Xenoestrogens can make their way into the waterways or the food chain. Some of these chemicals have been shown to cause health and reproduction problems in wildlife and humans.

Shellfish accumulate xenoestrogens

Shellfish feed by filtering the water around them. If xenoestrogens are present in the water they can be accumulated inside the shellfish. There is some concern that humans eating the shellfish could then be exposed to these chemicals.

Aim

To find out if humans eating cockles from some of the South Island's favourite recreational fishing areas are being exposed to unacceptable levels of estrogenic chemicals.

Collection of samples

Cockles (*Austromus stutchburyi*) were collected from 9 estuary sites in Chaggo and Christchurch (Figure 1). The sites were associated with a variety of land uses including sheep farming, sewage treatment and port activities.

Xenoestrogen extraction

Additional cockles were purchased from a retail outlet (Saf) for analysis. Ten of these were spiked with a known concentration of estrogen and analysed as a positive control (Spk). A blank control was also included (no shellfish, 'BL').



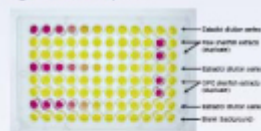
Analysis by yeast assay

The presence of xenoestrogens can be measured by detecting overall estrogenic activity in a sample. The shellfish extracts were tested for estrogenic activity using a yeast assay.

The Yeast Estrogen Screen (YES) uses specially

developed yeast that responds to estrogenic chemicals

Figure 2: The YES plate.



Only the spiked sample exceeded the background level of red colour.

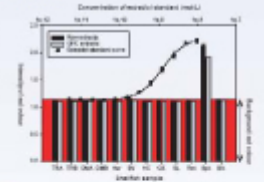
Will they turn lads into ladies?

Not! These results indicate that the level of estrogenic activity in shellfish collected from Chaggo Harbour and the Avon Heathcote Estuary is very low.

developed yeast that responds to estrogenic chemicals by changing an indicator dye from yellow to red. Samples are measured against the amount of red colour produced in response to a standard estrogen, 17 β -oestradiol, which is added to the yeast at known concentrations.

The estrogenic activity of shellfish measured by YES:

Figure 3: Results of cockle extract analysis by the YES.



It is likely that these cockles do not accumulate xenoestrogens to levels that are high enough to cause any problems for humans eating them.

...and challenge them to think

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Multiple Gravity Assist Trajectories

MGAT what is this?

Multiple Gravity Assist Trajectories (MGAT) can be defined as a system which uses the movement and gravity of a planet or other celestial body to alter the path and speed of a spacecraft.

Ovchinnikov, M.Y., Trifonov, S.P., Shirobokov, M.G. (2012)

Objective

ROSCOSMOS announced that the agency is working on developing the capabilities that permit humans to be sent to an asteroid in 2025, and to Mars in 2030. In addition, NASA has indicated that the next major step in the 2030s will be the development of a Mars mission to Mars, which will rely on an Orion and an evolved version of the Space Launch System, that will be then used to launch a heavy-lift rocket (Falcon Heavy) based on the information and published by the Roscosmos agency. The paper aims to explore the possibility of using gravity assist to alter the path and speed of a spacecraft, such as Orion, can be changed. The paper also shows the method of using gravity assist to alter the path and speed of a spacecraft, such as Orion, can be changed. The paper also shows the method of using gravity assist to alter the path and speed of a spacecraft, such as Orion, can be changed.

Introduction

Multiple Gravity Assist Trajectories (MGAT) have been key to the exploration of the solar system, making possible the first manned mission to Mars in 1968. The idea of using the gravitational field of planets to change the direction and speed of a spacecraft was first proposed in the 1950s by the Soviet Union and the United States. The advent of modern high efficiency computers, the design of trajectories incorporating gravity assistance, was made possible by the development of the Gravity Assist Trajectory (GAT) software. The MGAT is a trajectory that uses multiple gravity assists to reach a target. The MGAT is a trajectory that uses multiple gravity assists to reach a target. The MGAT is a trajectory that uses multiple gravity assists to reach a target.

Discussion

For decades, human interplanetary travel has been a dream of humanity. Space age has been working on developing the technology which permits sending spacecraft to other planets and extend our presence to new worlds. However, one of the most difficult problems to solve is the lack of a suitable trajectory for a spacecraft. The MGAT is a trajectory that uses multiple gravity assists to reach a target. The MGAT is a trajectory that uses multiple gravity assists to reach a target. The MGAT is a trajectory that uses multiple gravity assists to reach a target.

Conclusion

After the development of the MGAT, humans have the opportunity to reach any target in the solar system, such as planets and asteroids. Today, the use of MGAT is not only a theoretical concept, but a reality. The MGAT is a trajectory that uses multiple gravity assists to reach a target. The MGAT is a trajectory that uses multiple gravity assists to reach a target. The MGAT is a trajectory that uses multiple gravity assists to reach a target.

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Imagining across disciplines... Physics & Ecology

Exemplars of student posters from SCIGEN 101

Falcon for Grapes

What are the Ecological Benefits of having Falcons on Vineyards

Introduction

Over centuries vineyards have had devastating effects on grapes, being eaten or infected by pest birds (3, 6-8). Multiple deterrents such as drones, nets and poisons have been used to try eliminating pest birds from damaging grapes (1, 3). New methods arise by using predator and prey relationship where Birds of Prey have been used in numerous sites around the world as pest controls, in power stations, airports and vineyards (2, 4). Trained falcons are used with professional trainers at sites, showing successful bio-control results.

Benefits for vineyards

In New Zealand, falcons are a cheaper option than other deterrents such as guns. By relocating falcons from wild to vineyards, they can prey on birds that were damaging grapes. Pest birds damage the economy of vineyards by reducing white grapes or picking out flesh, leaving the grapes open to disease and bacterial infections (1, 5-9). Millions of dollars are lost from pest birds. From introducing falcons, there is around 83% less damage on grapes, with annual \$234/ha less crop damage on Sauvignon Blanc and \$326/ha less damage for Pinot Noir (6).

Benefits for falcons (5-7)

Falcons are under threat by loss of habitat due to human development and predation on falcon chicks by introduced species such as cats, rats and hedgehogs. Relocating and introducing them into agricultural sites, such as the vineyards, increases their survival rates. The study shows better nest predation, higher nest attendance, feeding rates and brooding rates, which all enhance chick survival rates. Falcon habitats are under threat due to human development. However, the introduced agricultural lands surprisingly provide a higher nesting success compared to falcons living in the hills. They also get better food quality and protection.

Conclusion

The New Zealand Falcons can act as deterrents and threats to birds and have higher population growth success in vineyards. It is both ecologically sustainable and conservation.

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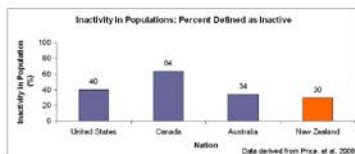
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ECONOMIC BENEFITS

Alternatives to ACC include either an uninhibited right to sue in response to injury, observable in the USA and UK, or a partial public scheme. Partial schemes, such as in Australia and Canada, provide assistance to injuries suffered in select circumstances, while allowing individuals to sue where government assistance is not available.

- One way that the economic benefits ACC delivers to New Zealand can be quantified is the reduced public healthcare costs that result from an active population. ACC provides financial assistance in the event of injury to sport, whilst countries with no public assistance (USA, UK) or public healthcare (Canada, Australia) do not.
- A recent Australian report by the Standing Committee on Recreation and Sport found that increasing costs for participants in physical activity has a negative correlation with participation in the specified activity (Price, et al. 2008).
- The statistical methods used and definition of inactivity between Canada and New Zealand are not the same and so are not directly comparable.
- Conversely, the USA and Australia used roughly comparable definitions and data collection methods as New Zealand. It is fair then to compare these, particularly with Australia which has the greatest similarity in cultural, socio-economic and environmental factors which could impact on these results.
- It is interesting to note the differences in inactivity between Australia and New Zealand can be attributed to the positive impact of ACC in encouraging participation in sports through creating a lower financial barrier.
- Comparing popular inactivity with Australia suggests New Zealand saves \$28 million annually through the avoidance of health costs associated with inactivity (Price, et al. 2008)
- Sport and Recreation New Zealand conservatively estimates the total cost of physical inactivity to be \$195 million per annum, a figure which could double if New Zealand's inactivity rate (30%) increased to Canada's (64%) (Price, et al. 2008)
- Though inactivity is only one way to measure economic benefits, ACC appears to contribute meaningfully to this trend.

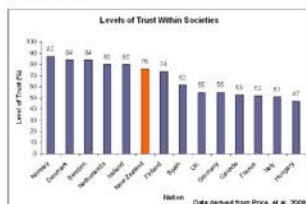
Country	Percent of Population
USA	40
Canada	64
Australia	34
New Zealand	30



Do the economic and social benefits of the public accident compensation scheme in New Zealand justify retaining it?

One perspective on which to gauge the benefits of ACC is its impact on social cohesion and loneliness. An important indicator of this is the level of trust people have in society. For example:

- covering all people for injury irrespective of fault income, ACC contributes to a sense of fairness in society. This can translate into a reduction in mistrust and division between social groups, increased tolerance, and lower rates of withdrawal of marginalised individuals from society (Pryor *et al.*, 2006).
- New Zealand's 2006 Quality of Life Survey found that 70% of people believed that people could be trusted (Pryor *et al.*, 2008). This compares favourably against Scandinavian countries with similar schemes. It also outperforms many OECD countries with mixed liberal and neo-liberal US compensation schemes, such as the United States (Pryor *et al.*, 2008).
- New Zealand's 2006 Quality of Life Survey also found that there was a nation with no public sector compensation scheme (Pryor *et al.*, 2008).
- It is important to attribute a particular share of the contribution to the success of New Zealand's system, and that it represents lessons



Looking briefly at economic and social benefits attributable to ACC, the scheme performs favourably compared with those of other nations. Considering ACC's impact on productivity reveals a significant financial contribution through alleviation of the costs associated with healthcare. Society, ACC has a positive though unquantifiable influence on increasing levels of trust within society. It would be useful to consider a mid-variety of economic and social factors revolving around ACC. This would aim to strongly establish the extent of its bearing on New Zealand. As it appears a success here, it would be interesting to inquire why countries such as the USA and UK do not utilise this scheme model. However, based on the data presented it is reasonable to conclude that the economic and social benefits of the scheme do justify its continuance in New Zealand.

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Produced by Matt O'Neale (4407094)

Imagining
across
disciplines...

Law &
Marketing

Exemplars of student posters from SCIGEN 101

The History of Colour Theory

The history of colour theory spans over several centuries and since ancient times, colour theorists have developed ideas and interpretations of colour relationships. Attempts to formalise and recognise order began with Leonardo da Vinci and have progressed ever since. Da Vinci noted that certain colours intensify each other, discovering the idea of complementary colours.

The first colour wheel was invented by Britain's Sir Isaac Newton who split white light into red, orange, yellow, green, blue, indigo and violet beams, then joined the two ends of the spectrum to form a circle showing the natural progression of colours.

More than a century later, while studying the psychological effects of colour, Germany's famed poet and playwright Johann Wolfgang von Goethe furthered colour theory. Goethe divided all colours into two groups. On the plus side he put the warm colours (red, orange and yellow), and on the minus side the cool colours (green, blue and violet). He noted that colours on the plus side produced excitement in viewers, while he associated the minus side colours with unsettled feelings. In 1810 Goethe published *The Theory of Colours*, in which he disagreed with Newton's conclusions. He believed that a scientific approach alone did not enable someone to fully understand colour, whereas Goethe's observations of the human perception of colour, rather than just the physics of light, allowed him to discover important aspects of colour theory, including a colour relationship to emotion.

How do consumers perceive colour?

More than just a visual phenomenon, colour distinguishes a brand's personality, draws attention to its characteristics and enables it to stand apart from competitors within the chaotic retail environment we experience today.

Studies by marketing psychologists have found that a lasting impression is made within sixty seconds of first sighting the product and that colour accounts for over two thirds of the audience's reaction to the brand. This illustrates the power that colour can have in deciding the success or failure of a brand. Research by the University of Loyola found that the use of colour increases a consumer's brand awareness by 80 percent, and has been shown to significantly help memory recall, an important element to brand recognition. Countless consumer products are now recognised by the colour of their brand, such as Coca-Cola's cherry red and Cadbury's velvety purple. This is because colour has the ability to capture attention, relax or irritate the eyes.

If you understand the way people commonly perceive different colours, you can then use them effectively to evoke a certain response from the consumer, and create an appropriate style and personality for any brand.

The Power of Colour

How can colour affect the success of a brand?

Common colour associations

Colour communicates with consumers psychologically through common colour associations developed over time, and it is this association with colour that determines an individual's perception to a product. In general warm colours such as red, orange or yellow send an uplifting and energetic message, instilling excitement in the viewer, while cooler colours such as dark blue and green symbolise truth and loyalty, and are used to create a calmer, more reserved association.

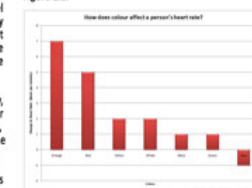
It is no accident that McDonalds use yellow and red, nor that the Bank of New Zealand uses blue. Warmer colours, like those seen in sale signs or in the branding for many fast-food restaurants, imply danger and urgency, encourage impulse buying and stimulate hunger, whereas the use of cooler colours in a brand is common with banks, dentists, medical centres and hospitals as customers feel safe and secure.

How colour affects the human heart rate

A colour will elicit an emotional and physical response. The common associations that we have developed are what affect how we feel psychologically, known as the emotional response. How our body physically reacts to the colour used in the brand is called the physical response, and it is this that affects the human heart rate. Research undertaken by the National Student Research Centre is summarised in Figure 1.1, illustrating the effects certain colours have on consumers.

When exposed to the colour orange, the heart rate increases dramatically, jumping from 80 to 87 beats per minute. The colour red had a very similar effect, increasing the heart rate by 5 beats per minute. These warm colours, as defined by Goethe, have a positive, exciting and stimulating effect on the viewer. In contrast, green (one of the cooler colours) does not affect the human heart rate significantly, only showing a change of one beat per minute. This supports the idea that the colour green makes consumers feel stable and have trust in the brand. When exposed to the colour blue, the heart rate decreased slightly. This illustrates the relaxation a consumer feels when they see a brand that incorporates this colour.

Figure 1.1:




NS: The standard benefit rate of an individual is 50 cents per week.

Conclusion

These findings offer support to the idea that colour impressions and decisions by consumers are both quick and enduring, proving that decisions about colour are crucial to the overall success of the brand. The use of the wrong colours could be a costly mistake.

Lauren Chernoborsky

[illegible]



Experiences to expose the imagination

On Campus...



Scenarios - class dialogue & reflection

Role Playing... learning about...



Lived Experience vs
Evidence-based research

Community voice is **not** homogenous

Some student placards from a 'mock' community meeting about 1080 pest control...

Off Campus...



Real-World Learning



A landscape photograph showing a sunset or sunrise over a field. The sky is filled with soft, colorful clouds in shades of pink, orange, and blue. In the foreground, there is a field of tall grass. On the left side, there are several trees, and on the right side, there is a single tree. The overall mood is peaceful and contemplative.

Blogs & Reflections expose the **imagination**

Student Blog

following a field trip to the Titirangi Village Market

“To me, I see most people that come to markets as hard working people trading their craftsmanship and products to make a living. However, watching that lady make that kids day kind of made me realise what my lecturer meant to “experience the community”. And it wasn’t just selling stuff to kids for an affordable price.”

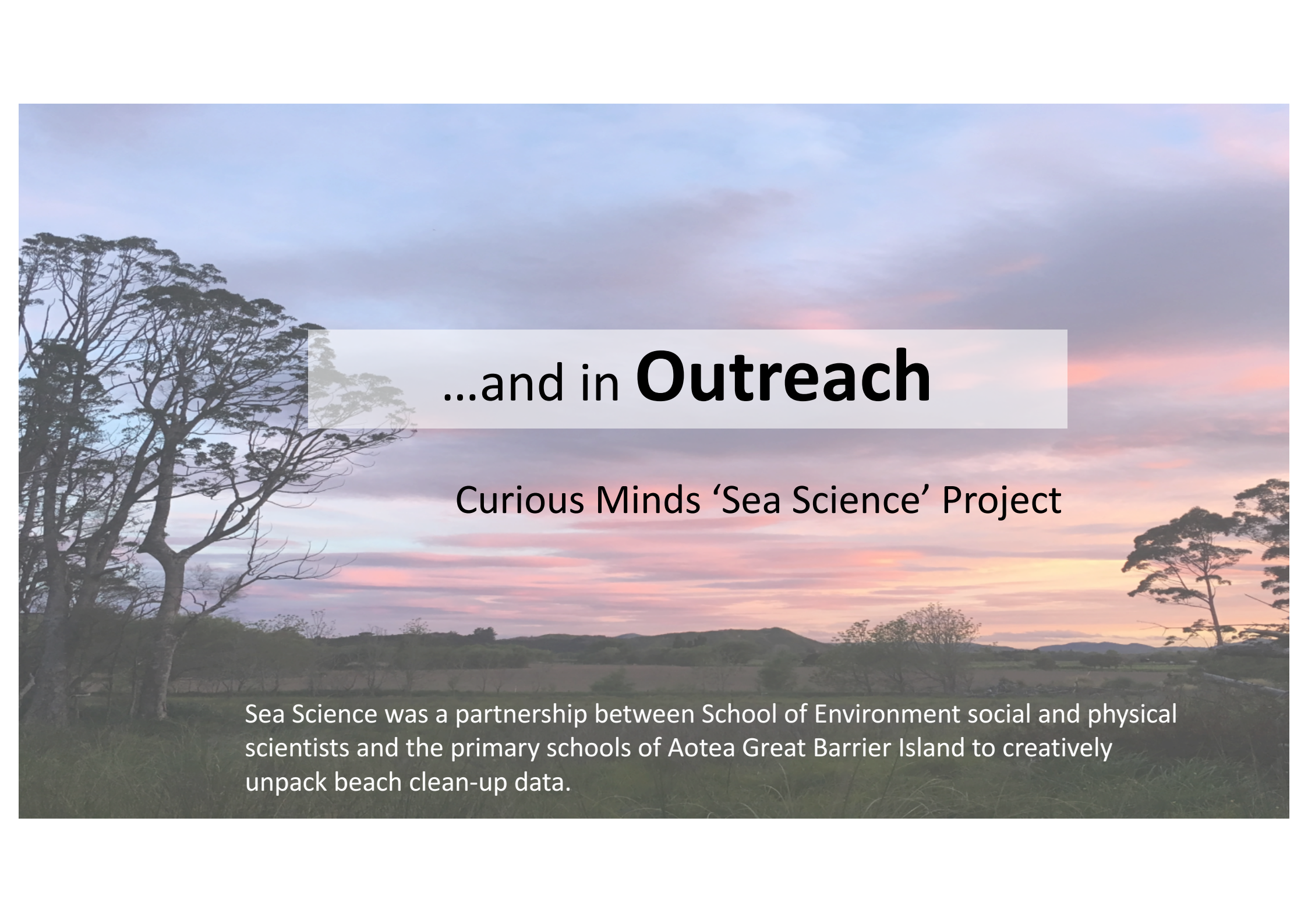
Extract from a student blog 2017, recalling an experience where a stall owner sold a piece of kauri gum to a small child for much less than the marked price because the child wanted the item but did not have enough money

Student Blog...Imagining community activism

“You march among the protestors up Queen St. Your voice thunders in synchronisation with the masses “We - demand – to let our Kauri stand!” There are no strangers in this crowd, there is no “I” or “you”; there is only “Us”. Together the collective identity is a manifestation of the deeply spiritual Kauri roots which permeate the soil of the Waitakere Ranges. You are speaking for the trees, who cannot speak for themselves. If Dr Seuss’ Lorax could see you, he would bow his head from the footpath as the troop stormed Queen St. Beneath his breath he would murmur his renowned philosophical wisdom;

‘Unless someone like you, cares a whole awful lot.
Nothing is going to get better. It’s not’ .”

Extract from a student blog 2017, inspired by a talk from a community activist on a fieldtrip to Titirangi to investigate the struggle to save kauri

The background image is a landscape photograph taken during the 'golden hour' of sunset or sunrise. On the left side, a large, dark silhouette of a tree with many branches is visible. The sky is filled with soft, horizontal clouds in shades of pink, orange, and light blue. In the distance, there are rolling hills or mountains. A semi-transparent white rectangular box is positioned in the upper-middle part of the image, containing the text '...and in Outreach'.

...and in **Outreach**

Curious Minds 'Sea Science' Project

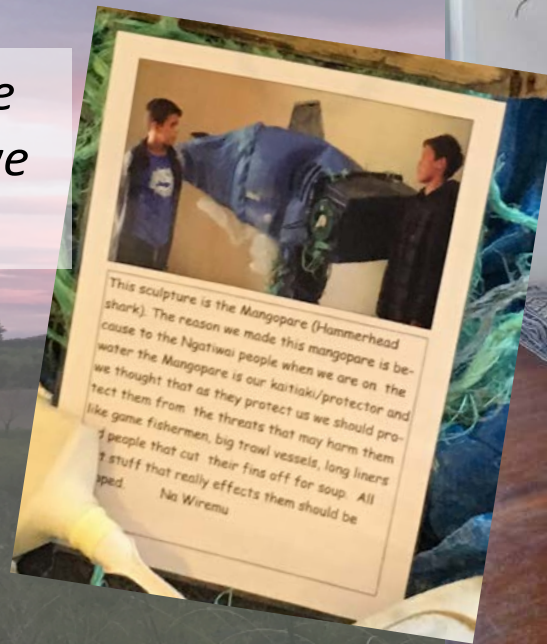
Sea Science was a partnership between School of Environment social and physical scientists and the primary schools of Aotea Great Barrier Island to creatively unpack beach clean-up data.

Science Report Writing...

‘Mangopare’- Hammerhead shark

*The protector of the
island. What are we
doing to protect it?*

Collective Report
by Te Kura o Okiwi



This sculpture was made
entirely from beach debris

Report Writing...

'Footprints'

*A statement on the health
& safety of shards of glass
found on the beaches.*

*6 year old student –
'Sea Science' Curious
Minds project*

This sculpture was made
entirely from beach debris

A landscape photograph showing a grassy field in the foreground, a line of trees in the middle ground, and rolling hills in the distance. The sky is filled with soft, colorful clouds in shades of pink, orange, and blue, indicating a sunset or sunrise. A semi-transparent white rectangular box is overlaid on the right side of the image, containing the text "Where to start...".

Where to start...

Start with the **WHY**

W H Y

H O

A W

T

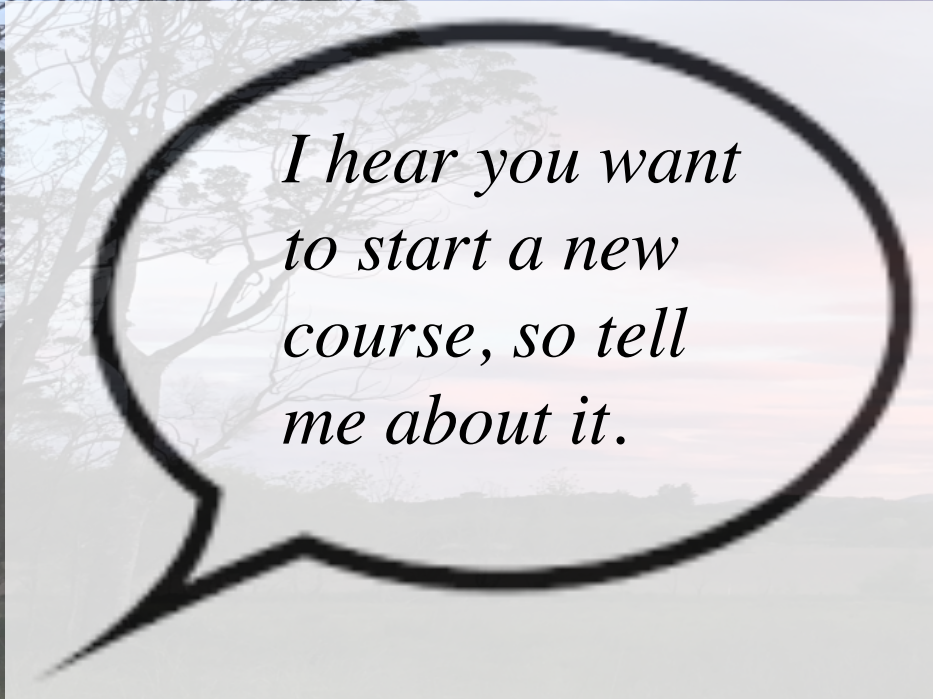
It's the 'Why' that
drives our passion.

Inspired by: Simon Sinek's *Start with why*

A scenic landscape photograph serving as a background. On the left, a large, dark tree with a thick trunk and many branches stands in a field of tall grass. The sky is filled with soft, colorful clouds in shades of pink, orange, and blue, suggesting a sunset or sunrise. In the distance, there are rolling hills and a few more trees. The overall mood is peaceful and natural.

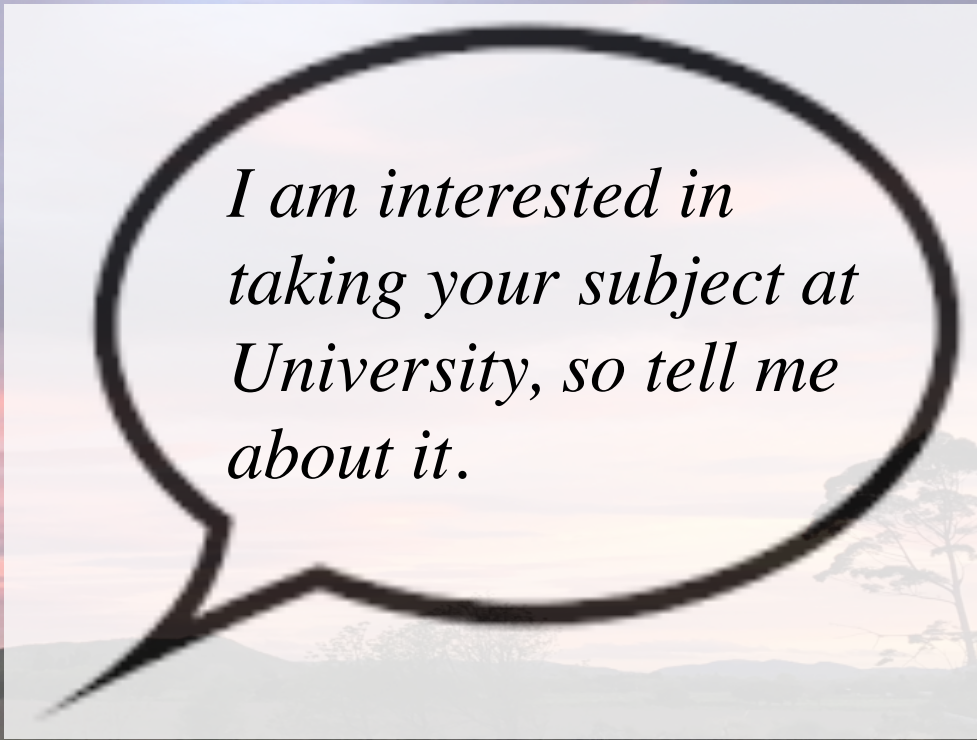
Interactive Group Activity

The **One** Minute Elevator Pitch



*I hear you want
to start a new
course, so tell
me about it.*

Curious HoD



*I am interested in
taking your subject at
University, so tell me
about it.*

Curious 16 year old

A landscape photograph of a grassy field with trees and a sunset sky. The sky is filled with soft, colorful clouds in shades of pink, orange, and blue. The foreground is a lush green field with some taller grasses. In the middle ground, there are several trees, including a large, leafy tree on the left and a smaller one on the right. The background shows rolling hills under the twilight sky.

Approach
Audience

Start with the **why**



Take-away message: overcome these Challenges

1

Challenge of **complexity**

2

Challenge to be **heard**

3

Challenge of **hearts & minds**

