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Ladders, Learning and Lessons from Charlie: exploring the potential of public click pedagogy[1]

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Abstract

Learning new material, developing new skills or making new discoveries can be complicated, lengthy and messy. Few of us go from inexperienced to skilled or novice to master in anything like a simple, tidy or routine manner. We often learn more from our mistakes than our successes. Yet, in efforts to 'teach' students various facts, skills or dispositions, formal education systems favor simplification of content and gloss the messiness of learning.

Depending upon its complexity, what we are attempting to learn is often rendered into a simpler, tidier, approximate version, one deemed suitable for our current level of knowledge by those who have greater expertise in what is to be learned. Well intentioned rendering often goes hand in hand with overlooking the specific moves or means through which individuals actually come to learn things.

Recounting our own experiences of learning to do/think/know something is difficult. The metaphor of Wittgenstein's ladder helps here. The image of the ladder suggests that as we learn more about a particular subject, we progress further up a ladder. But, just as importantly, as we climb higher, the lower or bottom rungs fall away. We don't necessarily remember the steps we took in the past. The questions, mistakes and missteps that occurred at the bottom of the ladder are forgotten. For the expert knower, climbing back *down* the ladder becomes more difficult the higher up the expert is. Remembering what it was like before we got to where we have on any particular ladder is not easy. Bringing the ladder metaphor together with the tidying or simplifying practices of education, it is possible to argue that the ladder built by an expert is always a ladder with its bottom rungs missing.

This paper is based upon a hunch that focusing on bottom rungs has a role to play in facilitating learning. The experience of coming to terms with a body of knowledge for the first time is rarely shared. Significantly, a student almost never gets a glimpse of what his or her teacher went through to achieve the understandings they now have.
We draw on lessons from actor-network theory (ANT) to make a case for what we call public click pedagogy, a public sharing of the steps made as one attempts to climb a ladder: mistakes, mess and missteps as well as 'aha' or 'click' moments.

Keywords

Public click pedagogy, actor-network theory, Wittgenstein's ladder, notebooks, ready made learning, learning in the making.

R N (Red Notebook)

126 no. mad dogs. Azores. although kept in numbers. p. 124. WebsterConsult W. Parish & Azara about dry season[.] 1791. seen commonly bad over whole world. {(Was it so in Sydney, consult History? Phillips.} 1826.27.28 get. drought at sydney. which caused Capt. Sturt expedition.— Another one in 1816 (?). —

(Darwin & Herbert, 1980, p. 63)

129 wide limits of Waders: Ascension. Keeling: at sea so commonly seen. at long distances; generally arrives first:—

New Zealand rats offering in the history of rats, in the antipodes a parallel case.—

Should urge that extinct Llama owed its death not to change of circumstances; reversed argument. knowing it to de a desert.— Tempted to believe animals created for a definite time:—not extinguished by change of circumstances:

(Darwin & Herbert, 1980, p. 66)

These are two excerpts from the *Red Notebook* of Charles Darwin. His notebooks are commonly enacted (Mol, 2002) as the records of a scientist puzzling across a large range of natural phenomena, including geology, paleontology and biology. In this paper we enact them as a trace of Darwin *learning*, an inscription that records his points of puzzling, his theoretical speculations, one of his logs of observations. It is not our purpose here to revisit the scholarly work that has carefully organised the artifacts that Darwin left as a basis for reconstructing the steps he took to arrive at a theory of what we now term evolution (Darwin, 1859), rather, we are interested in his notes.

When you read the *Red Notebook*, wonderfully annotated and edited by Sandra Herbert, you get a glimpse into the range of his interests, his grasp of the work of others in the many fields in which he was engaged. What also strikes you is the messiness of and a kind of jumpiness in the notes. In the second excerpt, for example, we skip from waders to rats to extinct Llamas in a few lines. Scholars of Darwin are better placed to write about the transformation of notes, diagrams, samples into the text that appears in his *On the Origin of the Species*. But, in these notes we have a trace of his musings, the ideas that came to the fore when prompted by his observations, the peripatetic manner of his recorded thoughts.

What Darwin did, is of course not unusual for scientists, nor for most writers and scholars. Keeping notebooks or journals is common for most scholars, researchers and many students[2]. What is interesting about Darwin's work is that it has been made

[2] We kept a log of our struggle with the ideas of this paper which will be posted in blog form: http://www.chrisbigum.com/wp/

available online[3]. It is *public*. Keeping the notion of these notes as a trace of the *learning* Darwin to the fore, we have an inscription of learning that is now public. We can examine the inscription. We can follow the articulations other scholars have made from these notes[4]. We can, in a sense, peer over Darwin's shoulder, working in his various laboratories, and trace his accumulation of other inscriptions, samples and artifacts. One of the end products of this is, of course the production of papers and books for publication (Latour & Woolgar, 1979).

When you juxtapose Darwin's collection of inscriptions, samples and artifacts with his finished work you have an example of the distinction Latour (1987, p. 4) makes between *ready made science* and *science in the making*. We have just, in a single sentence, collapsed a long and detailed argument made by Latour in a two hundred and seventy page book. What we want to draw attention to however, is that there are parallels to be drawn between the making of science and the making of learning.

8 x 7

> 'What is eight times seven?'
>
> 'Fifty . . .' The eldest boy wavered.
>
> 'Yes,' I said, encouraging.
>
> 'Fifty-four,' he ventured.
>
> 'Nearly,' I said. 'Fifty-six.'
>
> This hesitation, a habit of many of my students, intrigued me. It suggested not ignorance, but rather indecision. To say that a student has no idea of a solution, I realised, is untrue. Truth is, the learner does have ideas, too many, in fact – almost all of them bad. Without the knowledge necessary to eliminate this mental haze, the learner finds himself confronted with an embarrassment of wrong answers to helplessly pick from.
>
> What had the boy been thinking, I enquired, when he selected fifty-four as his answer? He admitted having previously considered fifty-three, fifty- six, fifty-seven, and fifty-five (in that order). He had felt sure that fifty-one or fifty-two would be too small an answer, both fifty-eight and fifty-nine, too high. Then I asked him why he had finally preferred fifty-four to fifty-three. He replied that he had thought of the eight in the question, and the fact that fifty is half of one hundred, and that half of eight is four. (Tammet, 2013, p. 43)

Daniel Tammet, diagnosed with high functioning autistic savant syndrome, recalls from his days as a home tutor of elementary mathematics, working with three children of a family, two boys and a girl. He writes of helping them with their times tables. He taught as he experienced numbers and patterns, with curiosity. He did not criticise them when they made mistakes nor when they were slow to answer a question. He told them when they were close to the right answer. In his account, Tammet goes on to describe how he explores patterns of even and odd numbers with the children.

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[3] http://darwin-online.org.uk/Introduction.html

[4] But not their notes as they worked on making their articulations.

In the excerpt quoted above, the child had no shortage of ideas about the answer to the question. He lacked the heuristics to work with number patterns although he had some awareness that he could progress by *eliminating* the many answers that came to mind. Unlike Darwin, the child did not keep a notebook.

Times tables are a tidied product of number patterns. Students typically experience times tables as facts to memorise and be quizzed on. You are either right or wrong. The child in Tammet's account is dealing with *ready made tables* mitigated by Tammet's attempts to engage them in *tables in the making*.

Tammet is interested in mistakes and in learning from them, a point we will take up later in the paper. Mistakes, however are not things that are often tolerated in formal education systems.

Learning how to *do* science

One of us, a long time ago, was an undergraduate science student studying at an established university. Science, and chemistry in particular, was his love. His preparation for university was not ideal. He recalls a good deal of 'self teaching' that took place. He entered university knowing nothing about what to expect. This was the mid 1960's. Practical work was a key element of most subjects he took. In some practical work, he was required to carry out experiments to measure the value of well known constants like *g* or the values of the properties of well known substances[5].

He soon discovered that if he used the data he collected to generate his results and the results fell outside an *acceptable* range, he would fail. He adapted, effectively learning how to reverse engineer acceptable results with acceptable error margins. His tutors and demonstrators were uninterested in results that did not conform to the known, right answers. There was no time or resources to participate in making science. He had to conform to *ready made science*. Mercifully circumstances changed when, in the final years of the degree, he was able to do experiments for which there were, at that point in time, no right answers. He was able to participate in *science in the making*.

It's easy to understand that for tutors when faced with, for example, a large number of incorrect values for something like *g*, the attraction of assessing laboratory reports based upon the actual value of *g* is great. Taking the time to work with each student to track down mistakes, errors or accidents is simply not feasible. The *tidiness* of the right answer offers an efficiency that wins every time over pursuing sources of error in incorrect results.

Since those pre-Internet days the importance of efficiency and tidiness have grown as the numbers of students in formal education systems have grown and access to an increasing set of online resources has grown considerably. Resources like the Khan academy,[6] free online courses, and the many resources that support do-it-yourself (DIY) learning for almost every field of human interest is indicative of the generosity of

[5] Such as the pH, solubility, melting or boiling points of substances.
[6] https://www.khanacademy.org/

experts to share their expertise and the willingness of large numbers of learners to make use of online materials. It is impossible to categorise all the current offerings online except to say that we would expect a spectrum that ranges from, making an analogy with Latour's (1987) distinction between the two faces of science, ready made learning through to versions of learning in the making. Learning we suggest, like science, has two faces: one that knows, the other that does not know yet (Latour, 1987, p.7).

The transition from not knowing yet to knowing can be complex. Depending upon the resource, learners can access, in addition to online materials, exchanges with other learners, support from experts or feedback from software that provides assessment of their learning. The significance of making this large array of learning resources public is yet to be realised. Some of its limits have been investigated in the research work of Sugata Mitra.

Learning from holes in walls

Sugata Mitra (Mitra, 2003, 2006, 2009, 2010; Mitra & Dangwal, 2010) has researched alternatives to providing formal education to parts of the world in which it is difficult or impossible to provide good teachers and, sometimes, schools.

He recalled one of his experiments in a keynote address he gave to an Association for Learning Technology (ALT) conference was (Mitra, 2010),

> So back in 1999, I tried an experiment. I made a ATM like structure into the wall of a slum which eventually got called the Hole in the Wall and put on the English internet and left it there. And very quickly saw that the children were beginning to teach themselves how to use the computer. This happened everywhere, including the deserts of Rajasthan… these children have seen a computer only a few days ago, or a few months ago. They don't know any English. They've taught themselves whatever English they needed to do, to be able to do all this…This was the conclusion from that section of the work, that groups of children can learn to use computers and the internet on their own, irrespective of who or where they are. So it didn't matter what language they spoke in, it didn't matter how rich or poor they were. And I tried this in India in hundreds and hundreds of villages. I tried it in Cambodia, I tried it in Africa, and everywhere we got the same result.

In 2006, he moved to England and decided to design an experiment to show that there are things that children *cannot* teach themselves. He chose a village called Kalikuppam[7]. Previously he had left two computers in the village so the children were familiar with them. His hypothesis was that Tamil speaking children cannot teach themselves the biotechnology of DNA replication. On the computers he provided resources, in English, about molecular biology. He put it this way to the children:

> 'There is some interesting new material on the computer, it is in English and it may be a bit hard to understand, but will you take a look at it?'… The children were never directly asked to learn anything (Mitra & Dangwal, 2010, p. 678).

The children were Tamil. The resources were in English. The only support was a young woman, a mediator, who knew no molecular biology and was recruited to provide

[7] Kalikuppam is located in the territory of Pondicherry in southern India.

grandmother-like encouragement8. After three months he came back to talk to the children. He recounted what happened (Mitra, 2010):

> I asked them “So, did you understand anything?” And they were absolutely quiet, and they said “Nothing.” So I said “Nothing at all?” And they said “No. it's in English, it's big chemistry words. We didn't understand anything at all.” So I said to them “How long did it take you to figure out that you can't understand anything?” So they said “But we look at it every day.” So I got a little puzzled there, I said “You don't understand this at all and you look at it every day. What do you do there?” So this girl then, the girl second from the left, she raised a hand and she said to me, in Tamil and English, “Apart from the fact that improper replication of the DNA molecule causes genetic disease, we've understood nothing else.”

There is little detail of how the children navigated their way through the materials or how they organised to help one another. What is clear from experiments like this and countless others in which the Internet provides some form of DIY learning, under less demanding circumstances than those of Mitra’s, is that learners willing to tackle acquiring new knowledge, skills, or dispositions, are able to do so, often with minimal or no support. Which is not to ignore the vast numbers of networks of humans offering help and advice to support newcomers into most of the information and ideas spaces in which humans are involved.

Climbing ladders, learning from mistakes

Juxtaposed, the four stories at the beginning of the paper comprise an indicative set of prevailing and emerging conditions for a variation in the course that learning something may take, what we have called public click pedagogy (PCP) which we will explore later in the paper.

At this point, we draw on Wittgenstein’s ladder (Perloff, 1996) as a metaphor for progress in learning something, i.e. learning something can be envisaged as akin to climbing a ladder. Once we have made it onto the first rung, the second rung becomes available to us and so on. The more we learn, the further up the ladder we progress. Interestingly, as we climb higher, the lower or bottom rungs become less accessible, it becomes difficult to climb back down, to *unlearn* as it were. We see the world from where we are now, not where we were, or how we came to where we are now. The questions, fumblings, mistakes and missed steps that occurred at the bottom of the ladder are forgotten. They are of no value when we have more of the ladder to climb or have reached a point on the ladder that allows us to think about climbing a different one. Darwin’s notebooks are a trace of his learning somewhat down the ladder. His theory about the origin of species is a trace of Darwin’s learning much further up.

What becomes of interest is how we actually move from one rung to the next. How one learns anything is typically a private matter. There may be involvement of a coach or teacher for some, but the struggle to move up a rung tends to be secret learner’s

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8 Mitra explained: “Well you stand behind the children when they're working on this, and you admire them. And you say to them 'Oh fantastic. What was that diagram, can you just show me, show it to me again? What does it say there? How does that work? My goodness, I couldn't have possibly understood this on my own.”

business. The vast literature concerned with getting at how learners learn is, in our account, represented by the story taken from Tammet (2013). We want to focus on the observation of Tammet's that the child faced with the multiplication problem actually had no shortage of possible answers, he lacked the ability to eliminate the wrong ones. Nassim Taleb (2012, p. 303) writes of *subtractive knowledg*e, that is removing what we think is wrong. He argues that knowledge grows much more by subtraction than addition.

Learning what to eliminate and what to keep is, depending upon the ladder you are climbing, not always easy to decide. Having the opportunity to make mistakes and to learn from them becomes a key element in ladder climbing. Later in his book, Tammet (2013, p. 188) draws on learning how to play chess to illustrate the point:

> With his mistakes, the beginner (what players call a 'patzer') immediately blows his cover. He brings his queen out too quickly, exchanges too many pieces too soon, moves his pawns in such a way that their formation finishes by resembling Swiss cheese. But the problem is more one of quantity than quality. The patzer loses not because he makes too many mistakes, but because he makes too few – a mere handful of classic blunders. He does not last long enough to make more!

Given the importance of making mistakes it does appear odd that ready made learning pays as little attention as it does to mistakes that are made climbing ladders. Daniel Dennett (2013, pp.19-20) observes:

> Scientists often ask me why philosophers devote so much of their effort to teaching and learning the history of their field. Chemists typically get by with only a rudimentary knowledge of the history of chemistry, picked up along the way, and many molecular biologists, it seems, are not even curious about what happened in biology before about 1950. My answer is that the history of philosophy is in large measure the history of very smart people making very tempting mistakes, and if you don't know the history, you are doomed to making the same darn mistakes all over again. That's why we teach the history of the field to our students, and scientists who blithely ignore philosophy do so at their own risk.

So, how we build ladders to be climbed by learners matters. The ladders for learners are typically built by people with expertise, people high up the ladder. Their ability to recall what it was like before they got to a high place on the ladder is, as we have argued, at best limited. It is not unfair to suggest that in many of the ladders to be found in formal education settings that there is a well-intentioned emphasis on making ladders easier to climb. Content is made as simple as it can. In addition, the messiness of producing *ready made learning* is tidied away, and the messiness of student learning[9] is glossed. As a result, for many learners, the ladders appear to have the bottom rungs missing.

As we suggest in the learning to do science story, these are considerations imposed by the scale and funding associated with much of formal education. *Ready made learning* is preferred over *learning in the making*. Here, it is important to note that we are not arguing for learning everything from scratch, in the way Darwin learned as he climbed

[9] As the paper by Ibrar Bhatt and Roberto de Roock in this symposium illustrates.

the ladder that was later to be labeled, the origin of species. What we are interested in doing is learning *from* Darwin, and others like him who make public their bottom rungs, their notebooks, their logs, their mistakes and missteps. We are interested in the potential of learning in public.

Towards public click pedagogy

The Internet is currently used to support a broad range of practices associated with helping learners. Mitra's work makes it clear that we tend to underestimate what a learner is capable of with only online content to draw from, even under the most difficult of conditions. Much of the material and approaches to support learners is, however, still very much based upon ladders being built by experts and content being moved from paper to a digital format. What has been made public is largely the work of knowers, of experts of the skilled.

Alongside the conventional provision of content, there can be found, here and there, accounts by experts about *how* they go about their work. This is not the kind of thing you would expect to come across regularly in any given field. For example, Maureen Ogle, an historian recently published a piece about the day-to-day work of a practicing historian (Ogle, 2013). Her account could comfortably be mapped onto Darwin's learning and eventual production of texts. As she (np) puts it:

> When I'm working on a project (and most of my projects are books) (and I'm pretty much always working on a project), my actual "work" falls into one of two general categories: First I research; then I write about what I've learned. The research comes first (because I can't write until I know something) and is the most time-consuming of the two categories.

A little closer to what we are working towards is the web log of David Jones[10]. Like Ogle, Jones has considerable expertise in his field but makes public his workings as he explores the field of learning analytics. We don't see his notebooks, the ways he assembles and works with data and artifacts, the traces, the collected pdf's, the databases he uses to assemble his accounts of his learning. He does share, as do a growing number of academics, the ways he makes use of various pieces of software. This is more than simply how to use a piece of software, for which for most of the commonly used pieces of software there is an abundance of text and video help. Jones' blog is one of a number of sources in which what was previously been regarded as private academic business is being made public.

We also acknowledge that there is a significant history of pedagogy which requires students to write reflectively about their learning. Making that public is closer to the kind of writing you find in Jones' blog and others like it.

The accounts we have briefly mentioned so far are closer to ready made learning than learning in the making. They are tidy. They still simplify to some degree. They are considerably removed from the notes in Darwin's notebook or the image of Ogle's office at the end of her last project[11]. Importantly, we see little account of the mistakes,

[10] http://davidtjones.wordpress.com/
[11] It appears at the top of the article.

of abandoned blind alleys, of what is removed along the way as enquiry proceeded. Also absent are the 'aha' or 'click' moments[12]. We are not suggesting that these moments would be somehow common across a cohort of learners, rather that these moments matter in shaping the flow and logic of a finished text or an account of how the text was arrived at.

The rich account of the messiness of students working on assignments reported by Bhatt and de Roock in this symposium reminds us that we are still a long way from filling in the bottom rungs on most of our ladders.

The approach that PCP represents is one in which accounts of how learners go about their work are valued. Instead of learning remaining private, it is made public. Instead of valuing ready made knowledge, it values learning in the making. Instead of glossing mistakes and missteps it records them and the steps taken

We acknowledge that this is not an easy thing to do[13]. Nor, as we have suggested is it something that is undertaken for all learning. We do however believe that there is value in making public some learning in the making. In making it public, it is also made permanent and available not only to the learner at another time but also to other learners. It may even be of interest to other learners, much further up the ladder.

Importantly, in this paper, we have tried to argue that there is a strong resemblance between the learner faced with an unknown terrain and a scientist, like Darwin, faced with the many question he tackled. Drawing on the work of scholars informed by an ANT sensibility as they studied the work of scientists, we have argued, given the ease with which accounts can be published online, that attention can now be given to the work learners do as they struggle to reach the bottom rung of a ladder. The work can be made public. The work has value. The work can help expose the nature and detail of what learners *actually* do rather than having to rely upon the finished writing of a learner as the sole indicator of what has transpired at the learner's desk.

There is something incongruous writing about learning in public within the constraints of a paper such as this. We can only hope that, at the end of our exploration, we do not have to write something akin to what Darwin wrote, in large letters, on the back of the red notebook: 'Nothing For any Purpose'.

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[12] An idea borrowed from Johansson (2012)

[13] We have conducted mostly failed experiments into how to do this in formal and informal settings. And yes, we did keep public records of them.

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