THE PHILOSOPHY CLUB

Collaborative inquiry and dialogic argument with young people

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NEW MODES OF PERCEPTION

Facilitator's runsheet for a 100-minute workshop on sensory substitution and augmentation

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For reference: Some of the big questions underlying this workshop:

- How do our senses shape our reality?
- Should sensory substitution be promoted to overcome the social exclusion of people with sensory impairments?
- Should sensory augmentation go mainstream?

Resources needed for this workshop:

- This runsheet, and a speaking ball
- Accompanying slideshow with video clips embedded
- Backup copies of video clips:
  - Access+Ability BrainPort, featuring Emilie Gossiaux
  - Daniel Kish – echolocation – inquiry stimulus clip
  - Neil Harbisson – inquiry stimulus clip
- Paper & pencils/pens for participants to use
- Activity cards (printed and cut) for card-sorting activity described on pages 6–7. The following quantities are for one small group of 10–12 students:
  - Two copies of each of the two cards designated for subgroups 1 and 3;
  - Two copies of each of the two cards designated for subgroups 2 and 4;
  - One copy of the header cards 'Disagree' and 'Agree'
- Creative response stimuli quotes/short texts (printed and cut)

[Time from start: 0:00]

Introduction

> SLIDE: Cover slide [Image by Fabian von Poser]

Welcome and introductions

Warm-up activity: Keep your eyes closed while you attempt to draw a dog. (No peeking!)

[0:02]

Segment 1: Emilie Gossiaux

> SLIDE > PLAY video clip: Access+Ability BrainPort, featuring Emilie Gossiaux[1] (2 mins)

For reference – video description from the Smithsonian Institution website: BrainPort is based on the proposition that one sees with the brain, not with the eyes. Embedded in the headset is a camera, a surrogate 'eye', that translates the shapes of things in the physical world into vibrations that can be felt through a device placed on the user's tongue. With practice, one can learn to interpret the vibrating patterns and actually start to see.

Transcript:

My name is Emilie Gossiaux. I'm an artist and I'm getting my MFA in sculpture.

I've always been an artist. After graduating from high school I went to Cooper Union in New York City.

And when I was a senior I was hit by a truck while riding my bike and I lost my vision. And it took me two years to finish my senior year and graduate. And I transitioned from being a drawer and printmaker to being a sculptor.

A year after the accident, Emilie was introduced to BrainPort, a device that translates light into electric pulses through an electrode that sits on her tongue.

So this is a sensory substitution device. There is a camera attached to the nose of these sunglasses. And attached to the sunglasses is this tongue-piece that sits in your mouth. And there's hundreds of little electrodes that will shock your tongue very gently. And that will create the tactile sensation on your tongue that will then translate in your mind's eye as vision.

With the ballpoint pen and the pattern it lets you feel the texture of what I'm drawing. So I can feel the line, and I can also feel it on my tongue – with the electric shock of the BrainPort on my tongue. So I can feel both at the same time so that helps me visualise what I'm drawing better.

[1] Video credit: Gauthier, C. J. (Producer), Access+Ability BrainPort, featuring Emilie Gossiaux [Video]. Cooper Hewitt, Smithsonian Design Museum. YouTube 15 December 2017.

[0:04]

<u>> SLIDE: BrainPort: A sensory substitution device</u>

Narrative:

A sighted journalist, Nicola Twilley, tried out the BrainPort and described being blindfolded and putting what she called 'the lollipop' in her mouth. She later wrote:

> Suddenly, there was a slightly sour fizzing on my tongue, and we were ready to begin. [The experimenter put] a plastic banana and a ball on the table [and] said "See if you can tell which is on the left and which is on the right. Lips clamped shut around the BrainPort cable, I swept my head slowly from side to side… emitting a startled [sound] as I [perceived] each effervescent object. Although I couldn't explain exactly how I knew, after scanning back and forth for a few seconds I was pretty sure that the ball was on the left and the banana was on the right, and I reached to to double-check. "You grabbed that ball like you saw it!" [the experimenter] said.
>
> Half an hour later, I had successfully navigated an obstacle course of office chairs, and identified the letter 'O' written on the whiteboard…
>
> Just then, our lunch arrived. [The experimenter] warned me to avoid hot peppers and pickles, in order to spare my overstimulated tongue. I barely heard her, slumped in my chair and suddenly aware of how hard I had been concentrating… Stripped of sight, I'd had to squeeze every drop of information I could about the world around me from a plastic square tingling like Pop Rocks on my tongue.[2]

[0:06]

Free response time

Invite brief free-form responses to the video clip and subsequent narrative.

[0:08]

Discussion (13 mins)

"The idea that underlies sensory substitution is … that the brain is capable of processing perceptual information in much the same way, no matter which organ delivers it."[3] The BrainPort's inventor, neuroscientist Paul Bach-y-Rita, says: "You don't see with the eyes. You see with the brain."

Do you agree?

When a person uses the BrainPort, are they truly experiencing a form of vision? Can we call it 'seeing' if your tongue and brain can do it, without your eyes?

What is seeing? *(Pair talk)*

[2] Twilley, N. (2017, May 8). Seeing with your tongue. *New Yorker.* https://www.newyorker.com/magazine/2017/05/15/seeing-with-your-tongue

[3] ibid.

Note: "There is no agreement [among neuroscientists and philosophers] about what a sense actually is. Some argue that vision is defined by the organ that absorbs the information: anything that does not enter through the eye is not vision… [Others] favour a definition of vision that is determined by the source of the stimulus: vision is any processing of information that comes from reflected rays of light."[4]

Adventurer and blind BrainPort user Erik Weinhenmayer describes reaching the summit of a mountain when the sun had slipped out of view. He said: "The lighting was perfect. At that point, I wasn't even thinking about my tongue. I'm just thinking about the picture in my brain."

How do you make sense of a blind person claiming that "The lighting was perfect"?

Do you think he was having a similar experience as a sighted person would have had in that moment?

[0:21]

Narrative (1 min)

Learning how to use a sensory substitution device is tiring work, as the journalist mentioned. It's especially difficult for people who are congenitally blind (*blind since birth*) as they don't know basic principles of how vision works, such as occlusion (how one object can block another) or that things appear larger when they're closer. It can take 70 hours of training to grasp these concepts and learn to identify objects and faces.

> SLIDE: [Blurry image]

One user describes the experience of using the BrainPort as constantly shifting "between decoding and seeing, between frustration and awe."

This calls to mind the experience of people, blind since birth, who have their sight restored through surgery. "These first moments for the newly sighted are blurry, incoherent, and saturated by brightness…and swirls of colors that do not make sense as shapes or faces or any kind of object."[5]

Note: This description refers to the work of Dr Pawan Sinha, a professor of vision whose surgical results in 2011 finally put to rest the 400-year-old philosophical conundrum known as 'the Molyneux problem'.

Experimental psychologist Michael Proulx has said that using a device like the BrainPort "giv[es] you an opportunity to [experience] what sensory perception must have been like when you were an infant." He says: "We can't remember the first year of life and how confusing all that visual information would have been… [Learning to use the BrainPort is] starting you back at square one again, and you have to build up an expertise and an understanding over time."

[4] ibid.

[5] House, P. (2014, August 28). What People Cured of Blindness See. *New Yorker*. https://www.newyorker.com/tech/annals-of-technology/people-cured-blindness-see

[0:22]

Discussion (4 mins)

Do you agree with Michael Proulx that using the BrainPort would be akin to going back to babyhood in your sensory perception, having to re-learn to interpret a confusing world?

Can you meaningfully hold an opinion on this without trying the BrainPort for yourself?

Background information for facilitators: Sensory-substitution devices rely on neuroplasticity (adapting and rewiring the brain) and cross-modal integration, where information from one sensory modality (such as vision) is translated into another (such as touch).

[0:26]

Segment 2: Daniel Kish

This next video clip features Daniel Kish, expert in human echolocation and President of World Access for the Blind.

> SLIDE > PLAY video clip: Daniel Kish – echolocation – inquiry stimulus clip [6] (5 mins)

Transcript:

[Daniel Kish] There's a whole dimension of experience available to the perceptive blind person.

[Daniel clicking] If I click at a surface, it answers back. It's like asking a question. What are you and where are you?

I can get, through echolocation, a really rich, palpable, satisfying, three-dimensional, fuzzy geometry. There's hardly a richer tapestry of sound and essence.

If you can learn to manage and function as a blind person, you've overcome one of the greatest challenges to befall anyone. Echolocation leads to greater freedom.

[Daniel and Nathan both clicking] [both chuckling]

"See if you can find a high point of the ceiling. Where does it seem like it's the tallest?"

"Right about, eh… Maybe a little more. Ah, there."

"Okay, what does it seem like it does up there?"

[both clicking]

[Nathan] "Man, you can't really tell if there's, like, a hole up there because it's not that clear."

[Daniel] "Can you articulate what that sounds like? How is this click coming back different from, say, if you were standing closer to the wall?"

[Nathan] "'Cause it's coming back so quickly that it's a little more in-your-face-feeling." ….

[6] This clip is excerpted from excerpts from Wolin, B., & Minahan, M. (Directors). Echo [documentary]. *The New Yorker*.

I think Daniel was an example of what somebody could do as a blind person. Daniel was the answer to how. ….

[Daniel] A lot of students don't get the chance to learn to skateboard because they're just told that, 'You can't do that, you shouldn't do that, we're not gonna let you try this.'

"So you don't really think anyone tried to say you shouldn't be doing that?"

[Student] "Well, usually, if they say, You shouldn't do that, I'd say, 'Screw you, I don't care, 'cause there's no way to stop me.'" ….

We're still back in the dark ages of cautiously designed, cautiously implemented systems of instruction for blind folks. That's not the way you learn echolocation. ….

It makes a teacher proud.

[0:26]

Free response time

Invite brief free-form responses to the video clip.

[0:28]

> SLIDE: [Daniel Kish holding perspex square]

Activity

Let's see if we can experience a bit of echolocation for ourselves.

Close your eyes and click your tongue repeatedly as you gradually bring a flat object (e.g. a book, or your flat-palmed hand) towards your face. At what point do you hear the sound of the echo change?

It might work best to have one person demonstrate this while the rest of the group (the audience) shuts their eyes.

[0:30]

> SLIDE: [Daniel Kish and Nathan in cave]

Card-sorting activity

Lay down headings 'Disagree' and 'Agree' at opposite ends of a spectrum.

Disagree …….. Agree

I want you to break into four pairs/subgroups. I'm going to give each pair two cards with statements on them. I want you to think with your partner about to what extent you agree or disagree with each statement. **Don't lay your cards down just yet** – we will do that together when we come back together as a whole group.

Distribute one pair of statements to each of four subgroups as follows:

– *the following statements (each on a separate card) to subgroups 1 and 3:*

Blindness is only a *difference*, not a *disability*.

Echolocation is a superhuman ability.

– *the following statements (each on a separate card) to subgroups 2 and 4:*

Humans can adapt to any limitation.

If everyone learned echolocation, the human species would be enhanced.

Subgroup deliberation (5 mins)

Report back & discuss (12 mins)

Invite each subgroup to lay a card down on the spectrum, explaining their thinking. Give a 'right of reply' to the other group that considered that same statement, before moving on.

……

[0:47] **Break** (3 mins)

……

[0:50]

Segment 3: Neil Harbisson

> SLIDE > PLAY video clip: Neil Harbisson – inquiry stimulus clip [7] (4 mins)

Transcript

[Neil Harbisson] I am a cyborg, and 'cyborg' comes from the union between cybernetics and organism and that's how I feel.

I have a visual condition called achromatism which is total colour-blindness.

My antenna is a body part and it allows me to hear colours. So it has a colour sensor that picks up the light frequencies in front of me. It sends the light frequencies to a chip at the back of my head and then the chip transposes the colours into sound waves. So I hear colour through bone conduction.

I don't feel that I'm *using* technology, I don't feel that I'm *wearing* technology, I feel that I *am* technology. I feel no difference between the software and my brain, or the antenna and the other body part. The software is a part of my mind and the antenna is a part of my body.

"I convinced the doctor to have it surgically implanted, and now it's just inside. So it's an antenna implant."

[7] The majority of this clip is excerpted from Brunkalla, G. (2015, January 29) Hearing Colours [Video]. Some audio in the clip is also taken from SBS (2014, October 28), Neil Harbisson: Eyeborg [Video] SBS: The Feed. YouTube; and from TED (2012, July 21) Neil Harbisson: I listen to color [Video]. YouTube.

"So you have that on all the time?"

"Yeah it's permanent, it's a body part."

"You don't take it off when you go to bed?"

"I sleep with the antenna, I take showers with the antenna. It's just a new body part for me."

At the start though, I had to memorise the names you give for each colour, so I had to memorise the notes. But after some time all this information became a perception – I didn't have to think about the notes. And this perception became a feeling, I started to have favourite colours and I started to dream in colours. The software and my brain had united. That's when I started to feel like a cyborg.

Having new senses or new body parts will create new conversations between people. They are also interested in knowing, for example, how their face sounds. So I just scan their face and tell them how they sound. So it creates conversations that I would never have had with people if I didn't have this sense.

So before, I realised that people made connections between things or objects, and I could not see the link between these two objects. For example, the colour of the sky and the colour of someone's eyes – I mean, in the greyscale world there is no connection.

Now that I can hear colour, I have such connections, and connections go beyond that as well because also when I hear sounds I can relate the sound to an object or a colour. So if I hear the G sharp of a taxi, the horn of a taxi, that to me is related to a lime, for example. 'Cause it sounds just like a lime.

My favourite colour is infrared, and it's a colour that is not actually visible to the human eye. It's a colour that I can perceive in total darkness.

Well, having a new sense changes the way you perceive everything.

And then I didn't see why I should stop there. There's many more colours that are in other places that I am not. So I didn't see why I should not add internet so that other people could share the colours that they are seeing. So if someone in America wants to send colours of a sunset they can just connect the mobile phone to my head and then I suddenly sense the colours of the sunset.

Having internet allows me to have an eye in each continent. So now there's five people that have connection to my head and they don't give this information to anyone else because I can easily be hacked – so someone else could just connect to my head and send colours in the middle of the night and that could be quite annoying.

And then I didn't see why I should stop on planet Earth. There's also colours in space and this can allow me to connect to satellites. Space is very noisy because there's lots of ultraviolets and infrareds and also visual colours. So it was overwhelming when I connected the antenna to NASA's satellite because there was a lot of information.

[0:54]

Free response time

Invite brief free-form responses to the video clip.

[0:56]

> SLIDE: The world's first legally-recognised cyborg

Discussion (15 mins)

Neil Harbisson's antenna, which translates colours into audible frequencies, effectively extends his sensory perception beyond the typical human range, including hearing ultra-violet and infra-red frequencies, and tuning in to colours out in space.

Is it possible, then, for us to invent entirely new senses or super-abilities? *(Pair talk – invite idea generation)*

Should sensory augmentation go mainstream?

Note: Harbisson's partner Moon Ribas has implanted online seismic sensors under her skin, which vibrate whenever an earthquake occurs.

Harbisson also suggests that we could develop "an infrared detector built into our heads to detect if there's a presence behind us."[8]

He also points to a range of senses that "might seem strange but they're very normal in other species"[9]*, such as polarised light vision, heat vision, magnetoreception and electroreception. Some animals also have exceptional navigational abilities and very heightened capacities for ordinary human senses (consider for example dogs' sense of smell).*

The VEST (Versatile Extra-Sensory Transducer) is a waistcoat designed for deaf people, with embedded vibratory motors that translates sound frequencies into tactile stimuli. In the future, however, the VEST might be used by a broader cross-section of the public that wishes to 'feel' stock-market data or even space weather (depending on what data is harnessed).

Neil Harbisson can receive visual data from people around the world. As he says, he has 'an eye in five continents'.

How might our perception change if each of us could 'see' the world through someone else's senses?

Could this foster greater empathy and understanding among people worldwide?

[1:11]

Activity: Draw a tortoise

Bear with me, because this point of this activity will make sense in a couple of minutes!

> SLIDE: [Tortoise]

Here's a photo of a tortoise. I'd like you to please draw a *cross-section* of the tortoise. (Or to think of it another way, if you had X-ray vision, what would you see when you look at a tortoise side-on?)

[Participants draw, and then share drawings]

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[8] Jeffries, S. (2014, May 6). Neil Harbisson: the world's first cyborg artist. *The Guardian*. https://www.theguardian.com/artanddesign/2014/may/06/neil-harbisson-worlds-first-cyborg-artist

[9] Brethour, D. (2015, October 7). Why Are You Sending Me Colours In My Head? An Interview With Cyborg Artist Neil Harbisson. *Headstuff*. https://headstuff.org/topical/science/why-are-you-sending-me-colours-in-my-head-an-interview-with-cyborg-artist-neil-harbisson/

Many of us intuitively suppose that a tortoise lives *inside* its shell, with the shell being a separate entity that protects and shelters it.

But as the reporter Helen Sullivan says…

> SLIDE: [Tortoise cross-section]

"the tortoise does not live inside a shell, it *is* a shell… the sockets of [tortoises'] hip and shoulder bones are inside their shells, right at the top."

Personally, I was completely astonished when I learned this particular fact about tortoises. And I think it offers us a way of understanding something about Neil Harbisson's identity.

Remember that he said: "I don't feel that I'm *using* technology, I don't feel like I'm *wearing* technology. I feel like I *am* technology."[10]

[1:14]

Discussion (16 mins)

Do you think it's true that Neil Harbisson *is* technology – or does he just *feel* that way to him?

Are there limits to what we can *be*? What are those limits?

Are there limits to what we can *identify* as? If so, what are those limits?

Note: Harbisson has said: "I am a biological cyborg… What really changed the way I identified myself was the union between the mind and the software."[11]

How does technology shape our sense of self?

[1:30]

Creative response time

> SLIDE: Your creative response

Creative response time is an opportunity for students to produce any kind of creative response to the discussions they've had today. It could be a written reflection, story, dialogue, comic, poem, drawing, mini-zine, persuasive argument, letter, or whatever other format they like.

Creative response stimuli *(print and cut; or show on* **SLIDE***)*

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"Doors aren't open to blind kids in this society, almost any society, the doors are shut, barred, locked. You have to kick down that door because we've spent millennia being kept in the dark."
– Daniel Kish, expert in human echolocation

[10] Brunkalla, G. (2015, January 29) Hearing Colours [Video]. [01:15–01:21]

[11] Brethour, D. (2015, October 7). Why Are You Sending Me Colours In My Head? An Interview With Cyborg Artist Neil Harbisson. *Headstuff*. https://headstuff.org/topical/science/why-are-you-sending-me-colours-in-my-head-an-interview-with-cyborg-artist-neil-harbisson/

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A man using a sensory substitution device to identify a plaid shirt says, "It sounds a bit checkered."
– Adapted from 'Seeing with your Tongue', *New Yorker*

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Imagine a person, blind from birth, who could tell apart a cube and a sphere by touch. If her vision were restored, and she was presented with the same cube and sphere, would she be able to tell which was which *by sight alone*?
– An articulation of the Molyneux problem

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"Subjective experience isn't the whole story. Humans, unlike bees, don't normally see ultraviolet light; we can't sense Earth's magnetic field, unlike turtles, worms and wolves; are deaf to high and low pitch noises that other animals can hear; and have a relatively weak sense of smell."
– Alison George, *New Scientist*

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"The doorbell tastes like burnt toast."

"Chocolate smells pink and stripy."

"Thursday feels fuzzy."

"The letter 'A' is red."

These are the kinds of cross-sensory associations you might hear from people who have *synaesthesia* – a perceptual phenomenon in which stimulating one sense leads to involuntary experience in another sense.

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[1:40] **End of workshop**

Further reading

The following excerpt from the *New Yorker* article 'What People Cured of Blindness See' describes the Molyneux problem (which originated in 17th century), and its empirical resolution (discovered in the 21st century).

> In 2011, Dr. Pawan Sinha, a professor of vision and computational neuroscience at M.I.T., published his answer to an almost-four-hundred-year-old philosophical problem. The philosopher William Molyneux, whose wife was blind, had proposed a thought experiment in the seventeenth century about a person, blind from birth, who could tell apart a cube and a sphere by touch: If his vision were restored and he was presented with the same cube and sphere, would he be able to tell which was which by sight alone? The philosophical camps on Molyneux's question divided roughly through the centuries into those who believe that certain qualities, such as the roundness of spheres, are innate and shared among the senses (the Yeses), and those who insist that, to understand roundness, the eyes must have already seen roundness (the Nos). … after the discovery in the early eighteenth century that a simple cataract surgery could lift the curtain of blindness for some, Molyneux's thought experiment became, simply, an experiment.
>
> Since 2003, Sinha, through a non-profit that he founded called Project Prakash, has organized and supervised sight-restoration surgeries for more than two hundred blind children from some of the poorest regions in India. The surgeries were given to any child who medically qualified, a subset of whom had been blind since birth with cataracts. After sight had been restored, Sinha posed Molyneux's question.
>
> The results might have disappointed those in Molyneux's Yes camp. Sinha showed me a video in which a teen-age boy, blind since birth because of opaque cataracts, sees for the first time. The boy sits still and blinks silently, the room around him reflecting in his eyes as a kind of proof of their new transparency. Sinha believes these first moments for the newly sighted are blurry, incoherent, and saturated by brightness—like walking into daylight with dilated pupils—and swirls of colors that do not make sense as shapes or faces or any kind of object. "The moments immediately following bandage removal are not quite as 'magical' as Hollywood movies would have us believe," Sinha told me. To answer Molyneux, then: No. A cube and a sphere are both lost in this confusion.
>
> Stephen Kosslyn, a pioneer in the field of vision and mental imagery, told me that he was not surprised by Sinha's results—many of the seemingly natural qualities in everyday vision are not innate but are instead learned through experience.[12]

[12] House, P. (2014, August 28). What People Cured of Blindness See. *New Yorker*. https://www.newyorker.com/tech/annals-of-technology/people-cured-blindness-see