Visual communication in science

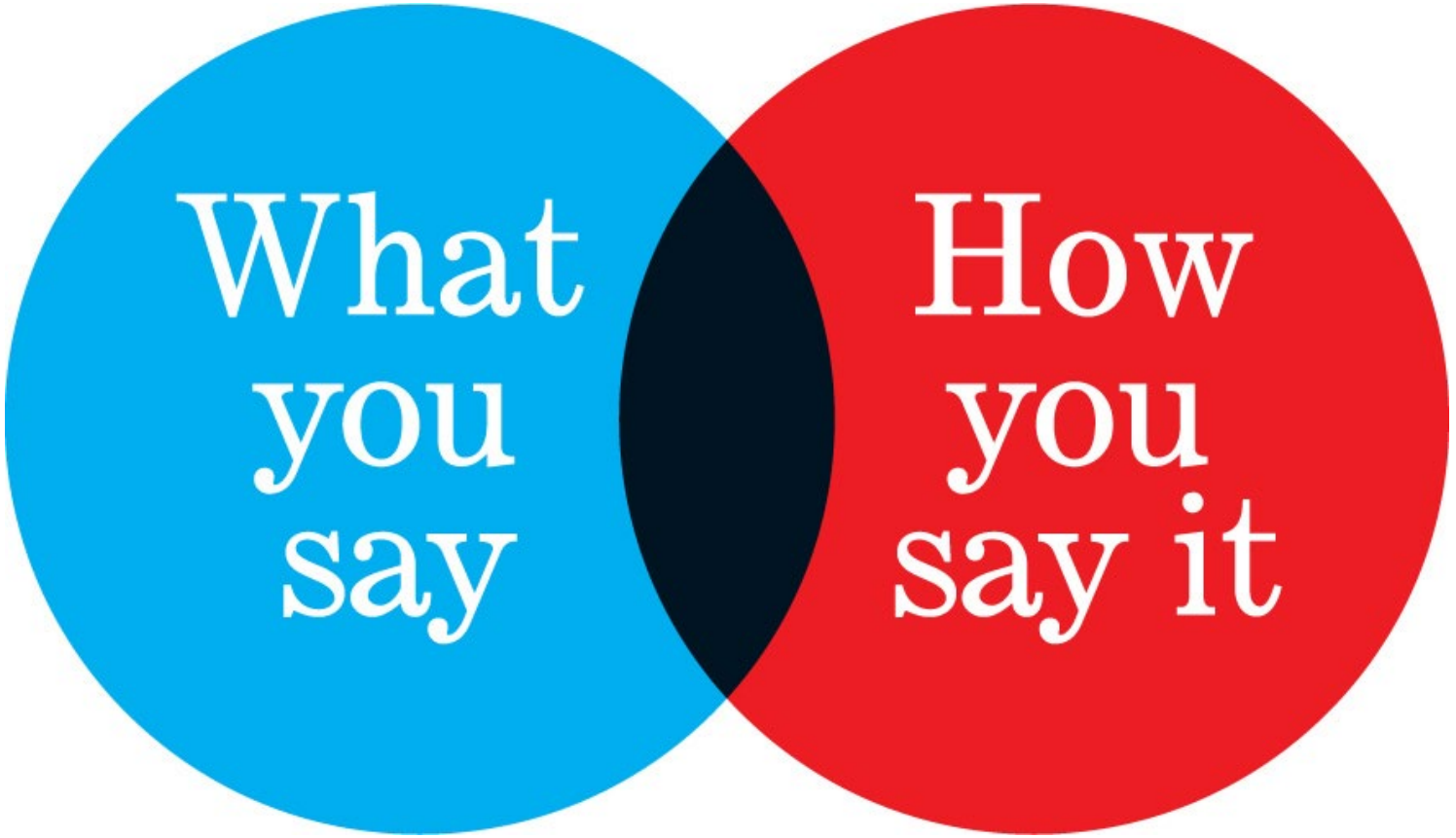
Hecht lab meeting

May 25, 2023

Two channels of information

Actual information being conveyed – values, text, etc.

Tell a concise, easy to follow, and logical "story"



Contextual associations based on how it is presented

Convey expertise, competence, quality, etc.

THE ROYAL SOCIETY biology letters

Contagious yawning in chimpanzees

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Recd 09.04.04; Accepted 28.05.04; Published online 21.07.04

Six adult female chimpanzees were shown video scenes of chimpanzees repeatedly yawning or of chimpanzees showing open-mouth facial expressions that were not yawns. Two out of the six females showed significantly higher frequencies of yawning in response to yawn videos; no chimpanzees showed the inverse. Three infant chimpanzees that accompanied their mothers did not yawn at all. These data are highly reminiscent of the contagious yawning effects reported for humans. Contagious yawning is thought to be based on the capacity for empathy. Contagious yawning in chimpanzees provides further evidence that these apes may possess advanced self-awareness and empathic abilities.

Keywords: chimpanzees; contagious yawning; video; development; self-awareness; empathy

1. INTRODUCTION

Experimental evidence supports the common observation that seeing other people yawn can induce yawning (Provine 1986, 1989; Platek *et al.* 2003). Studies have shown that between 42% and 55% of human adults will yawn during, or shortly after, seeing a videotape of repeated yawns of other humans. The only systematic study to our knowledge of children, however, found that children aged younger than 5 years do not show this contagious yawning effect (Anderson & Meno 2003). Although yawning is widespread among vertebrate species, contagious yawning has been reported only in humans (Lehmann 1979; Baenninger 1987; Smith 1999). It has been suggested that contagious yawning reflects a basic capacity for empathy (Lehmann 1979), and a recent study linked human individual differences in susceptibility to contagious yawning to differences in empathic tendencies, self-recognition ability and theory of mind (Platek *et al.* 2003). We assessed whether chimpanzees—humans' nearest phylogenetic neighbours—are prone to contagious yawning when exposed to videotapes showing yawning of conspecifics. Evidence of contagious yawning would provide further evidence of similarities in the evolution of self- and other-awareness between great apes and humans.

2. MATERIAL AND METHODS

(a) *Subjects*

We tested six socially reared, group-living adult female chimpanzees (*Pan troglodytes*) living at the Primate Research Institute of Kyoto University. They were individually invited to leave their outdoor enclosure and enter a familiar test booth; three of them brought their 3-year-old dependent infants with them. The chimpanzees had extensive experience with experiments on learning and cognition (Matsuzawa 1985, 2003; Kawai & Matsuzawa 2000; Morimura & Matsuzawa 2001), but none had previously observed video stimuli of the type used here. This experimental work complied with the Guide for the Care and Use of Laboratory Primates, Primate Research Institute, Kyoto University.

(b) *Experimental apparatus*

We prepared two 'yawn' and two 'open-mouthed' videotapes. Yawn videos contained 10 naturally occurring yawns by chimpanzees, each separated by 6–10 s of a blue, blank screen (see figure 1 for an example). Open-mouthed videos were equated for total duration, and showed chimpanzees displaying eight or ten open-mouthed faces but not yawning (for example, while pant-hooting or grinning), again separated by a blank screen. The videos displayed chimpanzees in various postures and orientations, the most salient feature being the yawns or open-mouthed expressions. One yawn video presented yawns by familiar chimpanzees from the subjects' own group, and the other presented yawns by unfamiliar chimpanzees in the wild. The videos were shown silently on a 35 cm monitor (Panasonic TH-14RF2) positioned on a small table 30 cm high and *ca.* 8 cm from the front of the glass-walled booth.

(c) *Experimental procedure*

Two videotapes were shown in each session. Five minutes after the chimpanzee entered the booth, the monitor was switched on and the first video ran until completion of the last yawn or open-mouth (3 min). The monitor was then switched off and the chimpanzee was observed for 3 min. A 5-min distraction period then followed, after which the second video was shown (3 min), followed by another 5-min observation period. Each chimpanzee was tested during four sessions, with the following order of video combinations presented in each session: (i) familiar yawn, unfamiliar open-mouth; (ii) unfamiliar open-mouth, familiar yawn; (iii) familiar open-mouth, unfamiliar yawn; (iv) unfamiliar yawn, familiar open-mouth. All sessions were videotaped through the glass walls of the booth, using three fixed-position cameras, two of which were operated manually. The three authors were present but remained passive throughout, except that T.M. occasionally encouraged the chimpanzee to watch the monitor if her attention appeared to wane. All yawns by the subject chimpanzees were scored in real time and then verified by subsequent video analysis; agreement between the three authors was 10[illegible]

3. RESULTS

The [illegible] chimpanzees yawned on average 7 times during [illegible] the open-mouth videos and [illegible] to 10 yawns during and after the yawn videos. The data were analysed both at the group level and individual level. There were no significant effects at group level, as assessed by paired *t*-tests. However, two chimpanzees (Ai, Mari) showed significantly higher frequencies of yawning during [illegible] than to open-mouth videos (2 and 9; both $p < 0.01$, binomial tests). Figure 1 shows a chimpanzee yawning during exposure to a yawn video, and figure 2 presents the data for all of the adult chimpanzees. Social familiarity of the chimpanzees in the videos did not affect yawning frequency. No chimpanzee showed significantly more yawning in response to the open-mouth videos, and open-mouth videos did not elicit facial expressions. None of the three infant chimpanzees yawned at any time during the tests.

4. DISCUSSION

Higher frequencies of yawning in response to yawn stimuli compared with the open-mouth control stimuli indicate a contagion effect in 33% of the adult chimpanzees. This percentage is only slightly lower than the percentages reported for adult humans exposed to visual yawn stimuli (Provine 1986; Platek *et al.* 2003). It can be argued that the percentage of chimpanzees showing contagious yawning is even more impressive, given that adult human participants are usually aware of the phenomenon being studied, and simply thinking about yawning may induce yawns (Provine 1989). The chimpanzees had no knowledge of what the experimenters were interested in, and had no idea of what was expected of them. Unlike Old World monkeys (Deputte 1994), chimpanzees do not appear to show a sex difference in their frequency of yawning.

None of the infant chimpanzees that accompanied their mothers showed any yawning, even though they watched the videos and saw their mothers yawning. This absence of contagious yawning in infant chimpanzees recalls the absence of contagious yawning in human toddlers reported by Anderson & Meno (2003). Further work on the young chimpanzees will clarify the extent to which contagious yawning in chimpanzees resembles the same behaviour in humans.

Chimpanzees display self-recognition in mirrors (Gallup 1970; Povinelli *et al.* 1997), a sign of objective self-awareness that has been linked with the capacity for empathy (Gallup 1982). Monkeys do not show self-recognition (Anderson 1994), and observations of social behaviour reveal much more convincing evidence of empathy in chimpanzees than in monkeys (de Waal 1996). Observational studies of spontaneous yawning in monkeys indicate that it is not contagious (Baenninger 1987; Deputte 1994). Given the distribution of self-recognition and social cognitive abilities among primates, we predict that susceptibility to contagious yawning will be found in other great apes, but not monkeys, and that individual differences in susceptibility to contagious yawning may be related to differences in self-recognition and empathy.

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Figure 1. A yawn response during presentation of a yawn videotape. Ai watches a yawn on the screen (top left), starts to yawn as the stimulus yawn ends (top right), continues to yawn (bottom left), and completes the yawn while the screen is blank (bottom right). See electronic Appendix A.

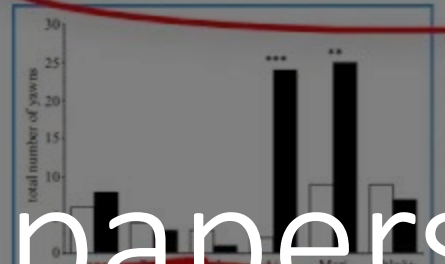

Figure 2. Total frequency of yawns by six adult female chimpanzees during or after exposure to open-mouth videos (open bars) and yawn (filled bars) videos. Ages in years are [illegible] that were tested with their infant. $^{**}p < 0.01$; $^{***}p < 0.001$.

Acknowledgements

The present study was financially supported by the following grants [illegible]102010, 12002009, 21COE-A2-Kyoto University, JSPS-HOPE). Thanks are due to Misato Hayashi, Yuu Mizuno, Masaki Tomonaga, Masayuki Tanaka and Juri Suzuki for their assistance and support. We are grateful to Miho Nakamura for providing the videotapes of yawning by Mahale and PRI chimpanzees.

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Scientific papers

Paper figures: What you say

- As with grant writing: assume your audience is distracted, in a rush, and only vaguely interested!

- Many people read the abstract and look at the figures as a way to “skim” an article

  → the figures should be able to tell (most of) the story

- Many journals will tell you not to repeat information in the figure itself and in the legend. But readers lose focus and interest if they have to skip back and forth between the figure & the legend too much.

Paper figures: How you say it

- The most striking or exciting part of the figure should be the visual focal point
  - Other components should coordinate and balance with it in size, shape, and color
  - Your best background color might be black!

- Spend time to get crisp, clear renderings of brain images and nice graphical icons/photos
  - BioRender, stock photography

- Pay attention to your use of “white space”

Good figures will be…

- Able to tell (mostly) the whole story of the article in graphical format
- Interpretable (mostly) without the legend
- Re-useable and shareable!
  - Classroom, talks/lectures, media/social media
  - Ideally, not just by you!

Posters

Posters: What you say

- Standard layout for organizing information

This Scientific Poster Template Is Provided By PosterNerd

Enter A Title And Add Logos To Your Poster

Add Author Names and Information
Include University or Department Names if Needed

Abstract

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Traits	One	Dozen	All
N	75	75	225
Age (yr)	44.8	44.1	44.4
Height (cm)	165.8	166.2	165.6
Weight (kg)	72.6	73.6	73.4
BMI (kg/m²)	27.7	27.5	28.1
Race: white	72	71	221
Post-menopause	7	6	13
Injury duration (yr)	N/A	8.9	7.7
Injury subsidence			
Motor complete	10	11	31 (0.1)
Motor incomplete (A)	3	1	4 (0)
Motor incomplete (B)	1	1	4 (0)

Introduction

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Methodology

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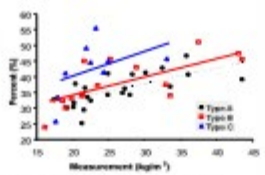

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Results

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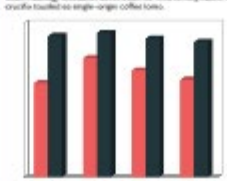

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Conclusion

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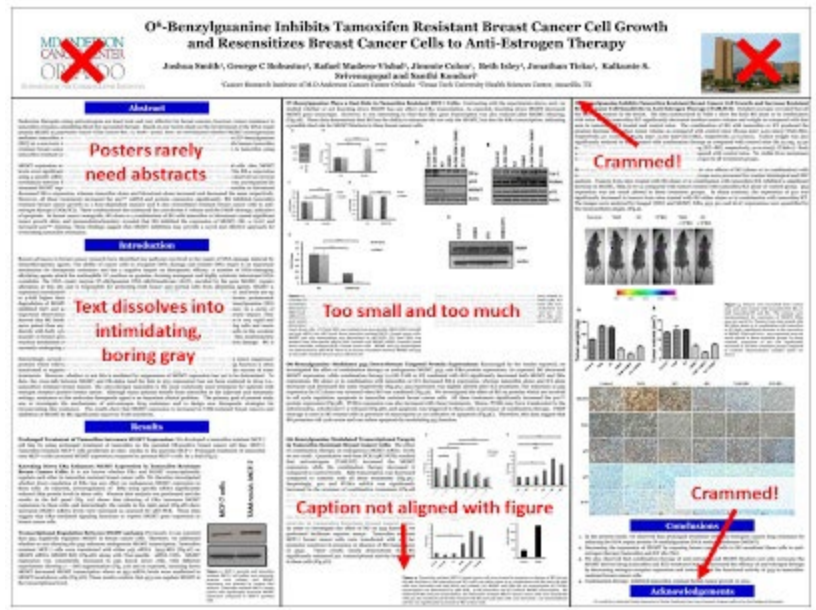
O⁶-Benzylguanine Inhibits Tamoxifen Resistant Breast Cancer Cell Growth and Resensitizes Breast Cancer Cells to Anti-Estrogen Therapy
Abstract
Introduction
Results
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Conclusions
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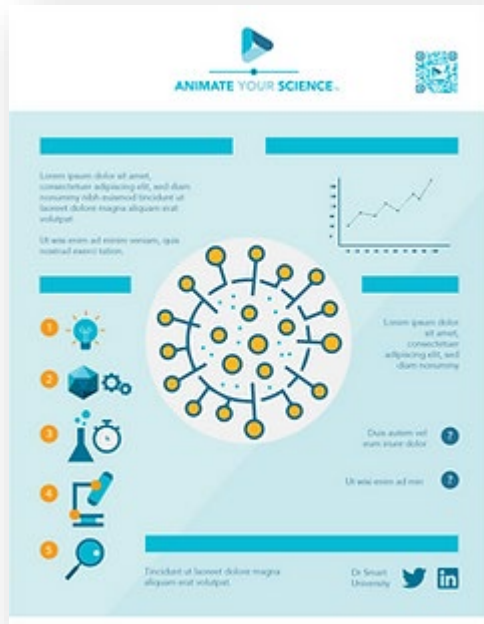


Developing and characterising a novel combined nanoelectrode system

L. P. Robinson, A. Mount

THE UNIVERSITY OF EDINBURGH

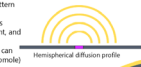
Electrochemistry at nanoelectrodes

Nanoelectrodes have several advantages for electrochemical sensing.


Linear diffusion profile

Transport to macroelectrodes proceeds through a relatively inefficient linear diffusion profile. They are also are highly affected by convection and iR drop.

In contrast, the diffusion pattern for nanoelectrodes quickly becomes hemispherical. This profile is much more efficient, and they are not so affected by convection or iR drop. They can reliably detect very low (attomole) concentrations of analyte.


Hemispherical diffusion profile

A Pt microsquare nanoband edge electrode (MNEE) array system in which the Pt nanoband acts as the working electrode has been developed. The project now aims to create a nanoelectrode device based on this system which has all three electrodes necessary for analysis on one chip.

Ag/AgCl as a combined electrode


Dendritic growth

The combined reference/counter electrode is created by electroplating a thin film of Ag onto the Pt microsquare.

Potentiostatic plating causes Ag to grow preferentially at the corners, creating dendrites. A galvanostatic plating protocol is being developed to provide the required smooth, shiny Ag deposit.

To convert the newly plated Ag surface to AgCl, it must be functionalised. Chemical functionalisation by immersion in $FeCl_3$ has been shown to produce uniform deposits of AgCl.

Combined nanoelectrode system

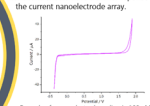
This design consists of a microsquare at the bottom of each cavity in the array, with the nanoband around the cavity edge.

The Ag/AgCl microsquare is a combined reference and counter electrode. As its area is so much larger than the Pt nanoband, the current passing through the square is not large enough to affect its use as the reference electrode.

This could create an on-chip device for sensitive analytical detection.

Characterisation

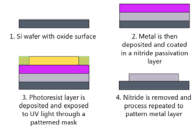
Cyclic voltammetry and electrochemical impedance spectroscopy will be used to verify that the system is behaving as predicted. The nanoband should have a similar reponse to the current nanoelectrode array.



Example of a nanoelectrode cycling in 100mM KCl solution. This cycle is used to determine the cleanliness of the electrode surface.

Fabrication

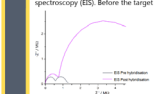
This design has been fabricated at the Scottish Microelectronics Centre using photolithography. In this technique layers of metal and insulator are deposited and patterned to produce the desired arrangement.



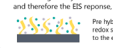
Each layer is deposited and patterned sequentially. This approach reliably produces uniform electrodes cheaply and easily.

An application

By coating the surface of the working electrode in a probe nucleic acid, the corresponding DNA sequence can be detected using electrochemical impedance spectroscopy (EIS). Before the target molecule is hybridised, the resistance measured for the redox couple is small. When the correct target is hybridised the resistance, and therefore the EIS reponse, is much larger.



EIS measurement of 50 nm electrode shows the increase in resistance upon addition of the target nucleic acid.


Pre hybridisation - the redox species has access to the electrode.

Post hybridisation - the access of the redox species is restricted, and so the resistance rises at the electrode.

Objectives

Having made the initial measurements, the next steps will include;

- complete fabrication of the combined system, including optimisation of nanoband and cavity dimensions
- further investigation of the sensitivity of nanoelectrodes for use in DNA sensing and the relationship between the response and concentration of the target
- optimisation of a galvanostatic silver plating protocol

Many thanks to Dr Damion Corrigan, Ilka Schmueser, Professor Andy Mount, the Mount group and the SMC for their continuing support and expertise.

SMC

EPSRC Pioneering research and skills

Organizing information on a poster

- Consciously choose an initial focal point
- Resist the urge to have too much text
- Use large headings and simple phrasing
- Images should be able to tell (most of) the story

- What is your goal in delivering this poster? → design information flow around this goal
  - Networking, job opportunity, technical troubleshooting, etc

Posters: How you say it

- #1: Practice!!!
- Engage your visitor. Ask them about themselves, ask them for input, etc. Avoid either you or your poster being a wall of text.
- Same as journal figures: spend the time to make it look sharp
  - Color schemes, spacing/balance, consistency, alignment
- Interactive elements?
- University logos, funding :/

Discussion

- Examples of figures or posters you do/don’t like?
- How do you make your figures & posters? Resources, software?
- What is challenging for you?
- What makes a figure or poster “bad” vs “good”?