OOPS! MOMENTS: KINETIC MATERIAL IN PARTICIPATORY WORKSHOPS

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ABSTRACT

We wish to alert facilitators to the merits of deploying kinetic resources within workshops. Design materials and activities involving unpredictable kinetic aspects such as balancing, bouncing, rolling and falling can lead to surprises that provoke a lively challenging of assumptions. Based on video data from many innovation workshops we show how materials with such dynamic qualities seem particularly suited to scaffold groups in exploring *'if – then'* causalities. Discussions concerning humour, aesthetics and agency help articulate the qualities of engagement offered by kinetic resources. Although our starting point is experiments in participatory business modelling, a kinetic oriented understanding of material offers insights for developing participatory and co-design activities more generally.

INTRODUCTION

Participatory Design (PD) practitioners utilise a wide range of 2D and 3D physical materials in a wide variety of different ways. Materials range from the figurative to the abstract, including life size props such as cardboard computers (Ehn & Kyng 1991), scale action figures such as dolls (Foverskov & Binder 2011), custom made game pieces (Brandt & Messeter 2004), bricolage (Agger Eriksen 2012), and using bespoke construction kits from other designers (Vaajakallio & Mattelmäki 2007).

An obvious, but overlooked property that all these materials share is a certain inertia and formal stability - the materials do not lend themselves very readily to motion. By contrast, this paper aims to explore the value of design materials with *kinetic* properties. Such dynamic materials bring surprises when it behaves unexpectedly. In these *Oops! Moments*, participants briskly attempt to explain away unexpected or unwanted actions of the material by improvising explanations that often give lively insights into participants' perspectives on workshop topics.

To argue the benefits of kinetic materials and their use as a route to *Oops! Moments,* we draw upon our research program of experimenting with designing novel means of facilitating discussions in the domain of business model innovation. This emerges from Participatory Design's long tradition of using tangible design materials to engage non-designers in developing new products and systems. With the move towards Participatory Innovation there is an incentive to expand such participatory practices also to business issues (Buur & Matthews 2008).

TERMINOLOGY AND STRUCTURE

To distinguish between the individual and collective physical materials in workshops and how they are used, we henceforth adopt the terminology from Sanders *et al*. (2010). So by *tools* we mean the individual bits or 'material components' used in activities. Likewise by *toolkit* we mean a collection of tools used together, and by *technique* we mean the processes, procedures and activities that describes how tools and toolkits are used. Collectively we refer to our materials and activities as "resources" as shorthand for encapsulating both the artifacts themselves and the processes or guidelines provided for their use to participants.

The paper is structured as follows: First we outline some approaches to participatory business model innovation and the limitations of some designerly attempts to deploy static tools. Then we present five different kinds of kinetic resources with brief details of the industrial settings in which they were deployed. After reporting on observed responses to these kinetic resources, and an analysis of their qualities, we seek to explain their success by referring to concepts in social psychology, innovation and aesthetics.

TANGIBLE BUSINESS MODELING

Osterwalder's process of business model innovation banks on the participation of a range of stakeholders, and his business model canvas has become immensely popular in the business world (Osterwalder & Pigneur

2009). There are other suggestions to engage a variety of participants in developing business, such as mapping the value flows between actors as coloured line graphs on flipcharts (den Ouden & Valkenburg 2011); describing business processes using acrylic flowchart symbols (Lübbe 2011); or embodied exploring of stakeholder relations using theatrical techniques (Ankenbrand 2011).

One of the most successful new practices has been the collaborative design of 'tangible business models', which allow participants without a business degree to understand and innovate a company's business through the use of tangible materials like toy bricks, bric-a-brac metal objects, foam pieces, even organic materials. Such materials are particularly suited to support mapping activities where participants together explore who are the stakeholders in the business venture, and how do/can they relate to one another in a value network (Buur *et al*. 2013). In business terminology this would be the key resources and the customer segments of a business model. However, as we shall see, there are many other aspects to discuss when trying to innovate a business model.

Through interaction analysis of video recordings, (Heinemann *et al.* 2009) we have shown how workshop participants co-construct meaning when building tangible maps of inter and intra organisational networks. What an object communicates is a social construct that is dependent upon the on going social actions and the social order that needs to be established or maintained between conversational partners. The objects work as *reifications* of abstract understandings of the actors in a value network; they work as physical metaphors.

LIMITATIONS OF STATIC MATERIALS

Heinemann *et al*. (FORTH) have also demonstrated that participants in these network map-making workshops typically identify one particular salient property of an object (eg, a 'heavy' ball) and then use that property to create a metaphor ('pushes away obstacles') about the organization's situation. Participants tend to use the salient properties of objects in very similar manners, namely to create metaphors with what we call 'negative associations'. In other words, the end result, independently of what object is being used and of what property of that object is invoked, is the creation of a metaphor that portrays an organization's relations as fraught with matters of power differences, competition, struggles.

Of the four purposes outlined by Sanders *et al.* (2010) for Participatory Design techniques, we feel that the "static" toolkits often do very well on the first three. Namely probing company participants, priming participants to be immersed in the topic, (although here in perhaps a more abstract sense than in most PD), and achieving a better understanding of their current perspective. For the fourth purpose, 'the generation of ideas or design concepts for the future' we find it more valuable to facilitate using what we call kinetic resources.

KINETICS AND CAUSALITIES

We have become interested in the assumptions about dynamic causalities built into every business model: if we as a company do this, then the customers will do that – buy our products and services. This is a crucial and difficult discussion, which can be supported by the use of design materials. Whereas expressing *causalities* in language is easy and non consequential, expressing them with kinetic materials provides an element of chance backtalk. Like in 'real' design processes, this allows the development of a 'conversation' with a design situation (Schön 1992) that can help framing challenges and discovering new opportunities for businesses.

We have seen that tangible materials can play a role here, and not just as metaphoric representations to help participants co-construct meaning. The underlying question is how tangible materials actually allow people in making sense of the business dynamics: In which ways do objects help create shared meaning? How do they help organise participatory practices? And how do they facilitate the creation of new business concepts? This paper presents an initial classification of what we have called 'kinetic materials' for tangible business modeling.

KINETIC RESOURCES REVIEWED

Our study is based on video recordings of how groups of professional participants interact with materials during participatory business modeling activities. Our main data is extracted from video documentation from seven experimental workshop sessions with eight different technology companies across five different projects. The projects involved companies and other stakeholders, users and customers, PD professionals, researchers and graduate students working with themes as different as indoor climate systems, sustainable energy generators, and hearing aids. This is supplemented by observations from activities with internal and external researchers, PhD and graduate students in which our kinetic resources were deployed. We have focused on those workshops where the toolkits involved exhibited some form of dynamic behaviour – where the material reacted to what participants tried to achieve in expected or unexpected ways.

Over the years we have experimented with toy train sets, balls running through hamster tubes, coloured brick towers, kitchenware with dynamic functions, pinball contraptions and others (Buur & Mitchell 2011). In all cases the challenge given to the participants was 'Design your future business using the material provided!' Typically these 20-30 minute building activities gave rise to intense conversations about the way the company in focus presently makes money, and how this may change.

FIVE EXAMPLES OF KINETIC RESOURCES

The activities we have studied are very different in the kinds of material employed and in the ways in which they offer possibilities for assembly and use.

Toy brick towers: Stacked, wooden toy bricks represent a very simple form of kinetics: When the stack gets too unstable they may fall in unexpected fashion. Based on

the concept of Silent Games (Harbraken & Gross 1987), the *Venture Tower Game* was developed to encourage small companies to discuss the challenges of establishing a joint venture (Groskovs 2011). Four participants each have a tower of coloured bricks representing their own company, and are asked to build together a fifth tower, joining their resources (Figure 1). The game is structured in three phases: (1) Build a strong foundation, (2) 'grow' the tower without adding any more resources, and (3) take back revenue (bricks) from the joint venture tower. The game was employed in one session with four Danish companies dealing with markets in Africa, and in another session with four small technology consultancies.

Figure 1: Four companies build a representation of a possible collaboration

Toy train set: Wooden railway sets for children lend themselves to building tracks where toy locomotives move along, branch out and circle back. In a project that brought together a ventilation manufacturer with suppliers and customers, we challenged the participants to build a model of how they see their business if they were able to coordinate efforts along the value chain. The toy train set we use is a classic Scandinavian design (Figure 2 that contains not only tracks and locomotives but also carriages for goods and passengers and pieces like stations, a bridge, a tunnel, a shed and a level crossing.

Figure 2: Toy train shown here as representing "dead end" for a business direction.

Tubes and balls: Balls rolling through straight or curved transparent tubes that can be assembled in several ways provide an opportunity to build dynamic contraptions where the paths of the balls may take different meanings. In contrast to the planned moves of the train set, the balls may bounce into unexpected paths. This particular tube tube set was a kit vended as an environment for pet hamsters (Figure 3). We experimented with this set in the same ventilation manufacturer project as above.

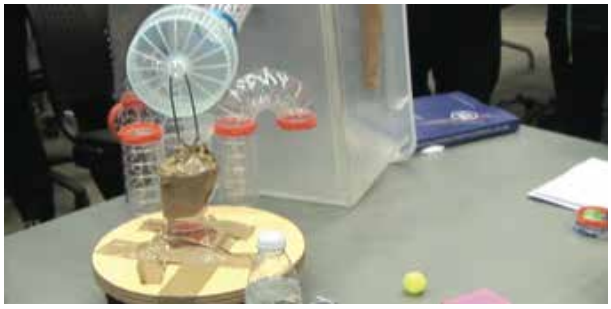

Figure 3: A hamster wheel as destination for tube conveyed balls

Pinball models: Originally suggested by one of our graduate student teams, a pinball model may represent customers moving towards a purchase, or streams of money. Marbles run down an inclined surface where levers and obstacles direct or divert the marbles in different directions (Figure 4). Depending on their path, the marbles will end up in one or more 'receptacles' at the bottom of the slope, representing for instance the company and its competitors. Our first case of a pinball model was built to show the business of a hearing aid manufacturer (Mitchell & Buur 2010). In a later workshop we challenged company participants to build their own pinball model of, respectively, the business of a new media company and of an amusement park (Buur & Gudisken 2012). Recently it has been in used to support academics in discussing inter institutional collaborations.

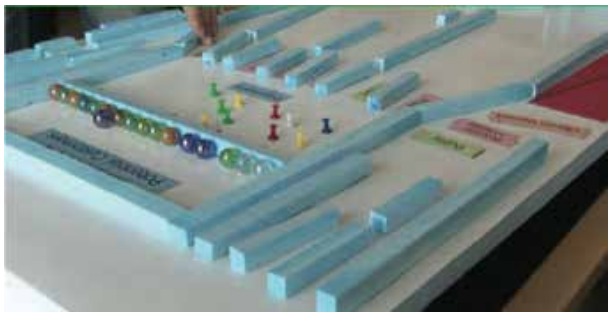

Figure 4: Marbles about to be released down a slope

Balancing contraptions Suspended poles and scales lend themselves to experimenting with balance and imbalance in business systems. Our first balancing contraption was developed to illustrate business dilemmas experienced by a lighting technology company. It took the form of a suspended mobile comprising a 2m long dowling pole, and two shorter poles suspended at either length of the main pole (see Figure 5). It was designed to support a discussion of the best relative proportion of resources between sales and development departments.

A later contraption was designed to encourage a smart materials manufacturer to discuss the balance between mutual costs and benefits in a customer relationship (Figure 6). Two weighing pans at opposite ends of beam were supported at its fulcrum by a small tabletop frame. A marble would wobble on the beam until an imbalance was reached, whereupon it would drop down to the table top through a hole in the beam via ramps in the frame.

Figure 5: Balancing sales and technology investments on hanging poles

Figure 6. Negotiating to balance inputs and outputs of a collaboration

OOPS! MOMENTS

Tangible materials in business modeling can facilitate the negotiation of meaning between participants, helping to reflect not only on the characteristics of a certain business, but also its relations to other concepts and ideas. Kinetic materials offer different ways to do so, and with their dynamic behaviour, generate 'surprises' and unexpected events that challenge participants to relate those behaviours to something that makes sense in the business model context. We call such occurrences *Oops! Moments. "*Oops!" because the temporary loss of control experienced by participants provokes explanatory exclamations or interjections that can be likened to expressing dismay at making a minor mistake.

What seems valuable is how the *Oops! Moments* are often used as triggers to describe stakeholder behaviour or other unpredictable events that occur while running a business. In this section we will show how participants attribute meaning to elements of the different materials, and how the dynamic behaviour brings in new themes in the discussion between participants.

POOLING RESOURCES

The brick tower is a set that comes already charged with its own meaning: we introduced towers as companies, and bricks as resources. This already shapes the discussion in a certain direction. Some participants immediately accept the definition of 'bricks as resources', and concentrate on the strategies to build the tower. Others first go into detailed negotiations to understand what each brick and combination of bricks might represent.

Finding themselves with a wobbly tower, representatives of the four companies doing business in Africa start a discussion of how important planning is, and of the need to agree upon a strategy before starting a business. Earlier in the activity, the difficulty that one of the participants had in placing a brick in a dangerous position triggered jokes about different mentalities of employees in other countries. In the case of the four consultancy companies, the need to reach a common understanding of the resources was important. At the outset, participants suggested that bricks mean individual competencies (e.g. hardware or software knowledge, designers) that they could bring to a business. Building the tower from the bottom up, participants realised that there are other ingredients necessary, such as the ideas involved, a business plan and so on, before the development of a product.

Oops! Moments: The towers become less stable than expected, and falls or crashes trigger new discussions. One of the consultants, when a part of their Venture Tower fell, blamed a brick representing a "middle manager who sabotaged it". This brought about a joke about whether to place the manager in charge again or place him in another position. Another accident, in which two bricks stuck together, generated a joke about some resources that are "very close to each other", implicating how some elements might represent more than isolated entities.

CREATING PATHS

The tubes and the train set present many similarities. Because of the dominant notion of path, they come to represent 'customer journeys' or 'product delivery'. Meaning is attributed to entire sections of the path, such as directions, curves and loops rather than to single track pieces of bends and straight lines. In the case of the ventilation manufacturer model, participants spent most of their time discussion the definition of one particular loop, the 'requirement specification loop' as they eventually name it. This loop represented the novel idea of a common access point for customers to all the companies in the value chain (Figure 7). Meaning is also attributed to special pieces such as bridges or joints. In activities using the train set, junctions frequently represent 'choices' between two or more possibilities. In a session with the hamster tubes, a rotating wheel became the focus of the model, representing the 'fun experience' provided to the customers by a service business. In another example, balls which get stuck in a funnel become customers "that do not try hard enough" during a selection procedure, thus incorporating in the model a discussion on how to evaluate the success of the selection, and number of customers a business needed.

Oops! Moments: The form of dynamic behaviour offered by the train and the tubes is quite different. The train set offers some unexpected challenges during the building

phase, when pieces that are supposed to create a path do not actually fit together, or when loops cannot be established easily in the desired shape: this difficulty brings the ventilation manufacturer team to talk about a "slow process". Also, the expansion of the paths offers challenges when participants run out of table space. In the final model presentation, the company representative explained the interrupted path as "individual modification for clients", to be built according to their needs. In another instance, a break in the track was related to customers with too ambitious wishes.

In the tube set, the bouncing balls add the unpredictable: these offer space to imagine characteristics of the users or of the business. During a conference workshop with the case of an entertainment application for outdoor events, one of the participants explained balls falling out of a path as 'users drop outs'. In the same model, a failure of a net to gather the balls under the spinning wheel was interpreted as an insufficient amount of safety measures.

Figure 7: Three interlinked companies discuss their requirement specification loop

GUIDING CUSTOMER BEHAVIOUR

The pinball model comes already as a strong metaphor, and as such is interpreted by participants. Marbles are seen as customers, or as flows of money, while levers and other elements become representative of barriers or incentives that companies can use to influence customer behaviour. The conversation with these models is very focused on strategies and evaluation of outcomes given by the behaviour of the marbles. Usually participants first create or adjust elements of the pinball field, then let the balls run. The results of the rolling are then evaluated in terms of actions done and possible new improvements in an iterative process of strategic evaluation and simulation.

Oops! Moments: The pinball model offers the highest degree of randomness and unpredictability of all the materials. Also, when teams work iteratively, it offers many possibilities to experiment with scenarios, through the modifications of the levers. Marbles get stuck, slow down, or sometimes follow paths that are not expected by participants. By trying to give meaning to marble behaviour, participants get also to the point of imagining to be in the position of the user: "If (this user) could see that (position of the lever), maybe he would go this way." This triggers discussions on customer behaviour, possible confusion and factors affecting their purchase choices. In (Buur & Gudisken 2012) we have reported upon how the participants create their own combined terms to explain model behaviour in business terms. When seeing an unexpected number of marbles running down along the side of the field, the participants coin the term'revenue highway', an elegant construction of both business vocabulary and metaphor.

BALANCING RISKS, STABILISING RESOURCES

The balancing contraptions offer a well-known metaphor – this is about finding an equilibrium state between contradictory influences. The CEO of the lighting company realised that the sales department when under-resourced can 'float off' uncontrollably. The different weights of this balancing poles provoked expressions of sympathy as to how managers could predict the weight of many decisions about resources in advance. After presentation at a board meeting, the management decided to increase the number of sales employees.

Oops! Moments: Often small influences can render the balancers unstable. This has proven surprisingly engaging for a full group of people, as it can several participants to keep the balancers in check (e.g. Figure 8). With the balancing poles, it was also unexpected how much action there was away from the main hanging structures. Participants became rather involved in conversations as to the relative weights of the bags that represent resources.. People become human weighing machines, holding pairs of bags, one in each hand, to see which was heavier. Thus they embodied a kinetic simulation of the model themselves.

Figure 8. With many considerations in balance, a potential partner reaches in to steady the whole deal!

KINDS OF KINETIC BEHAVIOUR

Let us try to investigate the main elements and constraints given by the materials to see what capability they have of developing some kind of kinetic behaviour independent of the participants' intentions. We do not offer this analysis to be prescriptive. Rather it is to aid facilitators' evaluation of which aspects of kinetics may be of value in developing resources for their own particular project challenges.

KINETIC MATERIALS

Some materials are composed of elements that are *inherently dynamic*. With this term, we mean the capability of the single elements to move or change form

as a result of users´ actions or other forces such as gravity. Such elements have the potential to show a behaviour that is not directly dependent on the participants, and thus generate unexpected events such as the ones described earlier. Examples can be hinges, springs, bouncing balls, marbles, or magnetic elements. Other sets, such as the *Tubes*, have a number of kinetic elements, such as the bouncing balls and the wheels. However, components of the *Tubes* do not move independently, but are considered part of a bigger set.

KINETIC ASSEMBLIES

Other materials are composed by static elements that can however develop dynamic behaviour or constraints when assembled or when associated with rules. Considering the hamster Tubes set, we can notice how most of its elements, the tubes, are not inherently dynamic. Only assembling them brings the kinetics in play. Paths rotate and distort with the force of gravity, or offer constraints where a certain combination is not possible due to the radius or length of the tube. The wheel, together with the bouncing balls rolling through the paths, adds a character of higher dynamics to the set. The tubes expand structures into the third dimension thus making it more difficult for the participants to imagine where balls will roll. While, if taken singularly, the elements might not seem to offer many possibilities, their combination brings to the discussion many challenges.

In the case of the Towers, the assembly rules play a big role. The bricks per se are static objects. But when stacked and used within the rules of the Venture Tower Game, (like in the original Jenga® game) the brick towers behave in ways that participants cannot easily predict. The constraints of not allowing top pieces of the tower to be moved directly, or the necessity to take bricks out of the base to keep building in height, force participants to use pieces in ways that generate dangerous combinations and potentially unstable structures. This adds an element of uncertainty: participants need to plan and coordinate their moves carefully in order to avoid the towers from falling.

KINETIC CONCEPTS

A third set of materials is one whose more powerful characteristic relies in the concepts themselves. In fact, while other uses of the material elements would be possible, the concepts are so strong that the participants accept them as such, and build their models according to them. In the case of the toy railway, once in place, the elements are themselves static, except for the trains, that are moveable by hand, and whose behaviour participants can control. The material itself affords ways of connecting and combining pieces into structures with more than one path, always consistent with the concept of a railway.

The pinball set offers a well-known dynamic concept of marbles rolling down a slope, bouncing off barriers and being directed by levers. Barrier angles often do not have the influences on marbles that participants intend. Running a larger number of marbles at the same time further increases dynamic complexity: marbles bounce off each other too, and participants cannot easily plan what routes the marbles will take.

RESTRAINING KINETICS

In the case of the balancing contraptions, the material plays a slightly different role: There's no stable equilibrium unless participants hold elements in place. This can turn into a collaborative effort, where several participants need to work together to keep materials in shape or prevent them from moving. In a sense, restraining kinetic material here results in kinaesthetic action on part of the participants. The tools provoke people to move. This gives rise to new perspectives and new discussions.

LOOSENING CONTROL - INCREASING SPONTANEITY

These various kinetic tools can give the impression of exhibiting a spontaneity that has an astonishing effect on conversation. Surprising materials leads to more spontaneous conversations. Participation in spontaneous processes can feel very risky due to the need to "loosen control" (Bogers & Larsen 2012). Similarly, Brandt and Grunnet have warned how performing with props can "*cause vulnerability for both designers and users"* (2007:19). The *Oops! Moments* can be seen as what Bogers and Larsen would call *invitations* or *openings* towards taking "more spontaneous moves together" (ibid) in their conversations.

Figure 9: Marbles stuck at barriers represent pre-users encountering obstacles on route to becoming customers.

DISCUSSION

ARE SURPRISES A GOOD THING?

If one considers surprises to occur as a result of failed predictions (Cast 1994) then it might be considered dispiriting for participants to experience such "failure", particularly within a professional encounter with new acquaintances. However, an aspect of innovation is going beyond expectations, therefore a workshop characterized by materials behaving contrary to expectation seems apt.

The shared experiencing in the workshop of kinetic resources with unclear and unpredictable causalities is a good prompt to discussions of the uncertainties of

business causalities. Furthermore, that the response to apparently unexpected events are collectively performed means that responsibility for any such failure is largely shared amongst participants and thus significantly mitigated. The spontaneous exclamations that ensue from kinetic materials talkback is invariably followed by seemingly good natured laughter. This attests to not only the risks of such spontaneity around *Oops! Moments* but more importantly, to the value of such risk taking. A shared joke can contribute to an increase in social capital (Adler & Kwon 2002) and create a lighter, more creative atmosphere. Furthermore, such laughter can be seen as emblematic of innovation in general. According to Virno, how a joke may play with and disrupt previously taken for granted relations can be seen as innovation and creativity in miniature (2008).

Wagner analysed an exercise in which a group of participants stood up and spread around an open space to make a business model map using their own bodies. He showed that laughter here was often a response to when one or more participants re-position themselves and in this way, breach the game order (Wagner 2012). This is precisely when participants discover a new way of looking at each other's roles and relations. In the case he looked at, Wagner also ascribed some laughter to an embarrassment in status differences between participating executives and students (2012). However, we have not detected discomfort associated with breaches of hierarchy in the kinetic materials workshops we have examined.

To us it appears that kinetic materials can offer some of the enlivening benefits of a more embodied exercise but without the potentially inhibiting factors associated with the prospect of standing up to perform. The kinetic materials might be considered as performing as a sort of surrogate embodiment for participants and so avoids the vulnerability that some participants can feel with more theatrically oriented techniques. In relation to the behaviour of tools and toolkits, laughter seems engendered just as much by the unexpected occurrences of something not happening, as something happening. For instance, when two pieces of train track do not quite fit together or the addition of another block to a quivering tower of bricks does not result in a demolition. Such non-kinetic moments are also often greeted with humour.

ARE THE OOPS! MOMENTS REALLY UNEXPECTED?

Wobbly blocks falling down or shoals of balls inter bouncing away unfathomably might not seem to an observer as particularly unexpected events. However, we would argue that what is important is not whether something is surprising to an observer, or even to the participants, but how, and what happens as a result of participants "doing" being surprised

Surprise in conversation has been argued to be a collaborative performance between the giver of a surprise and the recipient. Ethnomethodologists Wilkinson & Kitzinger (2006:150) showed how through such demonstrations, "co-conversationalists collaborate to reflect and reproduce a shared culture". Participants in simultaneously expressing surprise are subtly but powerfully expressing that they have similar viewpoints concerning expectations of a situation. The shared culture attested to, and revealed by these surprises are both an important means to, and an end of the workshop activities beyond the novel concepts that arise. If surprise and humour can foreground such a shared culture, then this can help as a means towards the levelling of hierarchies and bridging of organisational and disciplinary boundaries that we posit is necessary for valuable innovative concepts to emerge.

WHY MIGHT KINETICS WORK?

Movement has a kind of primacy for human sensing. Sheets-Johnstone was thinking of people's own movements when she declared "Infants are not *prelinguistic*, as is commonly declared; on the contrary, language is *post-kinetic*" (2010:2), but nevertheless, our evolutionary background has made us very alert to surprising movements.

Brandt argued that tangible mockups evoked more reflections from her participants because of being perceived by more senses than paper or computer models (2007). Most of our kinetic resources are highly multi-sensory in having sound in addition to the visual and tactile qualities of Brandt's mockups. The sound of a brick tower collapsing or dozens of marbles ricocheting can be quite startling.

We have yet to experiment with senses of smell and touch. However if, as some scientists do, we extend the notion of human senses beyond the usual five to allow for senses of balance, risk and movement, then our kinetic resource experiments can be considered even more multi-sensory. Other aspects of the value and potential of kinetic materials maybe explained through drawing upon theory concerning aesthetics and perspective taking.

HOW DO KINETICS REVEAL PERSPECTIVES?

The multi-faceted and complex nature of techniques such as our pinball and balancing contraptions means participants' attempts to comprehend the physical workings of the material is an activity that invariably provokes shared sense making in itself. Participants in our sessions do not have the benefit of a slow motion video replay. Upon playback we, as researchers can speculate to a fine level of detail as to which ball ricocheted off which other ball, or which adjustment to a balancing contraption had which effect. However, with many of our kinetic techniques, the "What If" question that participants ask when manipulating a tool requires collaborating to piece together an answer to "What just happened then?"

Participants may often differ in their interpretations and differences in foci concerning the response of kinetic resources. This can be seen as an instance of the value of ambiguity in design (Gaver 2003). The ambiguity here is particularly rich because it partially arises in response to live and immediate action and is given meaning through participants informally building shared narratives and

explanations of events.

HOW ARE KINETICS TRANSCENDENTAL?

Aspects of how our kinetic toolkits perform may be explained drawing upon the writings of the social psychologist Alex Gillespie as we have done to a business audience in (Mitchell 2013). Gillespie argues how going beyond the "here and now" can be achieved through *distanciation:* "stepping out of oneself and reflecting on one's own actions and activity" and *identification* "empathizing with other actors and participate to their experience" (Gillespie 2010:2). In this light, how the kinetic resources foster perspectives is valuable because they enable a shared and collaboratively "stepping in" or "stepping out" somewhere together.

HOW DO KINETICS HELP REFLECTING UPON SELF?

The kinetic resources offer, in several cases, means to facilitate distanciation from normal perspectives, both to participants and to the designers themselves. As in the words of one of the developers of the Pinball, the marbles unpredictability when released "is a bit like what happens when people use the model – we didn't really know what people's reactions would be". The unpredictability not only can thus a support reflection upon individual disciplinary challenges and positioning. In the case of the balancing dowling poles, participants can initially be seen achieving a sort of "extreme" distanciation: people get "caught" up in the dynamics of the model, initially playing with its features, trying not to be whacked by, or tangled up in it. After this initial exploration brings discoveries when people become comfortable with the contraption: after repeatedly trying to balance the poles, the representative of the lighting company suddenly came to realize how the resources of the company were unevenly distributed, being not deployed sufficiently in their sales department sector and thus unbalancing the whole business. It is interesting to note how the sales manager had already tried to bring attention to this point through more traditional means but that the imbalance of the poles, helped him to make his case more visible and compelling.

IDENTIFYING WITH SELF AND OTHERS?

As suggested earlier, dynamic models can also facilitate the development of a sort of empathy in helping participants identify with others' points of view. With the balancing poles, for example, the bags representing resources that accompanied the balancing poles differed greatly in their load. That the weight of the bags was not visually perceivable led to sympathy concerning difficulties for management for anticipating the "weight" of resources required for different strategies.

Interacting with the *pinball*, while giving a less immersive "god's eye" view, can also be argued to foster identification with stakeholders, and other influences in their business landscape. An innovation researcher whilst adjusting some barriers and levels on the ramp remarked how such changes would have been helpful for the company. However, upon closer observation, he re-considered the issues from a broader perspective, and stepped into the shoes of rivals "but the competitors would find out and respond to this".

We assume the high-powered industrialists in our workshops are not in the habit of considering themselves inert and powerless in the face of internal and external events in their work. However, in their dialogues we can also perceive a keen self-awareness concerning the limitations of their powers. They display strongly that innovative courses they consider will meet various kinds of resistance whether from competitors, colleagues, other stakeholders or regulators. Thus they also report that they can identify with the resistance they experience in attempting to manipulate the kinetic materials.

CAN AESTHETICS EXPLAIN MESMIRAZATION?

We contend that it is not just that our resources are kinetic that makes them valuable, but how they move. Several commentators have identified that design lacks adequate vocabulary, notation or other tools to effectively describe and innovate movement (Hopson 2009). Therefore we have turned to critiques of kinetic sculpture to support articulating how and why our kinetic resources have proved engaging.

Dorin (2009) convincingly argues that many simple mechanical artefacts can induce a state of fascination even if just for a moment. Most of the categories that he articulates as methods by which man made objects can give sensations of the sublime can be detected in our case techniques. The aesthetic principle seen most clearly is that of *Exposing Space* in our suspended balancing poles. Dorin explains this quality with reference to the well-known hanging "mobile" sculptures of Alexander Calder (Lipman & Aspinwall 1981). Although the notion of exposing space was far from our minds, it can be seen that our business model contraption shares similarities.

"Calder's playful pieces are captivating and elegant for all their simplicity. Their workings are laid plainly before the viewer, all that they are, is apparent at a glance – and yet this is not so, for their movement brings a vitality and opens a space which the static sculpture does not possess." (Dorin 2009:418)

But instead of "invisible air currents" that move Calder's components it is largely participant actions that "exposes inner complexity" of the balancing contraption.

Our *pinball* experiments share some qualities with the mesmiring category of "*Marking Time*" which he elucidates with reference to the flow of sand in an hourglass or the jet of a water fountain. Aspects of Dorin's category of *intricacy* are found in *pinball,* an elaborate railway system constructed with the *trainset,* and the balancing poles as soon as weights are added.

More outlandish and ambitious brick constructions that develop with the *Venture Tower* can be seen as sharing aspects of Dorin's quality of *Defying Nature.* And last, but not least, Dorin's kinetic aesthetic category of *Curiosity* is present in *pinball, trainset, tubes,* and

balancer. In activating the imagination of participants to discuss the if-then causalities of business, the quality of curiosity is perhaps most important of all.

FUTURE WORK: LEARN FROM SURPRISE MAESTROS

Although we argue that the *Oops! Moments* in our experiments are highly beneficial for participants, we must admit that in reviewing our video documentation, we do not find them in highly plentiful supply.

Thus, we may seek to much more explicitly develop resources for surprising participants. So far our resources are kinetic in common sense kind of way, rather than purposeful tricks or cheats. An intriguing avenue to explore in terms of engaging participants through livelier surprises could be to develop and evaluate tool kits drawing upon strong traditions of surprising objects from circus clowns, joke shops and magicians. The opaqueness and mystery of causalities in such artefacts may up to a certain point, mirror and provoke understandings of the murkiness of causalities in business. While minded that extreme surprise is likely to be counterproductive in terms of constructive dialogue. A prolonged or intense surprise is a shock, and this is often accompanied by a pause in verbalisation. A parallel can be drawn with the Marshall McLuhan adage concerning how every extension of a media results in a corresponding amputation (1964). Kinetic materials can add a lot to a workshop, but it seems probably that one can have too much of a good thing.

CONCLUSION

In this paper we presented a comparison of five kinds of kinetic design materials used to facilitate participatory business model workshops. We compared material characteristics in terms of dynamic behaviours and constraints, and the way in which unexpected events during their use trigger new ideas during the development of tangible business models.

We argue that kinetic materials are enlivening because they offer a balance of constraints and dynamics. The chance of unexpected events supports participants in developing business models that are commercially more robust since less predictable elements have been considered in the discussions. We conjecture that the good natured humour that accompany responses to the *Oops! Moments* may also result in business concepts that are also more socially robust. Thus working with kinetic materials can be said to be literally adding momentum to the outcome of innovation discussions. *Oops! Moments* never pass unremarked. Participants take the unexpected events as a challenge to explain. This questioning of participants by the materials is highly in line with some in the business literature who stress that metaphors in general are prompts to inquiries:

"metaphors do not answer questions, they rather pose new questions that business has to answer. But answering these questions will grant management a fresh look on their business surroundings and depict strengths and weakness of their business model from a different angle" (Etzold 2008:284)

Although business models may seem a little removed from more typical participatory design practices, we believe that an attention to kinetic materials offers great potential to any workshop which wishes to utilise metaphor creatively or touch in part upon abstract or otherwise difficult to visualise concepts, relationships and feelings. Kinetic tangibles appear to offer great promise in getting discussions of intangible topics moving.

We suggest that kinetic resources can offer an enriching layer to Liz Sanders' (2002) influential model of how design researchers can access user experiences through exploring a combination of user actions, speech, and making. What people say and do, both individually and collectively in response to surprises can reveal additional aspects of their knowledge and feelings. That many of our kinetic resources engage users in some kind of iterative making activities allows for participant to also express their response to surprises through non-verbal means. Furthermore, we envisage that unpredictable materials may enable reflection upon the if-then causalities and other assumptions in relations to participants' wishes and dreams.

We believe that the backtalk and liveliness of the *Oops! Moments* means they may offer a resource to facilitators truly in keeping with the meaning of the Latin roots of the word resource highlighted by Gillespie and Zittoun (2010): *resurgere* – resuscitate, splash back or rise again.

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