Episode 79: A Hole in the Head: Phineas Gage Revisited

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VOICEOVER
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JENNIFER COOK
Hello and welcome to Up Close coming to you from the University of Melbourne, Australia. I’m Jennifer Cook and I’d like you to imagine for a moment that it is 4.30 in the afternoon on a Wednesday, September the 13th 1848 and we’re in Vermont, the USA and a railway worker is about to make medical history.

25 year old Phineas Gage is drilling holes in rock for blasting. He’s using a special crowbar like tool called a tamping iron, and his job is to pack the powder and then the sand before lighting the fuse. But on this day he makes a mistake and begins tamping before the sand is added with disastrous results. The powder explodes and the tamping iron with a rough diameter of an inch and a quarter or 3cm shoots completely through his skull. But not only does Phineas survive, he lives for another 11 years. His case goes on to fascinate experts in the fields of psychology, neuropsychology and physiology.

But just how much do we really know about Phineas and his recovery. The conventional wisdom has him suffering a major personality change, becoming erratic and volatile, even working as a circus freak. But Malcolm Macmillan, a professorial fellow from the Department of Psychology, University of Melbourne, believes there’s evidence that Phineas may indeed have made a social recovery.

He joins me today on Up Close to discuss the ramifications of the Phineas Gage case for both patients and practitioners. Now Dr Macmillan, I’ve briefly explained Phineas’s accident, but what is so fascinating of course is the aftermath. Could you take us through what happened?

MALCOLM MACMILLAN
Well, he was knocked over, may not have been unconscious and within possibly a
few seconds got up and was helped to an ox cart and driven to the inn nearby where he stayed. He got out of the cart by himself, sat on the verandah and told everyone what had happened to him until a doctor turned up to see him. He looked up at Dr Williams and said "well doctor, here is business enough for you?", which is one of the greater understatements in medical law.

Now, he recovered after about three months, being treated by another doctor, Dr John Martin Harlow, who was actually resident in the town. Despite a couple of episodes of deliria with infection he did make enough of a recovery to go home in about the middle of November that year.

As far as we can tell from the first recording of what he was like, he was completely sound physically. He may have been a bit childish mentally but that?zs about all that we do now. Now, I?m more interested in the long term recovery, what happened to him after several years. That itself is a complicated story, because he did undergo a personality change according to Dr Harlow. But Dr Harlow didn?t report that until about 20 years after the accident itself.

JENNIFER COOK
So how would Phineas have been treated and handled as a patient?

MALCOLM MACMILLAN
Well, we know that fairly definitely for the time that he was still in Cavendish, Vermont, he was in the hotel that he lived in and he was nursed there by someone referred to as a medical attendant. Then he went home and he was able after a few weeks to be up and about and riding and walking and things like that. We know from a visitor who called on the family in August, a medical man from Boston, that he was then working. He was ploughing and so on. This is still what, about nine months after the accident.

The family did tell him that when Phineas got back from his stay in the inn he was weak and childish and had some kind of memory problem, but they said a stranger would notice nothing wrong with him.

JENNIFER COOK
What were the current theories of the mind during Phineas?zs mind?

MALCOLM MACMILLAN
Practically none. The only people saw a relationship between mental function and the brain were the phrenologists. Phrenologists nowadays are thought of as quacks and charlatans. That?zs far from the case, particularly in New England. They?re a very respectable subset of the medical profession. When one of the leading figures died, that is a phrenologist who was visiting died, the President of Harvard University was among the pallbearers. They were held in pretty high esteem and well represented in medical schools right through New England.

It wasn't until actually the year after Phineas died that even the link between
language and brain damage was made. That was in France and it was by Paul Broca. It’s something we all know now, that is, if people have strokes they’re liable to have a paralysis on one side and a loss of language. But that wasn’t even known at the time that Phineas was injured, the time during which he survived and wasn’t known until after his death.

JENNIFER COOK
So does the Phineas story looking at it from today’s point of view, does it support the theory of brain localisation and just what do we mean by that term?

MALCOLM MACMILLAN
Well, in 2009 it’s a bit difficult to know what we mean by brain localisation. There’s always been people who’ve taken a view that there aren’t functions localised in any particular part of the brain, so that for instance the language function is distributed over a wide area or the control of movement is through parts of the brain that are also distributed. But that’s always been opposed by a narrow localisation view, almost as if when you lose language that you’ve lost a dictionary of words that you can’t get to.

The modern view? I’m going to say modern view? it’s at least I suppose about 100 years old? is that the localisation isn’t strict, it is distributed. As far as personality is concerned, we know that the kind of behaviour that Phineas was supposed to have shown, that is, his profanity, his irreverence and things like that, that these functions are more likely to follow damage to the front parts of the brain, a bit above the eyes. They’re more likely to give rise to these sorts of personality defects, but exactly how they exercise that function we don’t know. There’s still a lot of minor detail really to get dug up about Phineas. I’ve now got to be fascinated with the question of did he make a social recovery or did he make a decent psychosocial adaptation?

JENNIFER COOK
What conclusions have you come to there and what’s your evidence for drawing those conclusions?

MALCOLM MACMILLAN
Well, partly it’s evidence that was already there, things that we already know or knew but just needed a more careful look. Partly it’s also something that we’ve discovered? when I say we I have a colleague, Matthew Lena in Boston who found this particular thing. It’s a report of an informal discussion at a medical meeting in Ohio, at which somebody asks the question what happened to Phineas Gage?

There was a doctor present who said he had been in Valparaiso, which is where Phineas was working. He knew that Phineas was working as a stagecoach driver and he was completely recovered in all his mental faculties. That is, he’d recovered completely psychologically. That’s that kind of evidence, but then you look more carefully and think, well somebody engaged Phineas to go to Chile to drive
stagecoaches.

JENNIFER COOK
Well that would take a lot of skill wouldn't it?

MALCOLM MACMILLAN
A lot of skill and a lot of personal qualities and of which impatience, profanity?

JENNIFER COOK
Childlike behaviour.

MALCOLM MACMILLAN
?and so on, just doesn't fit. So it?s partly looking back at that evidence and looking at the new evidence that I?ve pretty well come to the conclusion that he had, by the time he died, made a reasonable recovery. If Phineas recovered, he recovered more or less by himself and I believe he recovered because he was working in a structured environment. In working for a stagecoach line he had to be up at some ungodly hour of the morning, feed and groom the horses, harness them, have the coach ready to begin its journey from Valparaiso to Santiago at 4.00 in the morning. Then he had to load all the passengers luggage, take their fares, make the change and then drive for 12 to 13 hours before getting to Santiago at the other end of the run. Then he probably had to do the same thing the next day or maybe there was a break of two days. Now someone who is irrational is not going to cope with a job like that, but more to the point, someone who has got trouble in managing his behaviour is having through a job like that his behaviour managed for him. That matches exactly what is happening in the field of neuropsychological rehabilitation for these kinds of conditions, which are nowadays known as dysexecutive functions. The method was pioneered by a Soviet psychologist, the late Alexander Luria and used with a lot of success in the treatment of red army soldiers who had head injuries following the Second World War.

JENNIFER COOK
You?re listening to Up Close coming to you from the University of Melbourne, Australia. I?m Jennifer Cook and I?m talking with Malcolm Macmillan, a professorial fellow from the Department of Psychology, University of Melbourne, about the intriguing case of Phineas Gage. Now Malcolm, you were just mentioned the Soviet doctor Alexandra Luria. Luria places a lot of emphasis on internal language and overcoming the deficits of executive function. So what is this language like, and is it the language that you?re acculturated in?

MALCOLM MACMILLAN
No. What Luria meant was the use of speech or language rather in regulating
behaviour. You see this kind of thing a lot with children. Now I pick up the stick, now I do this, now I do this. All the dolls going here, there and the child is actually doing all of the manipulation of the stick and the doll, but talking to themselves about it, representing that external action. When it comes to the child? s own actions it usually is a long time before what the child uses in its speech becomes automatic and internalised and doesn't have any verbal reference.

Now it was that kind of thinking because Luria was also a psychologist before he was medically trained. He did a lot of work on variations in the use of language and the concepts that went with them across different cultures. He studied twins, identical and fraternal. He studied the aphasias and so on so he had a pretty fair idea of what he thought language would do.

In the case of the rehabilitation of people there would be a programme of things to do. It might be solving a kind of psychologist test problem. It might be something in a workshop. It might be some part of everyday life. You had first of all to take the simple instance of doing a simple mechanical task that involved a sequence of actions. You? d have someone sit next to you if you were the patient saying now put the screw into the screw hole, now pick up the screwdriver, now start turning the screw and so on. That kind of external language of the supervisor or the rehabilitation worker would eventually re-establish the patient? s own ability to talk him or herself through the act. Eventually it could be done as in the case of the child, without having to talk at all. My understanding of Luria and the rehabilitation practices that have developed from his work gives me a better understanding of Phineas, and the kind of adaptation he might have made.

JENNIFER COOK
Now Malcolm, what lessons can be learned from Phineas, very specific lessons in the treatment of this rehabilitation of the patients who suffer with frontal lobe injuries? We? ve spoken about this very structured healing process. What else is there?

MALCOLM MACMILLAN
Well, that? s really the main thing. I? ve been digging around in the literature to find cases where there might be some kind of recovery without formal treatment. I? ve picked up about 15 of them. Of course because they didn? t get any formal treatment they tend not to be reported in the literature, so there? s probably a lot more than the few that I? ve found.

I mean one was when I read about him, he was already 80 years old and had had a head injury during the time of the Spanish Civil War. Now he came from a very supportive family that ran a small business in which they could employ him, and he went on to marry and have children and work in the factory up until the time of his retirement. However, he required constant supervision, constant structuring of what he was doing for the rest of his life.

There is another case of a young girl. She was 17 at the time of her car accident when she had frontal lobe damage, with a 19 year long follow up, that is, she was in her mid-30s. Now she? d had a pretty terrible time of it in one way and another, in
and out of rehabilitation programmes, nursing homes, picked up by blokes and used sexually and so on. She had much more of the irrational behaviour that we associate with this syndrome, unlike the Spanish man. But eventually she fell into the hands? and this is how the authors report it? she was passed over to a man who had no sexual interest in her. But he decided he would rehabilitate her. So he drew up? this is now 17 years after the accident? he drew up a plan of what to do step by step day by day. He didn?t vary it one iota from one day to the next. After two years this lady was able to look after herself. She actually lost that skill, but she was able to look after herself. She could go out by herself and do the shopping and she could manage things around the house. So this is the kind of thing that Luria points to, but there is another aspect to it. Of course, not all of the patients that Luria woke about actually recovered. It?s hard to figure out from the statistics he gives, but it?s probably about 10%. It might even be as low as 5%. So what about the remainder? What about all these other soldiers who didn?t recover through the rehabilitation programme? Well they were given specially structured environments in which they could live, housing, workplace and so something like a kind of sheltered workshop with accommodation. They all supported themselves as far as I can tell from the descriptions that he gives. So even if the individual doesn't respond to a rehabilitation programme of the kind that I've described, there?s a lot of hope for structuring the environment and the things for everyday living in other ways.

JENNIFER COOK
Also too, I?d just like to briefly touch on some of the misconceptions we can have about that time and about Phineas?s life. Much has been made of the fact that he toured as part of Barnum?s so called circus freaks, but you have a different insight into Barnum himself.

MALCOLM MACMILLAN
Oh yes. I mean, there?s no question he didn?t tour as part of any sort of freak show. Barnum is now known as the circus man and of course we know about Barnum?s freaks. But Barnum actually exhibited those freaks at a stationary museum in the middle of New York City. He wasn?t into just promoting those kinds of things. He organised for Jenny Lind, the famous Swedish Nightingale, greatest singer of the middle 1800s. He was a man of a number of different parts. We haven't been able to find anything to confirm that Phineas was at Barnum?s museum, except a letter from Dr Bigelow, the surgeon who saw him a year after the accident. Writing to a friend saying yes, well Phineas did take that job at Barnum?s but he had to give it up because the public wasn't much interested in that kind of thing. If you think about it, if you?ve got a man holding a tamping iron and a head that?s now covered with a decent mop of hair, what is there to see? That?s apparently why, although he was anxious in Bigelow?s phrase to earn an honest penny, he gave up his appearances at Barnum?s. We do have a poster and a newspaper announcement ? these have recently been discovered ? of Phineas advertising that he was going to exhibit himself and give a
Talk on what had happened to him in Concord in New Hampshire. He does that complete with a stack of letters, testimonials from various doctors who have examined him and testify to the fact of the accident. In one of those appearances he's accompanied by somebody called General Washburn, a ?dwarf skeleton?, who played the violin and sang and so on, but that's as close as we get to him as part of a freak show.

JENNIFER COOK
Curiouser and curiouser. Now Malcolm, your research is ongoing and you'd like some help.

MALCOLM MACMILLAN
Yes. If anybody in the audience that hears this programme knows anything about Phineas in New England or particularly in Chile and more particularly in Valparaiso in the 1850s, I'd very much like to hear from them.

JENNIFER COOK
We'll make sure Malcolm, that your email is available on our Up Close website. Thanks for your time.

MALCOLM MACMILLAN
Well, thank you for allowing me to talk to your audience about it.

JENNIFER COOK
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