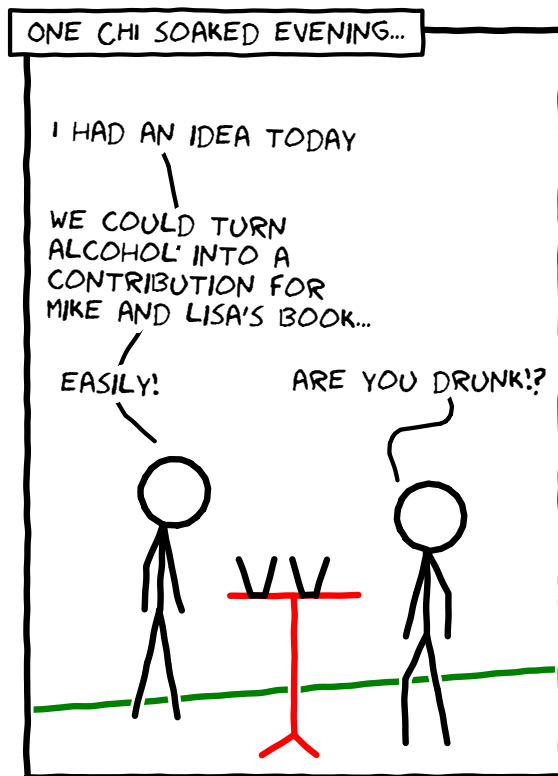


A conversation between two sustainable HCI researchers: the role of HCI in a positive socio-ecological transformation

Samuel Mann and Oliver Bates



[Figure 3.1: One CHI Soaked Evening]

ACT I: INTRODUCTION

Oliver: Have you seen Mike Hazas and Lisa Nathan's call for papers?

Sam: Yes, I love the premise.

Oliver: It's what we've been talking about. Do we write a chapter repositioning Human Computer Interaction (HCI) as an activist discipline?

Sam: The call for papers starts with a promise, "Digital technologies are hailed as revolutionary solutions to problems of environmental sustainability. Yet" (M. Hazas, personal communication, April 6, 2016). And that big 'yet' is the problem. Mike and Lisa are asking us to do something that's different. They are asking us to do something that is raising conundrums, is that the words they used? Raising the paradox of conflict and being disruptive.

Oliver: Do you think that HCI hasn't been disruptive enough?

Sam: Alright. If you look at the areas that they are asking for in terms of critical, ethical reflections, the political, shifting orientation, shifting the norms, the role of activism, do we think that HCI has been able to deliver at scale on any of those things so far?

Oliver: No. I don't think so.

Sam: Me neither, so our contribution wouldn't be on any of those themes individually but all of them together, why haven't we been able to have impact? Do we write a chapter repositioning HCI as an activist discipline?

Oliver: I remember you interviewing me two years ago and asking me if I was an activist. I said no. I thought I was just doing this because I was interested, not because I was trying to change anything. The more conversations I have with people and the more I got fired up about it, I realized activism is about actively seeking to change things.

Sam: Actively seeking to change things is a personal statement. Maybe that is that strong statement our chapter could make, that this is personal, who are we and why do we care? Then there's seeking to change things. What is it that we are seeking to change?

Oliver: That kind of complexity around the day-to-day use of these technologies, and why it continues to spread and grow, how it has become ubiquitous fascinates me. I started out looking at how people used energy in the home, and classifying that in terms of social practices or services to try and understand how daily energy demand was constructed. Then I got more interested in people, the way they reflected on their use of digital technology and day-to-day life. I focused on interactions with digital technology and how that is a complex ecosystem (Bates, Hazas, Friday, Morley & Clear, 2014). There are some seriously energy intensive components of digital technology and its use, the manufacture, the data side of things. There are some great reductions that it can encourage too!

My strengths are in data, and understanding the complexity.

I want to do the right thing. First, what is the right thing? That's what makes the sustainability agenda in computing so hard. We want innovation to provide solutions but we also see innovation as a cause of a lot of the environmental problems. What I would like to do is to start with that I am increasingly disillusioned with, computing's ability to deliver the "stuff".

Sam: Then we should talk about briefly about the promise of computing. And why hasn't it delivered? And why, despite this increasing disillusionment with computing's ability to deliver on this promise, we want to take an optimistic course.

Oliver: Not just that, there's a second message - the value of conversation.

Sam: Yes. We need to be talking with each other and colleagues from other disciplines about HCI's role in a sustainable future.

Oliver: Like you do in your conversations for Sustainable Lens. You have, what 300 podcasted conversations with people from architects to zoologists?

Sam: And everything in between. OK, so wherever possible we'll link to conversations we've had. So, it'll be a conversation-based optimistic take on computing's possible contribution to a positive future...

ACT II: THE PROMISE (AND PROBLEMS) OF COMPUTING

Oliver: Is it computing or is it HCI?

Sam: Well, if we define HCI as the relationship between computers and society rather than purely interaction design, or.

Oliver: Society is important! I think it's the clue to everything we are trying to do, empowering society to do stuff.

Sam: Then I'd like to talk about a definition of sustainability being ethics across time and space, and use that as a way into how it's about positive change at scale. How can we get there? And that's into the policy influencing decision tipping point, focusing on things that are going to get us into those tipping points and tip them.

Oliver: Within that there's work that's not necessarily straight technology development but more along the lines of what people are thinking about.

Sam: It's work like Allison Druin's work with children (2016), Batya Friedman's work in both value sensitive design, and multi lifespan information systems (2016) and Birgit Penzenstadler's software engineering work on getting sustainability into system requirements (2016). These are the things that we need to be getting in bulk.

Oliver: I think HCI is well suited for that. There were many people doing sustainability research, but at the last conference there were only a few papers. It's frustrating. Several authors have suggested directions that our research should be moving in, but it feels like a growing divide. Maybe more activism and being radical are a direction I should consider, but I'm concerned that if I pivot away from my current career trajectory that I'll compromise myself in some way. I don't want to pivot away from Sustainable-HCI but to keep my career on course I think I must.

Sam: Wait, you can't pivot away now! I thought I was leaving it in safe hands.

Oliver: What do you mean, leaving it? But you wrote the first papers on computing education for sustainability (Mann, Smith, & Muller, 2008), you defined the sustainable practitioner and challenged computing to see themselves as sustainable practitioners (Mann, 2011). Are you going back to computing? Joining the crowd that only do sustainability as a hobby alongside their real jobs?

Sam: No, the other way, I'm not leaving sustainability. It's computing I'm having doubts about (Mann, 2016). I was only ever in computing to make a difference, I'm doubting our ability to drive change. My work is on the notion of the sustainable practitioner or the sustainable lens being the way that you do that. You can think of all of education being about the development of your lens, how you see the world, your values, your mindset. The early bits of life and education are about developing your personal lens, mixing your values with opportunities to practice increasingly advanced sets of skills. Then higher education is developing professional lens. The focus of my work is about making sure that that personal and professional lens is also a sustainable lens. For me the most important thing I can be doing is identifying and helping the disciplines that have got the greatest societal leverage. That's the disciplines where the handprint, the potential to do good is massively greater than the negative impact, the footprint. I think that education, and computing, in particular HCI, are disciplines with very high societal leverage.

Oliver: Yes. Is this how we describe the promise of computing, having high leverage with a large handprint?

Sam: For the moment, let's just look at anthropogenic greenhouse gas emissions. Barath Raghavan (2016) and Chris Preist (2013) have come up with similar numbers, that the global impact of computing, is it about 2% of global emissions.

Oliver: That's nothing?

Sam: 2%, that's hardly anything but it's the same as the airline industry. We are desperately worried about air miles and so on, and computing is as bad.

Oliver: It looks like it's growing too, I mean in terms of core infrastructure, the number of connected devices we have in the house, tablets, and everything.

Sam: We're struggling with computing's footprint reduction but the much bigger potential impact is computing's ability to do good, computing's potential to reduce total carbon emissions, people are talking about 16 to 40%. That's massive. Skip Laitner estimates that our society runs on about 14% energy efficiency, he says "we are wasting most of what we produce" (Laitner, 2014).

Oliver: 2% through footprint or more than ten times that through handprint.

Sam: Most sustainable computing was about reducing the footprint of computing itself, remember all the fuss about virtualisation?

Oliver: And people were doing behaviour change work, first on the idea that people didn't know, so it was information, then using persuasion. "Sustainably Unpersuaded" (Brynjarsdottir, Håkansson, Pierce, Baumer, DiSalvo & Sengers, 2012) presented a critical view, questioning whether persuasion and behaviour change had any real effect on the global problems of sustainability. The recommendations of their work have widely been taken on board, with the most obvious example being those who use participatory design. We're framing research around practices instead of behaviours; developing implications of the dynamics of practices changing over time; and, increasingly authors who reflect on their own studies and findings.

Sam: Is this a good thing?

Oliver: Well yes, and no. Yes, as people have broadened understanding of persuasion, including users in the design process. So, participatory design, co-creating, co-design is something that HCI does. Moving beyond the individual, that's something we struggle with. It's hard to do things of scale, and represent demographics in the correct proportions but then they also suggest that we should shift from prescription to reflection. Then there's the "No". There's been a dramatic reduction in SHCI papers since that paper. Were they perhaps too critical of an emergent research focus?

Sam: I think that we've gotten ourselves stuck on efficiency, about computing's potential positive impact, and somehow got into our heads that apps that tell you how long you've been in the shower are going to save the world. If it was going to save the world, how come the world's not saved yet? I've been thinking about this, and I think that worse than being

ineffective, the focus on computing supported efficiencies are doing us harm. There are several reasons.

First, the values work. Bran Knowles' work (2014), based on the work of people such as Pella Thiel (2015). The rational, economic man approach appealing to people's wallet is disabling the altruistic "we need to be doing this because it's what we need to be doing justification", HCI hasn't moved beyond that selfish individualistic approach.

Second, I think that the notion that HCI computing can deliver all of these efficiency gains through behaviour change, or however they are going to achieve that is what Susan Krumdieck refers to as a green myth (2015). It's the miracle just around the corner.

Oliver: We are all going to have electric cars one day so let's keep building roads.

Sam: Yes. There's this notion that computing is going to save us. Kentaro Toyama talks about the "geek heresy" (2016), we think throwing technology at problems is going to solve it but his summary is technology exemplifies underlying human forces. If we are continuing to consume then throwing technology at it is not going to solve that problem.

Third, there's the substitution effects that we see all over the place.

Oliver: We found in both the domestic and non-domestic spaces there's a tension between installing the "state-of-the-art" IoT infrastructure and using the minimum set of monitoring and control infrastructure to make better decisions around buildings and energy (Bates & Friday, 2017).

Sam: Yes, individual devices might be more efficient but then we massively increase the bandwidth around it. We are not actually considering it in terms of absolute terms, in terms of planetary boundaries.

Oliver: It's the area under the curve, right. That's how we frame our work by reminding the readers that people look at the instantaneous savings but the area under the curve is massive because on aggregate, you're doing so many more things that consume.

Sam: Which leads to number four. Negativity. As Bob Costanza argues, Sustainability is positive (2016).

Oliver: How's your list going? Sam's list of what's wrong with efficiency focussed HCI. I've got down Rational resource man, Green myth, Substitution, Negativity. What's five in the great list of what we're doing wrong?

Sam: Five. Perhaps the biggest issue of all is the very nature of IT, all of HCI is absolutely done in a context of sell more stuff.

Oliver: On the fringe, there is the sort of un-designed movement (Pierce, 2012) or the related slow design but it's certainly not got major traction. We used those ideas as a framework to think about how to design technology, and for considering when designing something new is not necessarily the right thing to do.

Sam: Then there's the rebound effects like Airbnb causing more flights because it's easier to stay cheaply.

Oliver: I think it's the kind of one size fits all kind of way of thinking. I could build an app that's community driven and empowers people and society to make the "right decisions", but are you empowering people, or are you empowering capitalism?

Sam: That brings up some of the nature of sustainability problems which by definition aren't amenable to the paradigm that we generally work under: the clearly identify a problem, design a product, do some sort of experiment to measure an intervention.

Oliver: Yes. If the rebound is six, the nature of sustainability makes seven.

Sam: I'm excited by the work that focuses on community engagement, not as a means for behaviour change, but for the sake of an empowered community. Steve Benford's trajectories and uncomfortable interactions (2013), Lancaster's Tiree work I talked to Maria Ferrario (2015) about.

Oliver: Yes, plus Rob Comber empowering communities (2016) and Dave Green (2016), these are all good things, supporting community, beyond an experimental paradigm.

Sam: So those things are in response to that problem of the nature of sustainability. I think that the last problem, the eighth is that HCI in general has a weak understanding of sustainability. Weak as a technical term, as opposed to Daly's strong sustainability, the bullseye model, but also meaning limited understanding of sustainability. HCI seems to have gotten totally distracted by carbon, framing sustainability as only carbon efficiency for climate change, yes important but framing it that way also ignores all the other important effects. How can HCI help biodiversity loss, global inequities?

Oliver: Social change?

Sam: Intergenerational equity. Perhaps that's what sustainability really means and yet I don't know that anybody with a possible exception of Batya Friedman (2016) and Lisa Nathan's (2012) multi-lifespan information systems that have really looked at how we might start to address that. They identify three categories of problem that we're unlikely to solve in a single human lifespan. 1. limitations of the human psyche...lasting peace...the first generation agree to keeping children alive, the second generation grow up in environment where they don't feel threatened, maybe third generation can really build a peace. 2. tears in social fabric and, 3. environmental timescales.

Oliver: It feels like an up-hill battle to leave the world in a better state than when you joined it, or to be better for future generations.

Sam: Sustainability is of course, the attempt to solve that wicked problem. It's important that we cast sustainability as the positive solution.

Oliver: I agree.

Sam: That the nature of those wicked problems, the intergenerational timescales, the complex systems. While we have an approach to HCI which is focusing primarily on things that we know we can fix, we're not going to get there.

We've managed to depress ourselves. Where can we look for solutions for how HCI could better approach this?

Oliver: In 2014, after the workshop at CHI, Six Silberman set about outlining a set of "next steps" for sustainable HCI (Silberman et al., 2014). The paper attempts to rally those who work in sustainable HCI in order to bring a critical mass back to sustainable HCI and sustainable interaction design.

Sam: Yes, I talked with Six about how problems of sustainability are larger in time, space, organizational scale, diversity, and complexity than the scales and scopes addressed by traditional HCI design, evaluation, and fieldwork methods (Silberman, 2012). That I would have thought was a big enough intellectual challenge to spur on the field.

Oliver: Yes and under those wider understandings of sustainability, there are also a large number of other societal issues that link to problems of sustainability (e.g. equality and race, feminism and gender, food, land, water, ICT4Development), and with those issues there is a number of HCI researchers who are already doing "good" and helping change be affected in these areas. Do we still think we can get HCI together around the three pillars approach to sustainability?

Sam: Don't get me started on the nonsense that is a pillars approach "environmental sustainability". You heard me cheer when Hans Bruyninckx told a conference last year that "a pillars model is intellectual nonsense, you cannot have a little bit of sustainability on a finite planet" (Bruyninckx, 2015).

Oliver: It would be remiss of us not to mention Eli Blevis' rubric. In 2007 he placed sustainability as a core principle for HCI design and research, not just an afterthought. This year Chris Preist (2013) and Daniel Schien (2016), working with Eli, added additional rubrics and guidelines that emphasise more responsibility around the environmental impacts of the digital technology, data demand, and reliance upon digital services. Perhaps the most understated and implicit takeaway from these two papers is that everything that we do or make has an environmental impact.

Sam: But it is still largely concerned with reducing computing's own footprint. Ecological economist Sigrid Stagl (2007) wrote a piece in an education journal that has always stuck with me. It's an unpacking of the challenge of impoverished visions of sustainability that Eric Myers and Lisa Nathan raise (2015). It states that as a society we must learn to live in a complex world of interdependent systems with high uncertainties and multiple legitimate interests. We should think simultaneously of drivers and impacts of our actions across scales and barriers of space, time, culture, species and disciplinary boundaries. It means that we need to switch from a focus on outcomes to one of process.

Oliver: That's far away from an app that tells you to get out of the shower. But it's quite long, I'll never remember that.

Sam: OK, how about system conditions? Karl-Henrik Robèrt (2015) created the Framework for Strategic Sustainable Development. He told me we need to backcast from a sustainable world on the basis of living within system conditions. Göran Broman (2014) describes it with the metaphor of chess: checkmate is defined in a principled way, as system conditions. Winning chess, or reaching a sustainable society without any idea of the principles that define that situation would be very unlikely. So, let's see HCI adopt the system conditions.

Oliver: Still pretty long.

Sam: OK, shorter, and my current favourite definition of sustainability, which I've borrowed and adapted from Albert Norström (2015) is that sustainability is about a positive socio-ecological transformation.

Oliver: Is that our chapter title? Our contribution? The role of HCI in a positive socio-ecological transformation? Sustainability as innovation?

Sam: I like it, it says it is about change, but that is positive. While it's a serious predicament that needs major a change, we're not ready to give up. Perhaps we're a balance to Collapse Informatics that Bill Tomlinson (2012) promotes.

Oliver: Some would argue that Collapse Informatics is trying to help positivity in times of collapse. I think it's great for a headline, kind of like, Domsday. The world is on fire, we need to limit everything.

Sam: Peter Garrett didn't just sing, "how do we sleep while our beds are burning?" then build a bolt-hole in the desert. He campaigned and got himself into government. I think that what we need to be focusing on are the sorts of movements like the Transition Town movement. They're definitely not about setting up some sort of post-apocalyptic society. They're also not about convincing anybody that they have to change behaviour. They're about saying, "we're happily demonstrating a better way of living".

Oliver: *The time has come
To say fair's fair
To pay the rent
To pay our share*

Sam: We're trying to be disruptive, not write a write a musical. One of the issues is the flip side of that more technology is the future and computing is all about that, is that, the notion that you're talking about sustainability, you want me to start living in a cave again. If we're going to find a role for HCI in a sustainable future, we need to find a solution to the double paradox of sustainability being about going backwards (but not going backwards) with Sustainable HCI being about new ideas (but not new stuff).

Oliver: You jumped about doing a happy dance when I said, "sustainability as innovation" before.

Sam: I love that. I think what we need to be looking for positive precedents. We need to be looking for examples of people that are changing systems in positive values based way. Perhaps if everyone in HCI could make a point of seeking out people working and living

towards a transition. I visited Transition Town Oamaru and was blown away by the energy and passion and people such as Gail May-Sherman (2015) making a difference.

Oliver: That's OK for a town that has community values, but what about a business or other similar institutions?

Sam: There's Wishbone Design Studio (Latham & McIvor, 2016) a sustainable bike company, their dream was for a product that would last from ages one to five, and then be passed on to the next young rider, a 100% repairable product that would never end up in the landfill and they actively promote a second-hand market. The role of sustainability is also about values in the operation of the business and the relationship with customers.

Oliver: Why do we need to keep perpetuating growth when actually it's about building a system where it's kind of closed and innovating within that.

Sam: Or the Interface Carpet story of everlasting carpet as a service. In computing, we're only just seeing a slight nod to that with device loyalty that Christian Remy (2016) describes. And not at all in software, not so much the software itself, but driving a positive system change. The question is, how do we get this positive system change, at scale, via HCI?

Oliver: Is HCI the vehicle for that? What would it look like for HCI to be run on the same basis as that town, or that bike shop?

Sam: Well, back to what Kentaro Toyama said, that "technology exemplifies underlying human forces" (2016). Technology can make a difference if it works with those human forces, not trying to superimpose itself on top of them.

Oliver: We need a coherent kind of mission statement. Better branding and direction. It's not clear, as a community, where we are, what we do, what we all want to do.

ACT III: TRANSFORMATION

Sam: If we take as a starting point that sustainability is about a positive socio-ecological transformation.

Oliver: Yes.

Sam: It is about change. Yes, economics can be in there but only to achieving socio-ecological transformation.

Oliver: Where do the values fit in?

Sam: Phil Osborne talks about the relationship between values and value (Osborne, 2015). He says the production view of marketing has flipped to the service dominant logic of exchange.

Oliver: How does this help sustainable HCI?

Sam: We need to see HCI as a service. Not about products, but in the service of sustainable transformation. How about a criterion for all HCI, how does this contribute to that positive socio-ecological transformation?

Did you notice that I didn't say sustainable HCI because I think that the key is that we need to normalize this. This isn't just people working on sustainability, this should be applied to all HCI research.

Oliver: I could apply to all digital technology or technology in general, HCI as the link.

Sam: How can we get away with publishing papers that are blatantly unsustainable? I think if we could convince people to put that in as a criterion we would make great strides. Perhaps a positioning in terms of Bob Willard's sustainability and maturity matrix (2005), going from avoidance, compliance, efficiency, opportunity, the reason for doing. At least it would be able to see to what extent is this contributing. Like the energy stars on the fridge, you'd be able to make informed choices about the value of the work. And like the whiteware manufacturers, this would drive innovation.

Oliver: If that's your measure stick, how will people measure their walk against it?

Sam: We would give them a rubric. Almost every paper that does consider sustainability and HCI starts with a definition of sustainability, generally a pretty weak one. It might change if we were to provide people with a way of saying, "this paper sits as a 3.5 on the Bates and Mann sustainable HCI maturity scale."

Sam: If we base it on Willard's 5 stage maturity model for sustainable business, the first one is, Stage 1: The company feels no obligation beyond profits. It ignores sustainability and actively fights against related regulations.

So that becomes:

Stage 1: The researcher feels no obligation beyond publication. Research focuses on development of products without regard to wider implications. Ignores sustainability and ethics and/or actively argues that it doesn't apply this research.

Oliver: OK, I got this, the second stage: The researcher manages their ethical responsibilities as compliance. The researchers are aware of implications and perhaps include a small section in the discussion that acknowledges a single sustainability factor, but wasn't incorporated into the research question, methods or outcomes.

Sam: The third is the shower app.

Oliver: Stage 3: Research is about products that deliver incremental, continuous improvements in eco-efficiency. Sustainability as an opportunity to explore aspects of HCI: encouraging behaviour change or different ways to communicate. Little attempt to question whether the activity being made efficient is sustainable in wider terms, nor alternative approaches. If sustainability is defined, then it's pillars or "environmental sustainability".

Sam: Research in Stage 4 is research on sustainability, using HCI. It references complex sustainability themes. It is value driven. It adopts holistic sustainability, integrating all

aspects through process based approach. In this stage, different models become apparent, understanding products as a means to deliver a service to a customer. Researchers are more likely to talk about empowerment, democracy, participation and social systems than they are interventions for behaviour change.

Oliver: That's quite a leap from 3.

Sam: Yes, Willard describes that as a transformation. The early steps were transitions. Moving from Stage 3 to Stage 4 requires internalizing sustainability notions in profound ways, both personally and organizationally. The transformation to Stage 5 is one of the positive socio-ecological transformation being the premise of the research. Driven by a passionate, values-based commitment to improving the wellbeing of society, and the environment, the research helps build a better world because it is the right thing to do.

Oliver: So, Stage 4 researchers do the right things so that they are successful researchers. Stage 5 researchers are successful researchers so that they can continue to "do the right things."

Sam: Yes, where the right things are to drive a positive socio-ecological transformation.

ACT IV: MODELS AND METRICS

Oliver: I think we've got ourselves a rubric! You know how you must declare keywords at the start of the paper, you know classifications? Can the Mann and Bates thing be just there, you know?

Sam: There was a paper submitted to the sustainability track last year, it was on an App that helped you find a car park. I struggle to see how that had much to do with sustainability. The Mann and Bates metric might put that as a deluded 2 at best.

Oliver: Is there another dimension, something about scale of impact?

Sam: If we get back to that positive system change at scale, there are different ways you can achieve that. Remember how I talked to the head of the European Environment Agency, Hans Bruyninckx (2015)?

He said what they need to do is influence the 28 decision makers in European Environment Ministries. How could HCI help that happen? Robert Brewer (2014) has doggedly asked that at the last couple of conferences, how can we have impact at scale?

Oliver: That is the question, right. I guess do we get more involved in politics. are we saying HCI needs to struggle with that?

Sam: We need to find a way in. Whatever information systems that politicians are using to decide a particular vote, let's make sure that it promotes joined up, integrated thinking and includes a sustainability metric.

Oliver: You've been writing letters to the editor again.

Sam: Yes, but in terms of impact, imagine if the default for systems such as that supporting international trade could be. You could do it that way, but it would be more sustainable to do it this way. I talked to Dan Russell (2016) who works on improving search quality for Google. We called our talk “Searching for Sustainability”. I asked him what would Google tell you if you asked, “Should I ride my bike to work today?” At the moment it will interpret it as a weather question. Imagine if it said “Yeah, you should, otherwise your footprint this week will overshoot by 3000”.

Oliver: That would be an interesting challenge.

Sam: Exactly, a transformative HCI is much more interesting than the shower app. You know when you do a search on Google for a movie, it tells you as a fact on the home page. If you do a search on, is climate change real? Why doesn't Google come up with “Yes”? The potential is for influence at enormous scale. How can we help Google move to that position where they decide that that's the thing to do? That would have a massive impact.

Oliver: Isn't there something terrifying about large corporations tailoring answers and information.

Sam: Again, it's a messy question of information that is at the heart of sustainability. In the “The Virtues of Ignorance” Bill Vitek and Wes Jackson (2008) argue that a “knowledge-based worldview is both flawed and dangerous”. They argued for ignorance-based worldview: what would human cultures look like, if we began every endeavour and conversation with the humbling assumption that human understanding is limited by an ignorance that no amount of additional information can mitigate?

Oliver: HCI has dabbled in that, we've seen some design fiction work recently. But is ignorance defeatist?

Sam: Yeah, I think the book should have been called the Virtues of Humility. But the book argued ignorance celebrates knowledge (Vitek, 2008).

Oliver: That frames what most of HCI is doing, not testing, not even stating “invent more widgets” as a paradigm.

Sam: Paul Heltne (2008) says that ignorance is humble: “Acknowledging that one does not know is a humble kind of ignorance, one that is, in fact, filled often with the joy of discovery and wonder at what is discovered... This is the kind of ignorance based worldview that can help us fathom the messes we are in, articulate assumptions and processes, entertain questions and be enriched by them, and imagine new ways and new knowledge” (Heltne, 2008)

Oliver: This is what we need to inspire HCI.

Sam: Robert Root-Bernstein (2008) argues that science is not a search for solutions but a search for answerable questions – it must become acceptable to say “I don't know”. He says “science is a way of asking more and more meaningful questions.”

Oliver: The same challenge goes for HCI research. Can we just replace science and education with HCI?. HCI is about more meaningful questions and developing skills for critical evaluation. I think we can, but what are we going to do about it?

Sam: Well, we're going to write this chapter that discusses where we think we're going. Alison Druin is working with the US National Parks Service, reworking their digital strategy. She says at first people said, "Well what you should do is just start small. Do something small, have a success of it", but her response is "but the very issue is that there are already pockets of good stuff but there isn't a system of good stuff" (Druin, 2016). We can expand what Alison said to wider HCI, we could cherry pick things that are working. But there's an awful lot of areas where there's not good stuff happening, we need to focus on system change.

Oliver: As you say, cherry picking leaves too many gaps. Look at it in an HCI context, you get six sustainable HCI papers and then 300 talking about producing more of widgets without any consideration of environmental impact. And those six sustainable HCI will almost certainly be about energy efficiency and not considering the wider, deeper transformative sustainability we've been talking about.

Sam: One of the key things we've talked about is that relationship between sustainability and innovation, looking for positive alternatives. Transition Towns, Wishbone. What would it take to create a positive system change at scale?

Oliver: For a concrete contribution for HCI we talked about the Mann and Bates scale of sustainability. If you want to move a community towards something, you must start somewhere, right?

Sam: So if we had our rubric and we could ask people to somehow represent which of the UN's Sustainable Development Goals they're addressing through their work. They might say, "Well, actually it is energy, and it's not all these other things". Just doing that would be a useful thing for people to do.

Oliver: I agree with you. We are being active. We hosted a workshop on generating patterns around sustainability in HCI. Also, our #shcipat hashtag, where we tweeted proto-patterns from every talk we attended. The response showed there is interest and energy around broader conceptualizations of sustainability. It helped spark several conversations with presenters who've never even considered sustainable HCI.

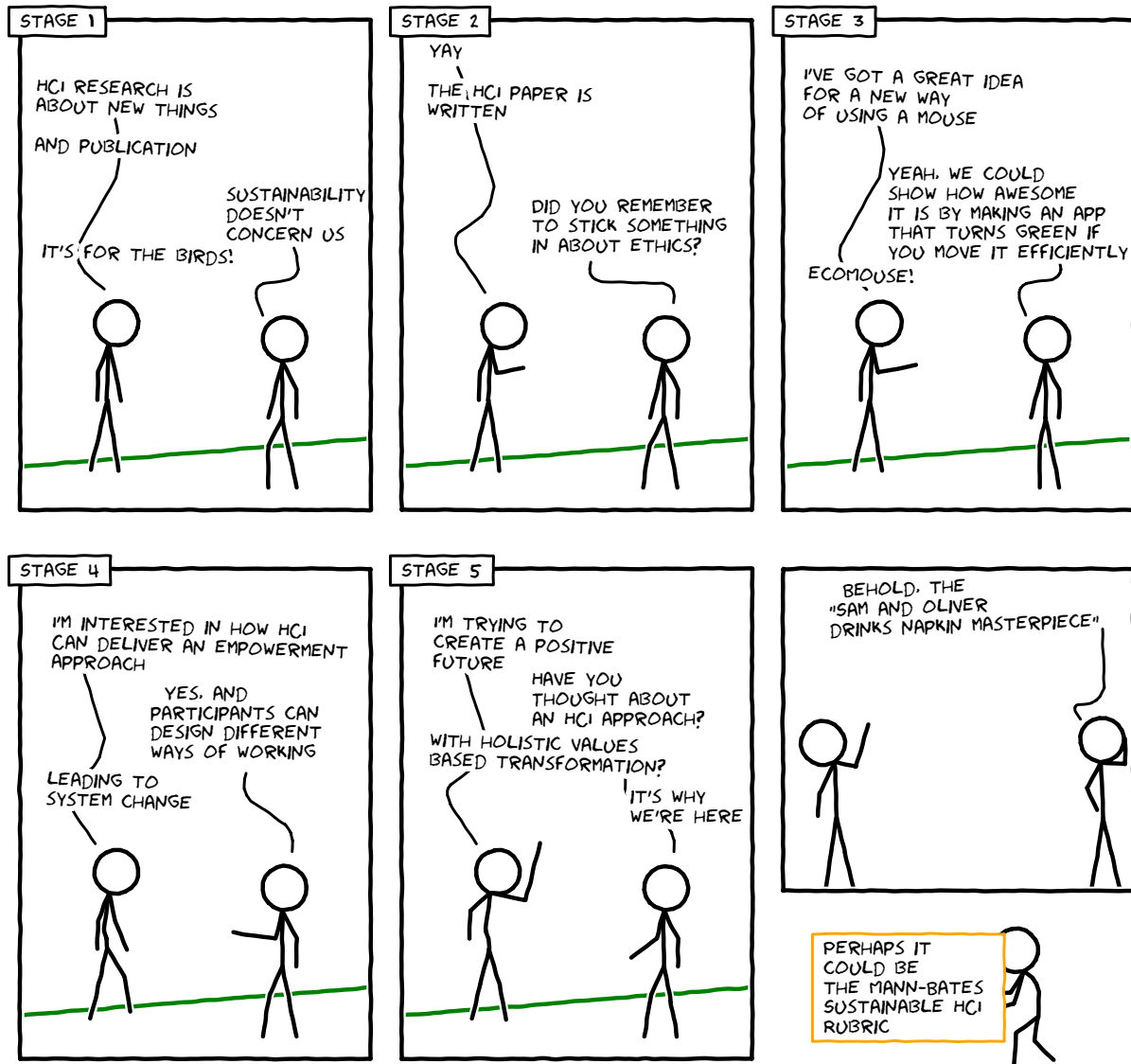
ACT V: CONCLUSION

Sam: We started out saying it's personal, that we could be activists.

Oliver: How can we be more activist-y? We could rank every paper in the conference against our maturity rubric. Go around and put the appropriate number of stickers on the door while they're talking. That might inspire some people to explore attitudes towards sustainability. We'd wind some people up. At least it would start a discussion around it. Talking of winding people up, we should write that chapter, it would be awesome.

Sam: What would awesome would be a chapter that explored these ideas as a conversation, reflecting on the challenges, raising questions, not presenting fixed, perfectly formed answers.

Oliver: Absolutely. We could finish with the rubric and then what Donald Norman said on your show, “Let’s be good together instead of narrow minded and apart” (2014).



[Figure 3.2: Mann-Bates Sustainable HCI Rubric]

REFERENCES

Bates, O., & Friday, A. (2017). Beyond Data in the Smart City: Repurposing Existing Campus IoT. *IEEE Pervasive Computing*, 16(2), 54-60.

Bates, O., Hazas, M., Friday, A., Morley, J., & Clear, A. K. (2014). Towards an holistic view of the energy and environmental impacts of domestic media and IT. In *Proceedings of the 32nd annual ACM conference on Human factors in computing systems* (pp. 1173-1182). ACM.

- Benford, S. (2013, July 5). *Experiencing changing trajectories*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=505>
- Blevis, E. (2007). Sustainable Interaction Design: Invention & Disposal, Renewal & Reuse. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 503–512). ACM. <https://doi.org/10.1145/1240624.1240705>
- Brewer, R. (2014, June 3). *Energy literacy*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=669>
- Broman, G. (2014, December 20). *Strategic sustainable development*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=767>
- Bruyninckx, H. (2015, September 9). *Challenging deep assumptions*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=914>
- Brynjarsdottir, H., Håkansson, M., Pierce, J., Baumer, E., DiSalvo, C. and Sengers, P. (2012, May). Sustainably unpersuaded: How persuasion narrows our vision of sustainability. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 947-956). ACM.
- Comber, R. (2016, March 19). *Empowering communities*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=1000>
- Constanza, R. (2016, July 29). *Positive systems thinking*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=1074>
- Druin, A. (2016, June 26). *Children as design partners in technology and sustainability*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=1016>
- Ferrario, M.A. (2015, February 15). *Participating co-developers*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=808>
- Friedman, B. (2016, July 1). *Values: working on problems that really matter*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=1022>
- Green, D. (2016, April 17). *Participatory documentary storytelling*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=998>
- Heltne, P. G. (2008). Imposed ignorance and humble ignorance - two worldviews. In W. Vitek & W. Jackson (Eds.), *The virtues of ignorance: Complexity, sustainability, and the limits of knowledge* (pp. 135-149). Lexington: University Press of Kentucky.
- Knowles, B. (2014, March 3). *Changing mindsets*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=625>
- Krumdieck, S. (2015, June 30). *Transition engineering*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=859>
- Laitner, J. A. (2014, March 28). *Intelligent efficiency*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=636>
- Latham, R. & McIvor, J. (2016, April 1). *Value driven bikes*. *Sustainable Lens [Podcast]*. <http://sustainablelens.org/?p=992>

Mann, S. (2011). *The green graduate: Educating every student as a sustainable practitioner*. New Zealand Council for Educational Research. New Zealand.

Mann, S. (2016). Computing education for sustainability: what gives me hope? *interactions*, 23(6), 44-47.

Mann, S., Smith, L., & Muller, L. (2008). Computing education for sustainability. *ACM SIGCSE Bulletin*, 40(4), 183-193.

May-Sherman, G. (2015, June 26). *Transition Oamaru. Sustainable Lens* [Podcast]. <http://sustainablelens.org/?p=869>

Meyers, E. M., & Nathan, L. P. (2016, February). Impoverished visions of sustainability: Encouraging disruption in digital learning environments. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing* (pp. 222-232). ACM.

Nathan, L.P. (2012, July, 14). *Information systems for societal challenges*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=325>

Norman, D. (2014, February 6). *Usability:sustainability*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=666>

Norström, A. (2015, November 26). *Nurturing social-ecological transformation*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=942>

Osborne, P. (2015, April 1). *Valuing Value*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=827>

Penzenstadler, B. (2016, January 7). *Sustainable software engineering*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=956>

Pierce, J. (2012, May). Undesigning technology: considering the negation of design by design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 957-966). ACM.

Preist, C. (2013, May 24, 2013). *Environmental impact of digital transformation*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=473>

Raghavan, B. (2016, February 21). *Computing at the heart of culture change*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=980>

Remy, C. (2016, July 27). *Loyalty to devices, not just brands*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=1071>

Robèrt, K.H. (2015, November 20). *Strategic sustainable development*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=938>

Root-Bernstein, R. (2008). I Don't Know! In W. Vitek & W. Jackson (Eds.), *The virtues of ignorance: Complexity, sustainability, and the limits of knowledge* (pp. 233-250). Lexington: University Press of Kentucky.

Russell, D. (2016, July 8). *Searching for sustainability*. Sustainable Lens [Podcast]. <http://sustainablelens.org/?p=1024>

- Schien, D. (2016, July, 21). *Footprints of digital infrastructure*. *Sustainable Lens* [Podcast]. <http://sustainablelens.org/?p=1030>
- Silberman, S. (2012, July, 12). *joined-up thinking*. *Sustainable Lens* [Podcast]. <http://sustainablelens.org/?p=321>
- Silberman, M. S., Nathan, L., Knowles, B., Bendor, R., Clear, A., Håkansson, M., Dillahunt, T., Mankoff, J. (2014). Next Steps for Sustainable HCI. *Interactions*, 21(5), 66–69. <https://doi.org/10.1145/2651820>
- Stagl, S. (2007). Theoretical foundations of learning processes for sustainable development. *International Journal of Sustainable Development and World Ecology*, 14(1), 52-62.
- Thiel P. (2015, November 30). *values-based change agent*. *Sustainable Lens* [Podcast]. <http://sustainablelens.org/?p=929>
- Tomlinson, B. (2012, January 6). *Dr Bill Tomlinson*. *Sustainable Lens* [Podcast]. Retrieved from <http://sustainablelens.org/?p=309>.
- Toyama, K. (2016, January 1). *Technology amplifies underlying human forces*. *Sustainable Lens* [Podcast]. <http://sustainablelens.org/?p=933>
- Vitek, B. (Ed.). (2008). *The virtues of ignorance: Complexity, sustainability, and the limits of knowledge*. University Press of Kentucky.
- Vitek, B., & Jackson, W. (2008). Introduction: Taking ignorance seriously. *The Virtues of Ignorance: Complexity, Sustainability, and the Limits of Knowledge*, 1-17.
- Willard, B. (2005). *The next sustainability wave: Building boardroom buy-in (Conscientious Commerce)*. Gabriola Island, British Columbia, Canada: New Society Publishers.