Institution: University of Nottingham

Unit of Assessment: UoA32

Title of case study: Changing Software Through Metaphysics

1. Summary of the impact

Mumford and **Tallant** engaged in consultancy work for IT companies, with both interactions leading to substantial positive benefits for commercial partners. Though 'early stage impacts', each consultancy has generated both commercial value and a change in software design of a key product.

Through **Mumford**'s consultancy, research led to significant changes to the development of a database tool developed by a national IT company, *FACE Recording and Measurement Systems*. This, in turn, has led to a patent application. *FACE* recently received an offer of $5m (US) for a product based upon the tool.

Through **Tallant**'s consultancy, research led to important changes to the development of an online calendar/event planner tool, developed by a Canadian software company—*Time.ly*. It also led to *Time.ly* being able to engage a wider audience. The financial value of such a company depends upon the number of users they can engage. *Time.ly* were recently valued at $8.4m (CAN).

Between them, **Mumford and Tallant have made significant contributions to companies or products valued at over £8m**.

2. Underpinning research

Work carried out between 2005 and 2012 (and published between 2007 and 2013), produced by Professor Stephen **Mumford** (Nottingham 1995-present) and Dr. Jonathan **Tallant** (2007-present), has two common strands. The first is that it is perfectly coherent (desirable, even) to treat at least some properties as being irreducibly *directed towards* some particular state.

For instance, **Mumford** [3.2] has argued that it is central to our best theory of properties that we treat them as *dispositions for* some state. To illustrate, just as the property of being soluble can be thought of as a disposition to dissolve in water, so we can think of all properties as being tendencies to behave in some way once brought into the right conditions. What is crucial, then, isn't merely that objects have some particular properties, but the *natures* of these properties—they are *tendencies*.

Mumford [3.1] (with co-author Anjum) expands this theory of properties to develop a theory of causation that treats causation itself as being a product of many different dispositions being brought together. Thus, the cause of the fire isn't simply that the match was struck, but needs to be understood as a far more complex arrangement, involving the properties of the match, of oxygen and various other factors—all of which are to be understood in dispositional terms. **Mumford** also argues that we should see these dispositions as not necessarily being additive. That is, it is not always true that a disposition to A and another disposition to A leads to a disposition to A that is of twice the intensity. For instance, one might think of ice as having a disposition to reduce swelling if applied to an injury for a short duration. One would naturally think that applying ice to a swelling for twice that duration would double the anti-inflamatory effects. But, in fact, if ice is applied to a swelling for too long it can actually lead to *increased* swelling. To deal with cases like this, **Mumford** has developed a model of dispositions where they are taken to *not* be additive.

In turn, **Tallant** [3.4 & 3.6] has defended the view that there are tensed facts or properties. This is the view that the world currently instantiates (for instance) properties of the form *having contained dinosaurs*, that are irreducibly past-directed properties. To speak loosely, the properties defended by both Mumford and Tallant do not make a difference to how their bearers *are*. Rather, they make a difference to how they *could be* or *have been*.

Tallant has used this account of properties, alongside other parts of his research [3. 5], to develop a defence of presentism. **Tallant** defends the view that only present objects exist, but also [in particular in 3.5] that there is constant change in which things these are. This position is most naturally thought of as a dynamic theory of time that is quite badly capture by static representations of time (such as those given by a time-line).

The second common strand present in the works described concerns 'negative truths'—truths of the form 'there are no xs'. Specifically, both **Mumford** [3. 3] and **Tallant** [3. 4] have defended the view that the negative truths do not have truthmakers. That is, truths like 'there are no unicorns' are not true because some object exists. Some other explanation is to be given of why we think negative truths are truths.

3. References to the research

Relevant Publications by Stephen Mumford:

3.1: (with Rani Lill Anjum) 2011. *Getting Causes from Powers*, Oxford: Oxford University Press, ISBN 978-0-19-969561-4.
[Included in REF2014 submission]

3.2: 2012. 'The Power of Power', in Ruth Groff and John Greco (eds), *Powers and Capacities in Philosophy: The New Aristotelianism*, London: Routledge, pp. 9-24.
[Item available on request.]

3.3: 2007. 'Negative Truth and Falsehood', *Proceedings of the Aristotelian Society*, 107. 45-71.
[DOI: 10.1111/j.1467-9264.2007.00211.x]

Relevant Publications by Jonathan Tallant

3.4: 2009. 'Presentism and Truth-making', *Erkenntnis*, 71, 407-16
[DOI 10.1007/s10670-009-9188-4]

3.5: 2010. 'Sketch of a Presentist Theory of Passage', *Erkenntnis*, 73, 133-40
[DOI 10.1007/s10670-010-9215-5]

3.6: 2013. 'Dubious By Nature', *Canadian Journal of Philosophy*, 43, 97-116
[DOI: 10.1080/00455091.2013.812372]

In review of 3.1 for *Analysis* (2013: 402-4), McKitrick describes this as 'a fresh perspective on some very well-trodden ground' (p. 402); Oxford University Press is the leading Press for Philosophy.

3.3, 3.4, 3.5 and 3.6 each appeared in an academic peer reviewed journal ranked by the *European Science Foundation* as INT2 ('international publications with significant visibility and influence in the various research domains in different countries') or INT1 ('international publications with high visibility and influence among researchers in the various research domains in different countries, regularly cited all over the world').

4. Details of the impact

In their consultancy roles, **Mumford** and **Tallant** have both deployed their research to help refine and enhance software tools and generate commercial value for commercial partners.

FACE, with whom **Mumford** engaged in his consultancy, specialise in the development of assessment tools and software for health and social care, and have a client base of more than 50 Primary Care Trusts and a range of other hospitals and other health bodies. [5.1]

Mumford's involvement with *FACE* began in 2011and since then his research has shaped the successful design of a database tool. Mumford drew on his research, during the consultancy, and, working with *FACE*, was able to help develop four important modifications to the tool, described below. A product based upon the tool has now been developed. FACE recently turned down a bid of $5m (US) for this product. [5.2]

FACE regard **Mumford**'s input as significant, noting that **Mumford** has played an, **"important role in helping us refine and develop the tool."** [5.2]

In his consulting role during the development of the database tool, Mumford was in a position to bring the results of his research in ontology directly to bear in modifying the product. His initial meetings with the company helped develop the relationship, and have since been formalised under

a commercial arrangement. In their own words:

> "We are developing a new information system which challenges the existing, long entrenched approach to database design…this system could pave the way for a fresh new approach to information management in all sectors of commerce and industry**. Professor Mumford's advice to us was very valuable.**" [5.2]

As noted above, there were four areas where Mumford's work had a particular influence over the design of the database tool; these are described in turn. As a result of Mumford's intervention:

1. **Changes were made** to the design of the database **so that it could represent what is not the case**. [5.2] Until **Mumford's** involvement the database was able to depict only what is the case: the 'positive' truths. It could not capture the so-called negative truths. It may be crucial in health care, for instance, that a patient is not allergic to drug *X* or that they are not currently presenting symptom *S*. **Mumford** challenged the designer to consider whether and how they could represent such negative truths given, as **Mumford** [3.3] (and also, **Tallant** [3.4]) showed, negative truths cannot be straightforwardly derived from the positive ones.

2. **Changes were made** to the design of the database **so that it could represent what *has been the* case, but is no longer**. [5.2] Drawing on **Mumford's** research [3.2], to show that previous tendencies (dispositions) can prove a significant factor in a medical assessment, **Mumford** was able to point out the need for refinements to handle specific cases. For instance, that someone is a former-alcoholic may be crucial to a treatment plan.

3. **Changes were made** to the design of the database **so that it could represent not merely what something actually does, but also what something may be disposed to do or have the capacity to do**. [5.2] A patient may not currently be unwell but it can be vital to know if they have a vulnerability that, if put to the test, might be serious or fatal, so the database needed to be able to record not just the actual facts, but what could be the case, based on our knowledge of dispositions and capacities. **Mumford's** expertise on the nature of dispositions was crucial to this addition.

4. **Changes were made** so that the database was **able to perform more than merely additive functions on its data**. [5.2] Having recorded facts Fa, Ga and Ha, for instance, about particular a, the database was able to form the conjunction Fa & Ga & Ha. **Mumford** was able to improve the tool so that it could perform a range of other functions. As shown [3.1], composition of causal factors often occurs according to a nonlinear function, meaning that resultant causal powers are not simply the mereological sum of component powers. To handle this, the database had to be designed to be able to record facts relative to an appropriate level of nature. For example, there can be facts about persons that are more than just the sum of facts about their parts; the database had to reflect this.

Tallant's involvement with *Time.ly* began in March 2012, and since then his research has shaped the current design of the software and supported a successful promotional campaign, after which the company has recently been valued at $8.4m (CAN).

Themes from **Tallant**'s research on presentism were disseminated via the Department's YouTube channel in August 2011. This led to the video being viewed more than 75,000 times, receiving 746 comments interacting with the material and more than 1,000 'likes' (recommendations). [5.4]

The video was viewed by the technology company, *Time.ly*. A Canadian software company, the key product that *Time.ly* produces for users is event planning and calendar software, which is currently used by more than 65,000 websites. [5.3] Clients include geographical based communities such as *Happening In Aspen* or *Logan Squarist* and also sector based communities like Brixton Buzz for music, or *Geekwire* for technology. [5.3] **Tallant** joined *Time.ly* in an advisory capacity in March 2012. Since then, they have taken part in regular consultation meetings via Skype. [5.3]

Tallant's work has yielded a change to how the product will represent time. In particular, **Tallant** has suggested that *Time.ly* refine the product to bring out the significance of the present moment. He has also explained how we can represent future events as *in the present* as things that are *going to be the case*. This is to treat them as akin to presently existing properties that *point towards* the future (in the manner that the tensed facts described in section 2 *point towards* other times).

These ideas draw on **Tallant**'s defence and descriptions of tensed facts. [3.4 & 3.6]

Tallant also noted that the product made by *Time.ly* is currently presented in a standard calendar view; a static format that fails to take into account the sense of importance that we normally attribute to the present, and that also fails to represent the sense that we have of *moving through time*, and the sense of time's passage that we have—a theme developed in **Tallant**'s research. [3.5]

Tallant's suggestions have **fed directly into the design of planned future iterations of the product and modifications will become available to users**. [5.3]

Tallant's work for Time.ly has demonstrably been **commercially valuable**. **Tallant** has written a number of promotional items for *Time.ly* [5.3], drawing upon his research on how people naturally think about and experience time. [3.4 & 3.5] This work with *Time.ly* has "helped the company to **engage with a wider audience**". [5.3] This is of financial value since, **"[a]udience is a crucial factor** for a company like Time.ly whose **value depends upon the number of users they can engage**". [5.3] To give some context, *Time.ly* has recently been valued at $8.4m (CAN) [5.3]; more than £5m.

5. Sources to corroborate the impact

5.1: *Face Users.* Date accessed, 28/08/213.
Available at: <http://www.face.eu.com/our-customers/face-users/>
5.2: Letter from the CFO of *FACE*
5.3: Letter from the CFO of *Time.ly*
5.4: *The Philosophy of Time* YouTube. Date accessed, 28/08/2013.
Available at: <http://www.youtube.com/watch?v=zw6hS_gy9MY>