

Let's start with the basics. I live here but many of you are from out of town, and I always start my talks like this so...

# SOCIAL DEVIANCE

Oh sorry, that's a slide from Andy Goodman's talk. Let me try that again.

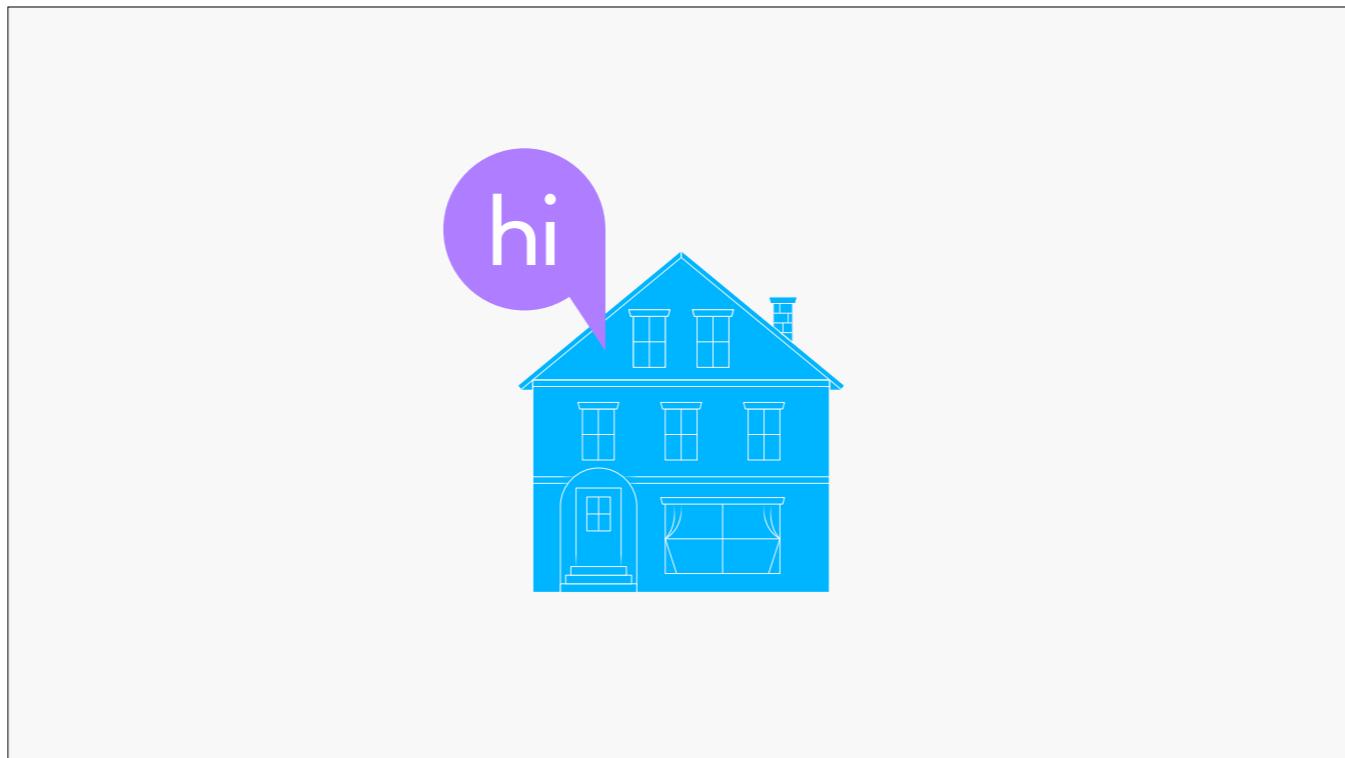


HELLO SAN FRANCISCO! Oh come on, we can do better than that! HELLO SAN FRANCISCO!

[insert video of last year's solid from above]



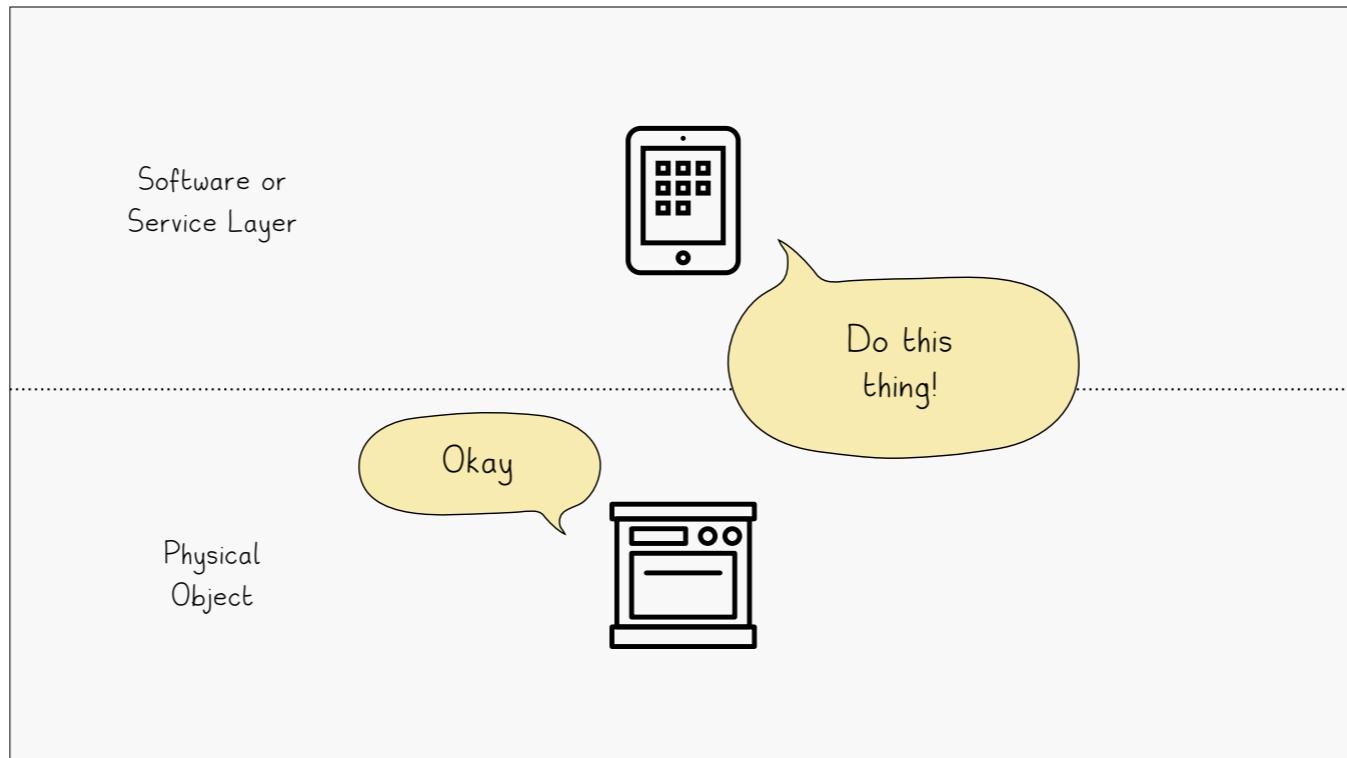
My name is Tom Coates. And this is a picture of me looking super cool. I've worked for various people like the BBC and Time Out and Yahoo and all kinds of other stuff, but at the moment I have a little company with my old friend Matt Biddulph called Thington based in San Francisco.



Thington as a company is concerned with the Internet of Things, but it's still in super-secret squirrel stealth mode, so I'm not going to talk about it much today.

However, I will say that this talk I'm going to give today is full of the thinking that we've been doing, and so if any of you out there are like magical detectives or something, then perhaps you can figure out our secrets for yourselves! And if any of you are interested in investing, we're more than willing to take the meetings.

I should also add that almost every single thing in this talk argues almost exactly the opposite as the talk that was in this room before me. All the way up to me wanting to set fire to Adam Curtis.



What I AM going to talk about is this relationship - the relationship we're currently building between physical network connected objects and some kind of software or service layer that sits alongside and/or above them. And I'm going to talk a bit about some attempts to dissolve the top layer here into the object itself through embedded interfaces, tangible computing or metaphors of enchantment. And I'm going to present a bit of a counter-argument to that take - presenting a few ways that I think we could and should be a bit nicer to the software or service layer.

BUT FIRST SOME HISTORY...



Now much of this narrative you'll be familiar with so I'll barrel through it pretty quickly.

This is 1943, and Thomas Watson the founder of IBM and the infamous statement he's alleged to have made... The statement is this one...

So actually there's very little evidence he made this statement at all, but there are lots of other statements from around the same time. Charles Darwin's grandson said:



"it is very possible that ... one machine would suffice to solve all the problems that are demanded of it from the whole country"

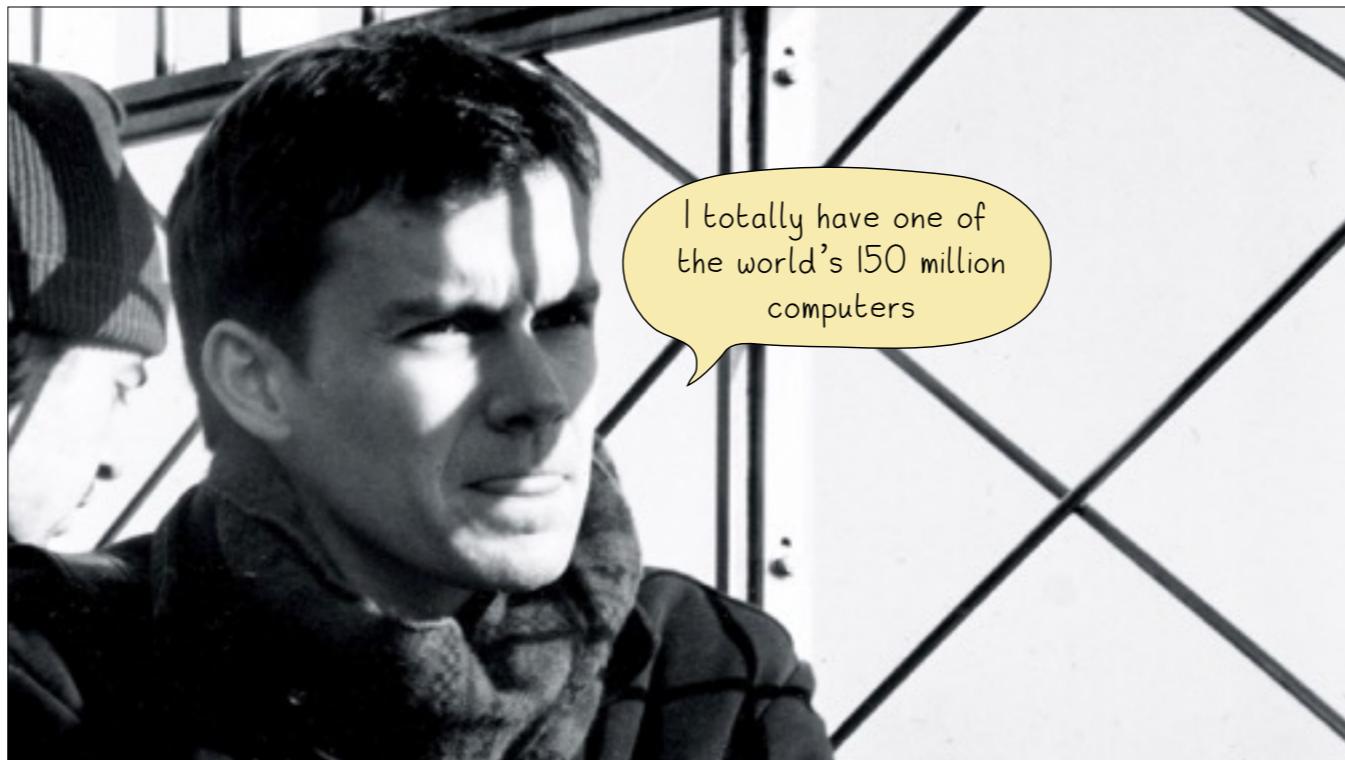
Early computing pioneer Howard Aiken also said something along these lines: "Originally one thought that if there were a half dozen large computers in this country, hidden away in research laboratories, this would take care of all requirements we had throughout the country"

But that was seventy years ago.



Let's cut to a little closer to home. This is me in the late seventies in my favorite Disney Winnie the Pooh t-shirt, in Norwich in the UK, not looking very cool. This is about thirty five years after Thomas Watson's statement, coincidentally halfway between that statement and today. This is also the year that The Dukes of Hazard TV show debut'ed on CBS and—according to Wikipedia—when President Jimmy Carter was attacked by a Swamp Rabbit.

In terms of computing, where are we? From the four or five computers that Thomas Watson thought we'd have, we're already up to the massive 50,000 units of computers sold each year.

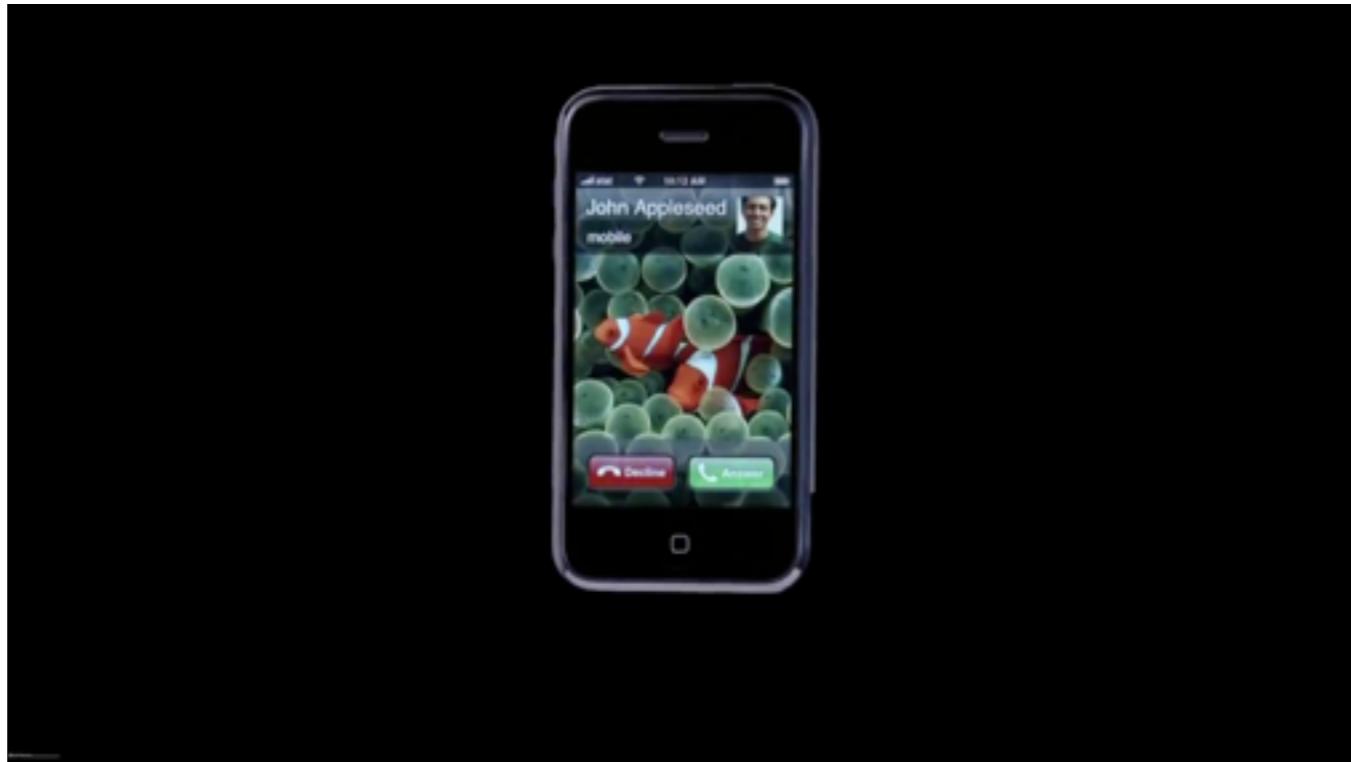


Let's leap forward - here I've finished primary and secondary school, and I've gone to University and I've also popped over to the US to have my photo taken here on top of the Empire State Building with my tongue out. Something like fifteen years have passed since that last photo and the 50,000 computers sold each year has also escalated dramatically. Now there are, in active use in the world, something like ... 150 million computers.



And these numbers just keep escalating and escalating. Ten years later (click) in total, over a billion computers would have been sold worldwide. Six years after that - the mid-2000s - that number would have (lick) doubled - an extra one billion computers sold in six years.

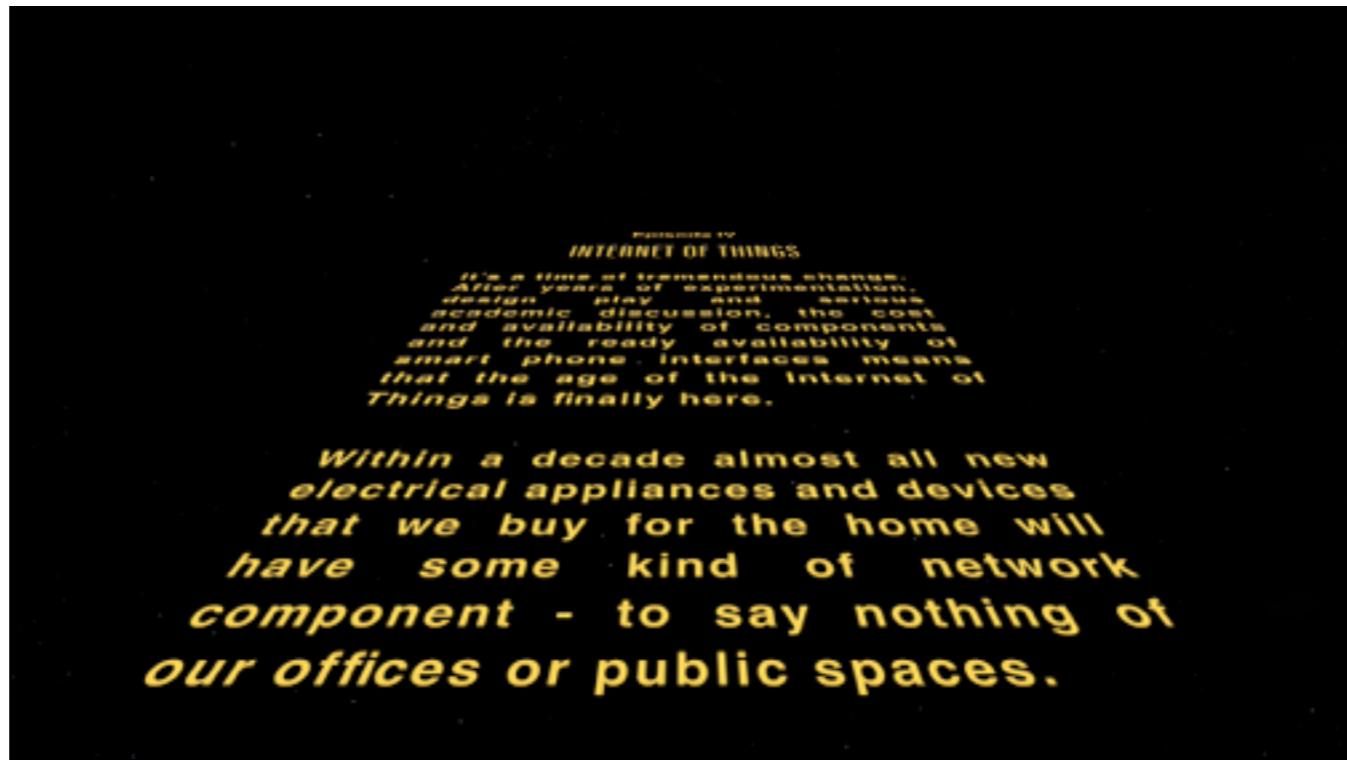
And then of course, we had the explosion of smart phones. Cheaper components, more power - all factored on Moore's law, made it increasingly possible to build relatively affordable, portable computers you could keep in your pocket.



I think we all forget how quickly things can change, but I think it's fair to say that the era of the modern smart-phone starts with the iPhone, and it's really important to remember that only launched \*seven\* years ago. This by the way, is the very first advert for the iPhone which essentially replaced single use telephones with general purpose computers connected to the phone network.

Three years after the iPhone launched - so about four years ago - in addition to all of the desktop and laptop computers we were buying, we were also buying 150 million smart phones were being sold each year sold. Next year, it's projected that we're likely to be selling 1.6 \*\* billion \*\* smart phones each year. That's one mobile phone SOLD EACH YEAR for every five people on the planet.

Now the reason I've taken you through this little adventure is to just remind you that within a human lifetime, we've gone from essentially nothing to billions of computers sold each year, ever more computation - shrinking and becoming more powerful every day. Much of that growth has happened in the last decade and it shows no sign of slowing down. We can expect a world of hundreds of billions, \*trillions\* of computers distributed around the world around us within a few years - everywhere they can make even the slightest incremental improvement.



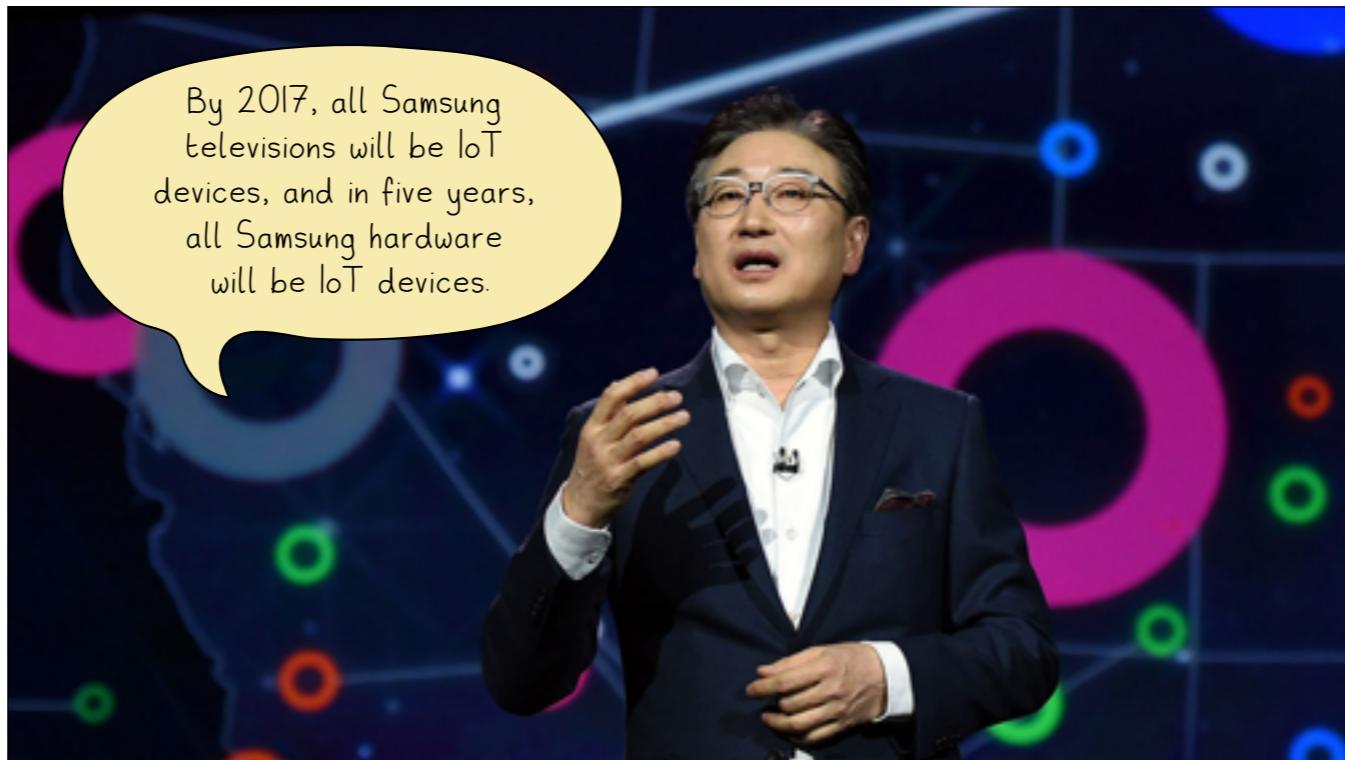
PRESENTED BY  
**INTERNET OF THINGS**

*It's a time of tremendous change. After years of experimentation, design, trial and academic discussion, the cost and availability of components and the ready availability of smart phone interfaces means that the age of the Internet of Things is finally here.*

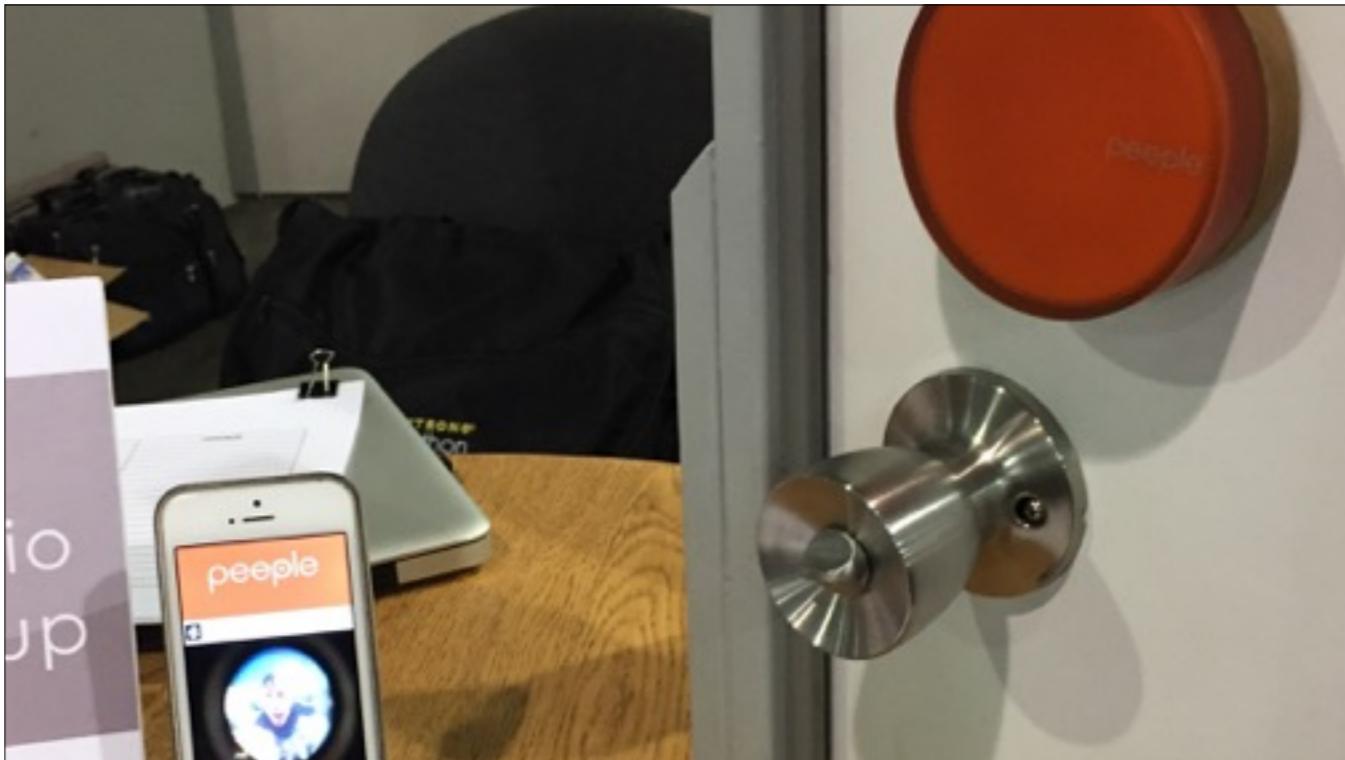
*Within a decade almost all new electrical appliances and devices that we buy for the home will have some kind of network component - to say nothing of our offices or public spaces.*

I'm talking of course about the Internet of Things, and this is where I make my first grandiose assertion of the day. It's a time of tremendous change. After years of design experiments and academic discussion, the cost and availability of components and the ready availability of smart phone interfaces means that the Internet of Things is finally rapidly approaching.

In fact, I'll go further and say that within a decade almost all new electrical appliances and devices that we buy for the home will have some kind of network component - to say nothing of our offices or public spaces. Quite seriously, the world of tomorrow is dripping in objects that belch out information or can take commands, or both...



But don't take my word for it - this is Samsung CEO at this year's Consumer Electronics Show in Las Vegas, where he made the Internet of Things their major focus...

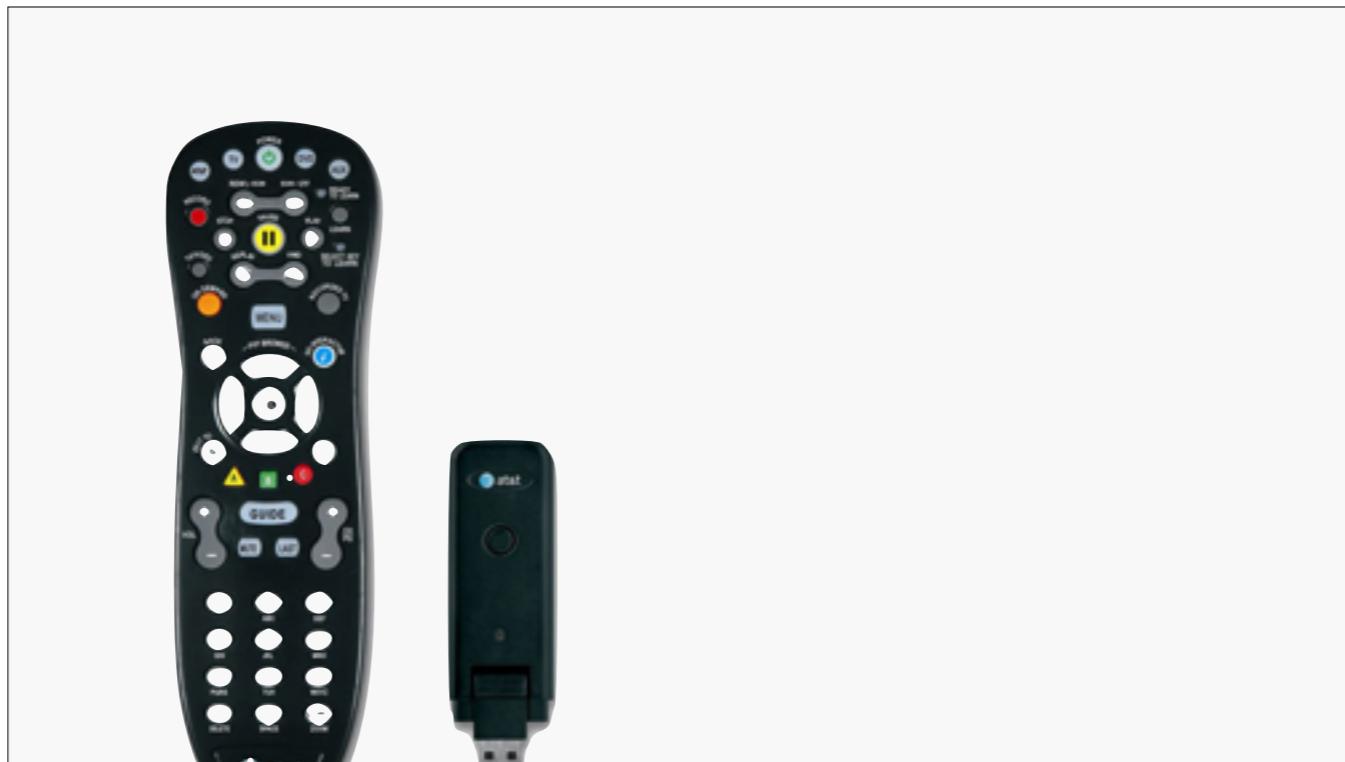


Wandering around CES this year, the place was full of Internet of Things products. They were everywhere. Whirlpool had smart washing machines and dryers that did all the noisy work when you left the house. There were at least three or four smart lock manufacturers in attendance, including some of the world's biggest names in lock-making. Samsung, Polaroid, Canon, Panasonic, Quirky, Sony, Belkin, Parrot, Honeywell and many many others all had smart home or internet of things products to try and sell to people.

There were smart dishwashers, heaters, smart air conditioning units and humidifiers, smart lighting, smart garage door openers, things to open curtains, check if your house was on fire, smart ovens and kitchen scales, smart vacuum cleaners and smart security systems. If it could take a battery or plug into the mains there was a smart version of it... And I know I'm talking to the choir here, but this is not a weird anomaly - this is not a fad, this is the future of every appliance in our homes - just as electricity changed them all, so the network will - IS DOING SO - in turn.



By the way, CES is an extraordinary event and after years of it being something that internet people didn't really attend, it feels like that's finally changing as software and computation starts moving quite dramatically into a space historically segregated from computation. I very much recommend it. If you get a chance to go, then please do so or HOVER TOM WILL COME AND GET YOU.



But honestly, however good the hardware was at CES and however much of it there was, often the power that they had, the benefits the technology brought, was not as good as I might have hoped. The power of the internet was just not being brought into the devices as much as you might have hoped - the networked parts of the product essentially being reduced to app-based remote controls.

While it was clear that they were \*\*going\*\* to be able to offer tremendous power to us all to control and understand the world around us, there was little sense of how we might harness or grab that power in comprehensible ways and put it in the hands of users.

And as I've said that's what I want to spend the rest of this talk discussing - what might the right models be for interacting with a world of connected objects that are more powerful and less awful than a remote control.



You should use the network  
to amplify a tool's core purpose,  
not to be another web browser  
or Twitter client.

Let's start with the basics. This is Matt Rolandson, a partner at the astonishingly creative Ammunition Group in San Francisco. Ammunition Group have done a number of pretty astonishing things, including the hardware for Square, the Nook e-reader for Barnes and Noble and all the brand and hardware design for the beats by dre line of headphones.

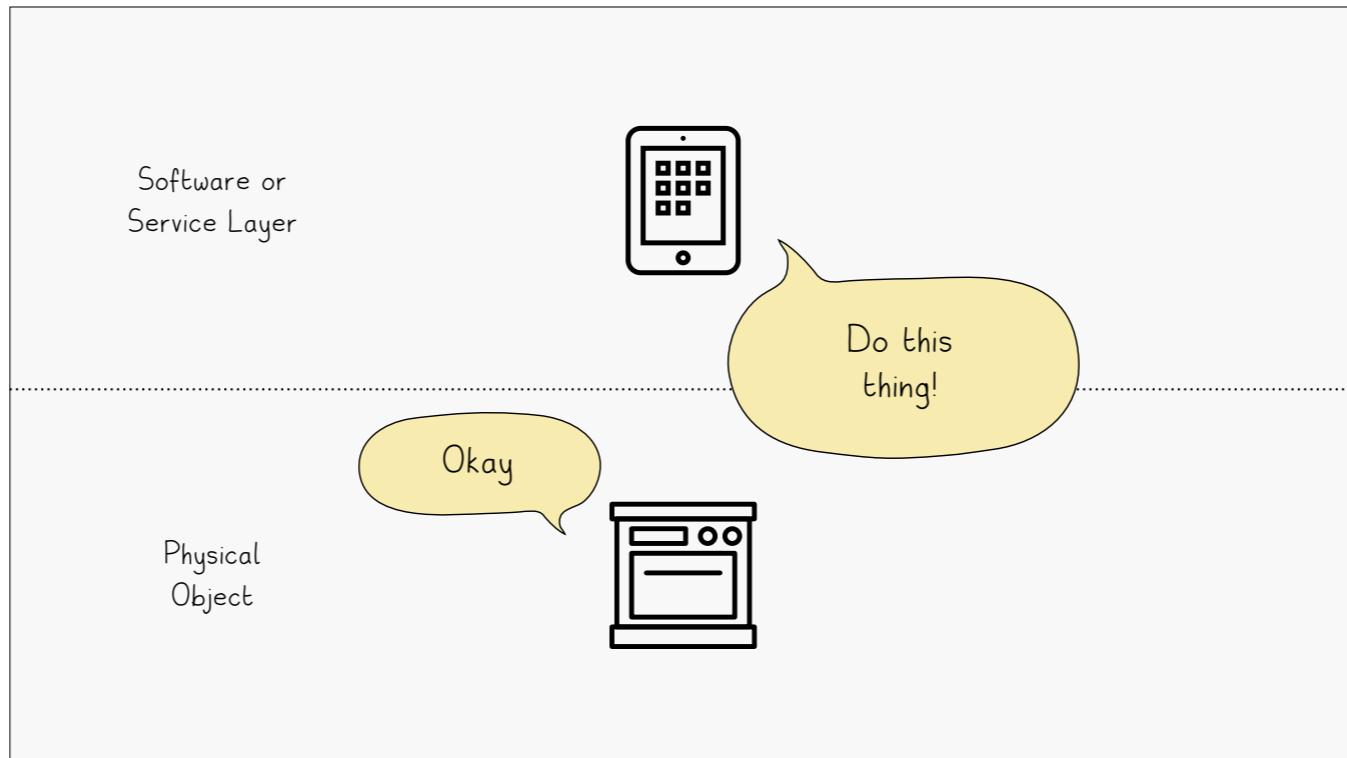
I think this is probably one of the most bluntly useful and apparently obvious things that anyone has said about the Internet of Things as it manifests in devices and appliances. You should use the network—use computation—to amplify a tool's core purpose. If you network an oven it should be a better oven, network a camera it should be to make it a better camera. I'm not going to be talking too much about how an oven or a fridge could be more useful today, mostly about how we should interact with the fridge in question, but keep this goal in mind because even though it seems obvious...



This is the kind of thing that people have tended to make. This is a classic from my all-time favourite Tumblr - “FUCK YEAH INTERNET FRIDGE” by Roo Reynolds...

This not only has some skeuomorphic replicas of things that you could just do with pen and paper and post-its or magnets. But also has it's own Twitter client, AP News interface and Pandora client.

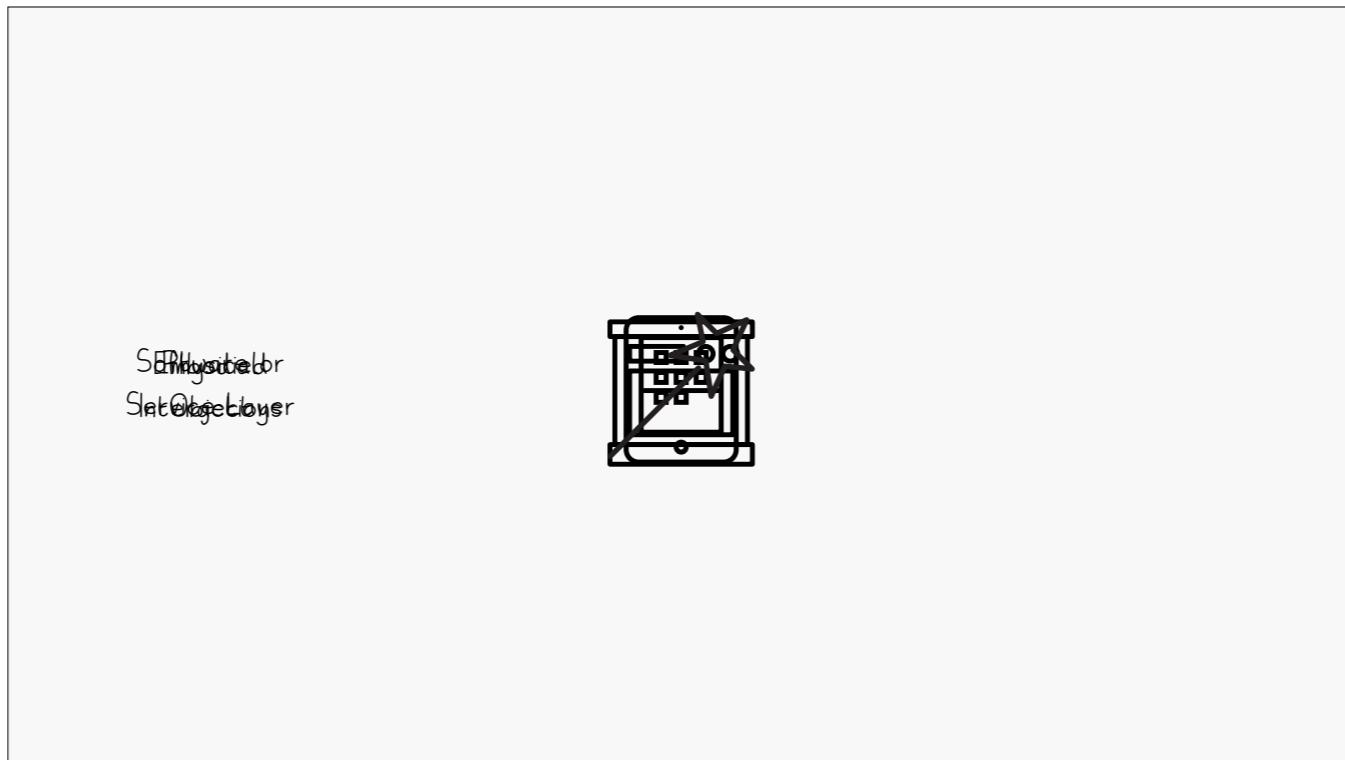
This is a new object that has come out into the world relatively recently and makes no sense whatsoever. What person with an incredibly expensive futuristic fridge with a screen on it doesn't have a laptop or an iPad or a smartphone? What person decides to read the news on their future fridge? Or post a Twitter message? This has nothing to do with making a better fridge - it's just about glueing other devices onto the front. It's about performing the internet.



Now luckily we've come a bit further than that recently, and so instead of that performance we have this one - which I mentioned earlier. Essentially there's an object - here an oven - and it comes with an app that runs on a mobile phone. The app is essentially a remote control for the main object, one that potentially has a few rule making components with it that make it a little more interesting and useful.

This is definitely a model that enhances the object its attached to - it makes it easier to control or check up upon from a distance, but it seems a bit simplistic and on the nose. Can this really be the extent of the future we're looking for? And is the reason it feels a bit dull an interaction problem?

One direction that designers have traditionally been very keen on is to attempt to do this...



... Dissolve the service layer and physical objects together to make something seamless and more powerful, that one might interact with in both the 'data' environment and the 'physical' environment at the same time. Essentially the goal here is to break down the distinction between the two parts of the 'thing' to make something new. There are many people making these arguments to the extent that it seems that this is the direction that—perhaps—the more cerebral parts of the design community think we should be moving in.

The potential of the internet of things is to improve on what mobile does so well. Instead of **availability** at the point of inspiration, IoT lets us shift to **interaction** with the point of inspiration. Add sensors and smarts to an object or place, and **you no longer have to pull out your phone for a digital interaction.**

Josh Clark  
Connected // Disconnected

This is a quote from Josh Clark, who has been talking around IoT on the design side at conferences for a while now and is a very sharp guy. He says ([click](#)).

Why use just your fingers to select what's on a display when you can use your whole body? It's often easier, and makes more sense. Like, when you use a hammer, you don't key into system to say "hit at point X with force F" and then stand back and let it happen, you just pick up the hammer and hit with it, using your body to judge strength and your eyes to judge position.

Matt Webb  
Waving, Not Designing

This is a quote from Matt Webb from a few years back. Genuinely I could list a thousand other people making this argument, but it might feel a bit like I was taking my Twitter arguments onto stage here and that would be unfair... Although...

 Boris Anthony  
@Bopuc

 Following

@tomcoates Bored. Tell me you all are doing embodied interactions with your "IoT" thingies!

12:17 PM - 27 Jan 2015

 Reply to @Bopuc

 Tom Coates @tomcoates - Jan 27  
@Bopuc: nope because that's a nice idea that has almost no comprehension or use yet

 Boris Anthony @Bopuc - Jan 27  
@tomcoates so Silicon Valley people forgot how to turn a nob or flick a switch or place a needle or stir a spoon or pour a kettle or... ? ;)

[View other replies](#)

 Tom Coates @tomcoates - Jan 27  
@Bopuc: The thing about those interactions is that they're awesome at the precise thing they do, not so great at everything else

 Boris Anthony @Bopuc - Jan 27  
@tomcoates cool, i still prefer the old school, physical interactions over the new things ;)

 @MikeIsaac

contractor model is ancient (and well known/treated in publishing)  
[nytimes.com/2015/06/25/iso](http://nytimes.com/2015/06/25/iso) ...

Amazon's company, called [Flex](#), sends experts to deliver and/or robots in homes and offices. But rather than requiring people to independent contractors, a practice championed by most retail companies, including the ride-hailing app Uber. Mr. Jobs I to actually employ the people who would be working for him.

there's a good chance that one day there could be a change in I qualify those contractor jobs -- and I'd rather be taking the risk they I need not be subject to that business risk," said Mr. Jobs, the executive who founded Apple's retail division and later stepped down.

 Wired UK @WiredUK

Boris: Uber drivers will have to take scaled-down Knowledge test [wired.co.uk/2qqf8r](http://wired.co.uk/2qqf8r)



 d\_st @MikeIsaac

Facebook to get swipe? [twitter.com/CNBC/status/611111111111111111](http://twitter.com/CNBC/status/611111111111111111) ...

 joanne mcneill @joanne.mcneill

3h



Anyway much of this thinking is inspired by the ground-breaking work of people like Paul Dourish, David Rose, Durrell Bishop, Natalie Jeremijenko, Hiroshi Ishii - some of whom are here today. Now I have to apologise here because for brevity I'm going to have to wildly over-simplify their positions and perspectives, many of which differ wildly from each other - and there's so much more to their positions than the truncated version I can present today.... ...but the very simplest way of expressing this position is that we can and should find ways to blur and even dissolve the distinction between the digital and the physical - rather than have a differentiated service layer, the magical intelligence should merge with the physical object. And that, in the doing of this, simpler, clearer, more powerful, magical objects emerge.



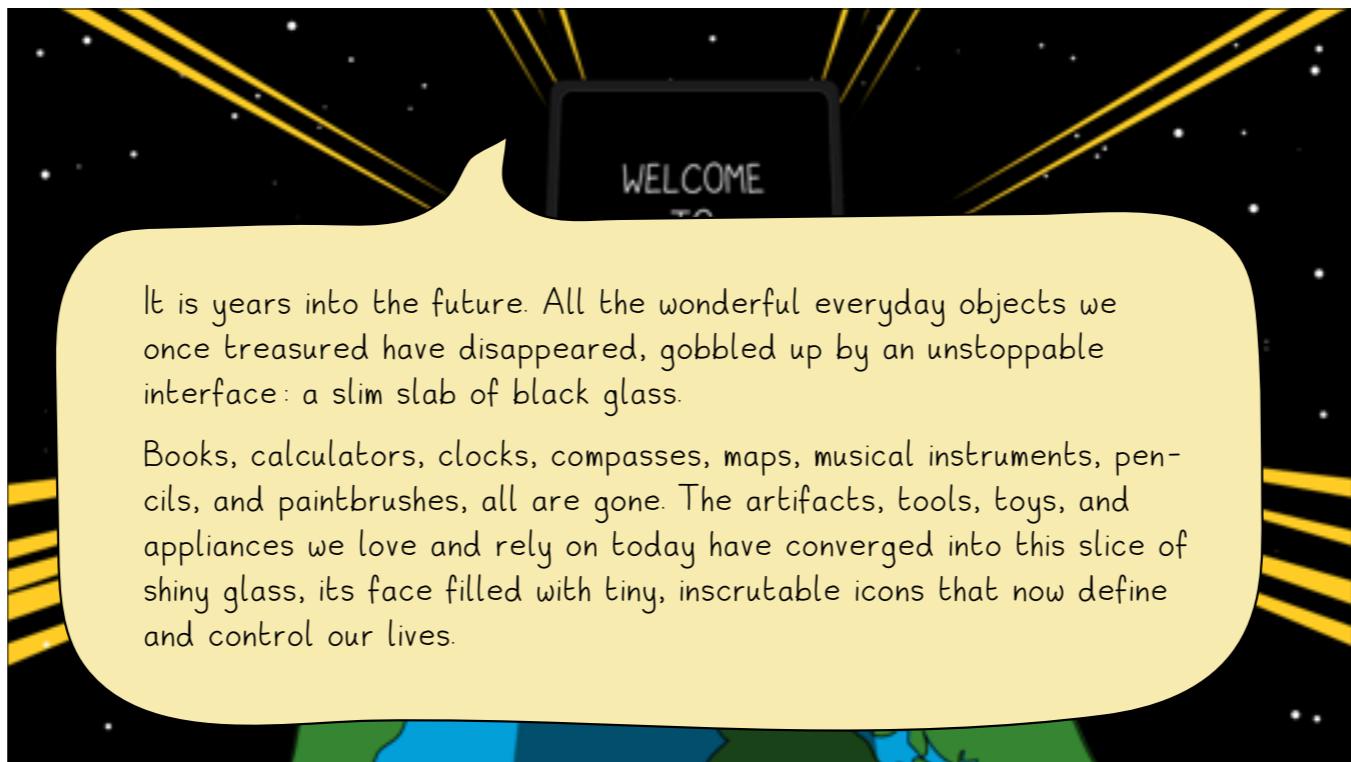
Tangible & Embodied  
Computing

The ‘thing in itself’

To summarize again, they would probably argue that the future is in creating new models that provide physical ways to manipulate information, and—more relevant to our discussion today—ways in which physical objects can be enhanced or ‘enriched’ with computation and the internet.

At one level the argument is that the interfaces we have today - particularly the windows metaphors on laptop or desktop computers, or the touchscreens of our phones - are too abstracted and separate from the world around us and the ways in which human beings understand that world.

Let me give you an example - David Rose in his book “Enchanted Objects” talks about four visions of the future. The most awful one he describes is called (click)



"Terminal World" and its a world in which touchscreens and phones have asserted dominance, even displacing most other objects. He talks about it as his 'nightmare' as follows:

It is years into the future. All the wonderful everyday objects we once treasured have disappeared, gobbled up by an unstoppable interface: a slim slab of black glass. Books, calculators, clocks, compasses, maps, musical instruments, pencils and paintbrushes, all are gone. The artifacts, tools, toys and appliances we love and rely on today have converged into this slice of shiny glass, its face filled with tiny, inscrutable icons that now define and control our lives...



When he talks about this horror, I can't help but think about this video by Corning called 'A day made of glass', in which there's absolutely no escape from e-mail and in which everything—even the mirrors by your toilet—are ready to be touched and smeared and prodded by people's gross little post-pooping fingers... This is a diversion though, because, let's be honest, how often do people go and fit out their kitchens and bathrooms from scratch? Sometimes it's amazing how much the future looks like things that you can quite easily build in After Effects...



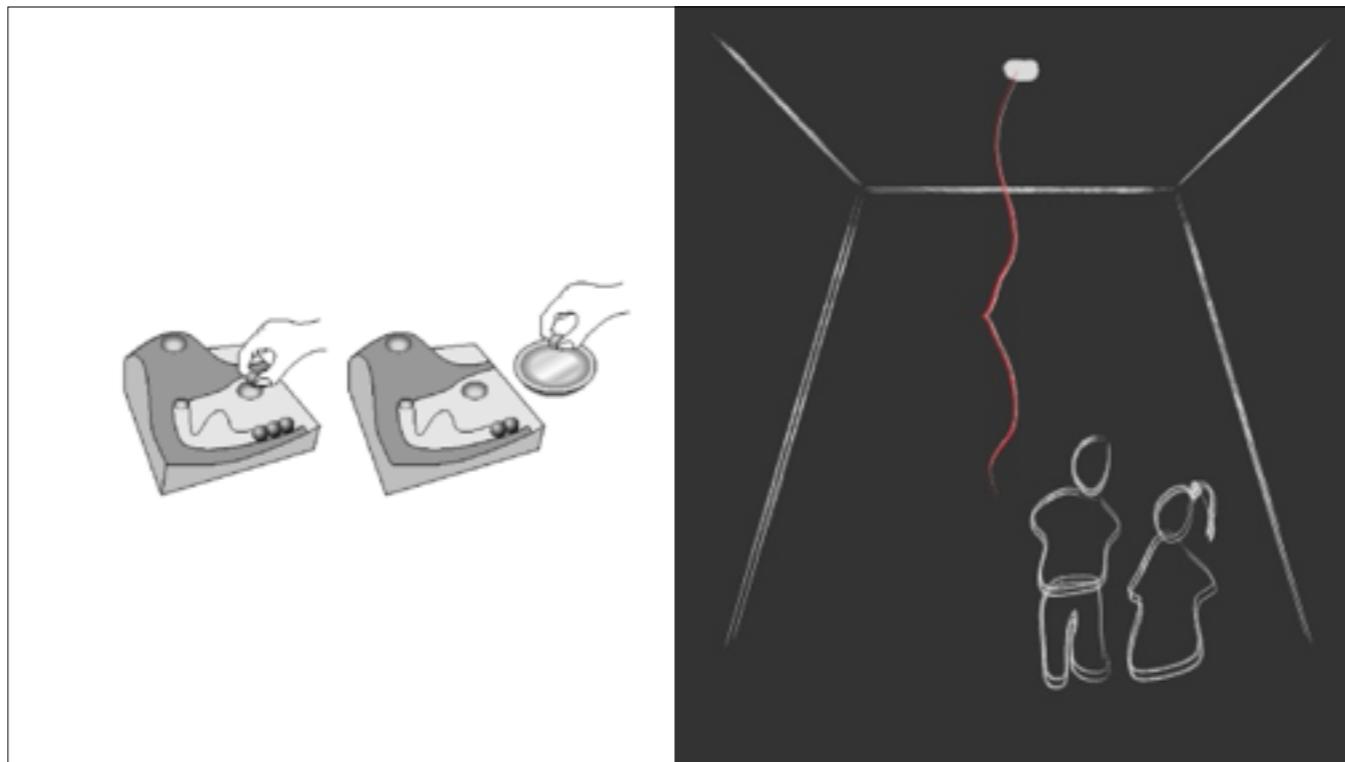
Anyway, I'm getting ahead of myself. Back to David Rose and (click) his pathological fear of telephones. (click). Unsurprisingly, David doesn't want phones to eat his children, and so he presents an alternative view that he calls 'Enchanted Objects'. He describes it as 'technology that atomizes, combining with the objects that make up the very fabric of daily living' and the examples he provides are really lovely.



One particular example he worked on himself is the Glowcaps system, which beeps and flashes with increasing urgency if you forget to take your pills on any given day. And he talks about many others, including Nest Thermostats that predict your temperature needs, umbrellas with lights upon them that signal up when it's going to rain that day and many more. These are genuinely useful and interesting things and there genuinely are more of them every day coming into the world. The Glowcaps alone have a huge impact on people whose drug regimens have to be strictly adhered to to have the desired effect. They bring information from the network to inform you how and when to interact with the physical world around you.



The metaphor here, as I've said, is 'enchantment' - magical interactions - bringing the intelligence into the object itself as you would with an ancient sword, rather than believing in the presence of a separate, service layer. And that can mean both the object reacting physically in some way to context or data in the cloud, or even more it can reflect a tactile or physical interface, where you can manipulate the object in some way to edit something in the parallel world of the internet.



Leaping back in time quite a long way for a moment for illustrative purposes, here are two classic examples from the early nineties of the blurring of the physical and the digital - bringing the virtual representation and the real object so close that they become one definite thing.

On the left we have Durrell Bishop's answering machine. This pumps out a little marble when you have a message, and you place the marble on a sensor tray to play it back. Natalie Jeremijenko's dangling string simply indicates the amount of network traffic in a space by twitching a string in a room, giving people an ambient awareness of activity.

I bring these up because they are classics of the field - almost foundations of the field - of tangible computing and were first to articulate some of these goals that we've talked about so far..

### The Stages of Human Experience of Interaction with Computers

Electrical	Directly manipulate circuits
Symbolic	Abstraction to Machine Code or Assembly Language
Textual	Writing programs, interacting with DOS-like interfaces
Graphical	Icons, Windows, Touchscreens, Use of Space
Tangible	The physical manipulation of data, using 'natural' affordances

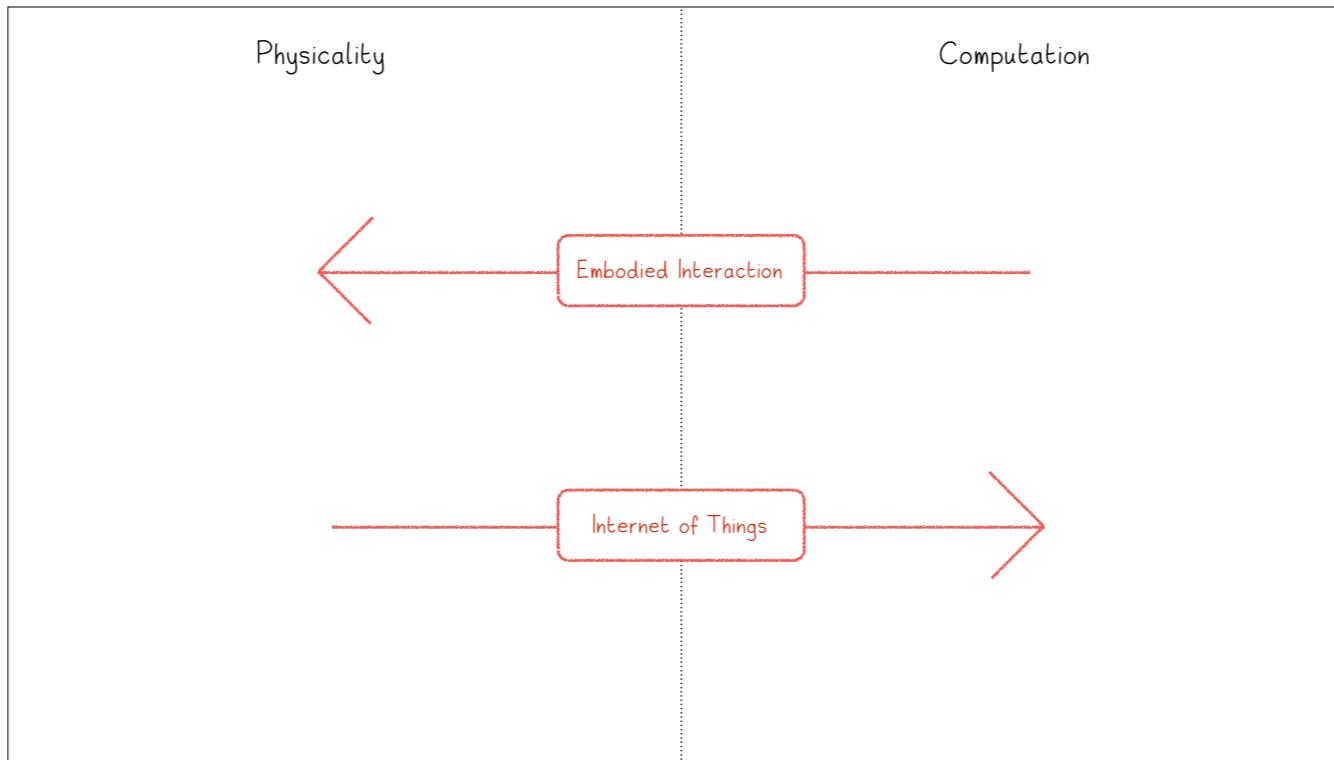
Paul Dourish, in fact, went a step further in his seminal book 'Where the Action is' around 2001, suggesting not just that things would be better if the physical and the digital were closer together but that such a path was effectively inevitable and natural.

He framing our interactions with technology as a series of approaches that build one upon the other, each employing a skillset that more closely reflects how human beings understand and instinctively interact with the world.

And it certainly does seem like there continues to be a lot of ways in which more tangible interactions with enchanted objects could provide a lot of power in the world. It's clear we'll see a lot more of this kind of approach - the focusing on the invisibility of the technology, dissolving in the use of the object. It promises a certain seamlessness of interaction.



But is it the ultimate answer to how we interact with a world of connected objects? There's a desire in this direction to try and make every object self-explanatory, self-evident, complete and seamless. And that seems like a flawed enterprise to me and it seems to miss where quite a lot of the power of connected objects might be... And also, if I'm honest, I think it's a misrepresentation of the ideas of these people...



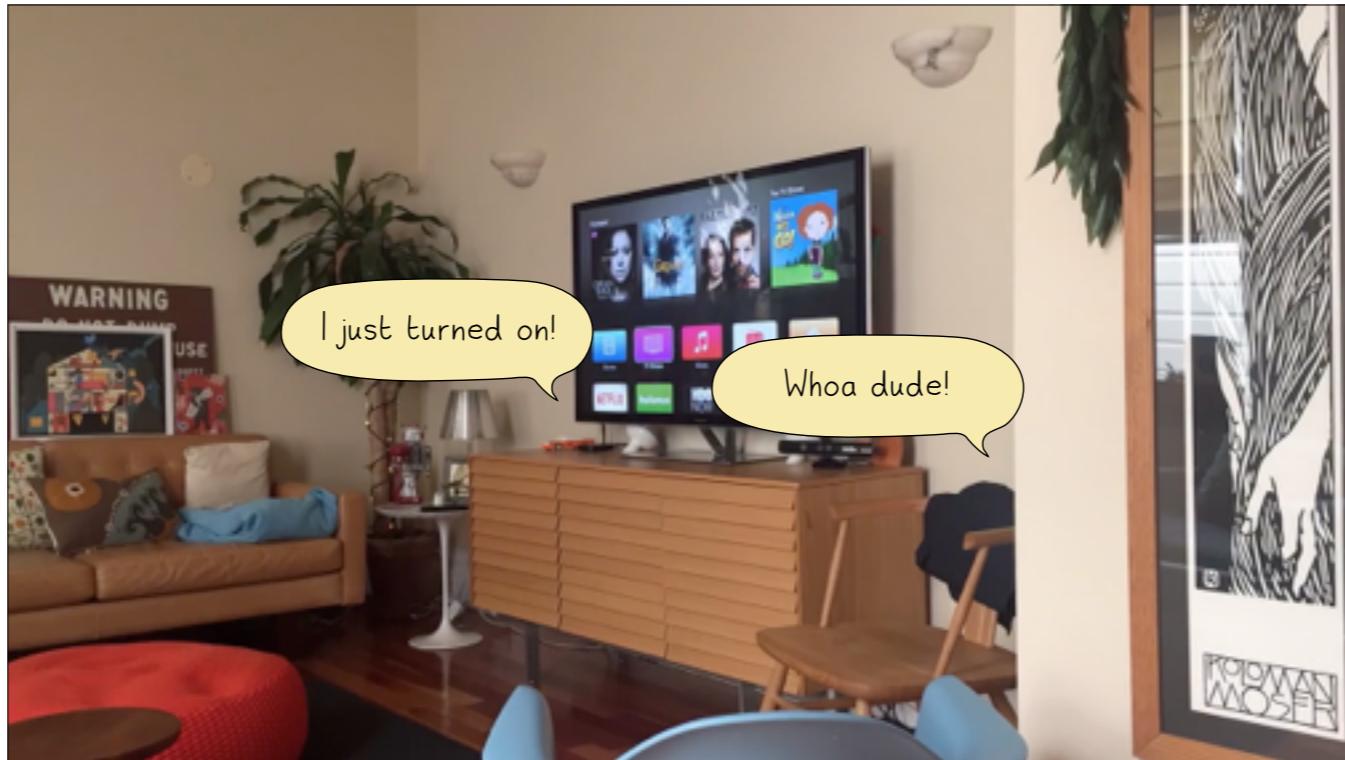
In the first place, I think there's a bit of a category mistake going on here. For Hiroshi Ishii and Paul Dourish, for example, the work they're doing is more concerned with using physical interfaces to manipulate data, rather than bringing computation into devices. Their focus seems generally in making the manipulation of digital objects more intuitive by bringing it into the physical, a space that we have dedicated millions of years of evolution to understanding intuitively.

The internet of things, however, is much more about enhancing the physical with the digital, making the objects make more sense at a distance, or drawing out information from them and bringing it into a virtual space where we can do stuff with it.

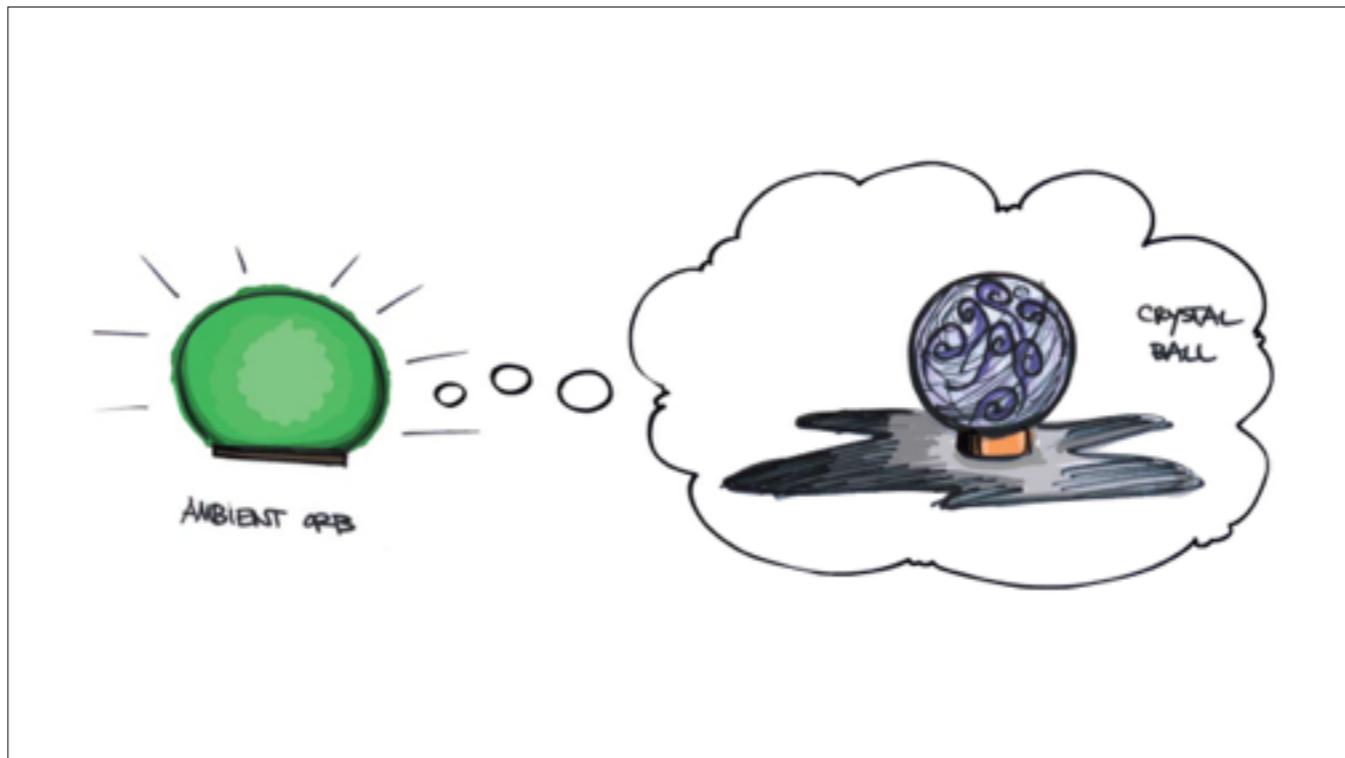
In some ways, you might argue that the fact that the two merge the physical and the digital is a coincidence - and that in all the ways that count, they are actually opposites of one another.



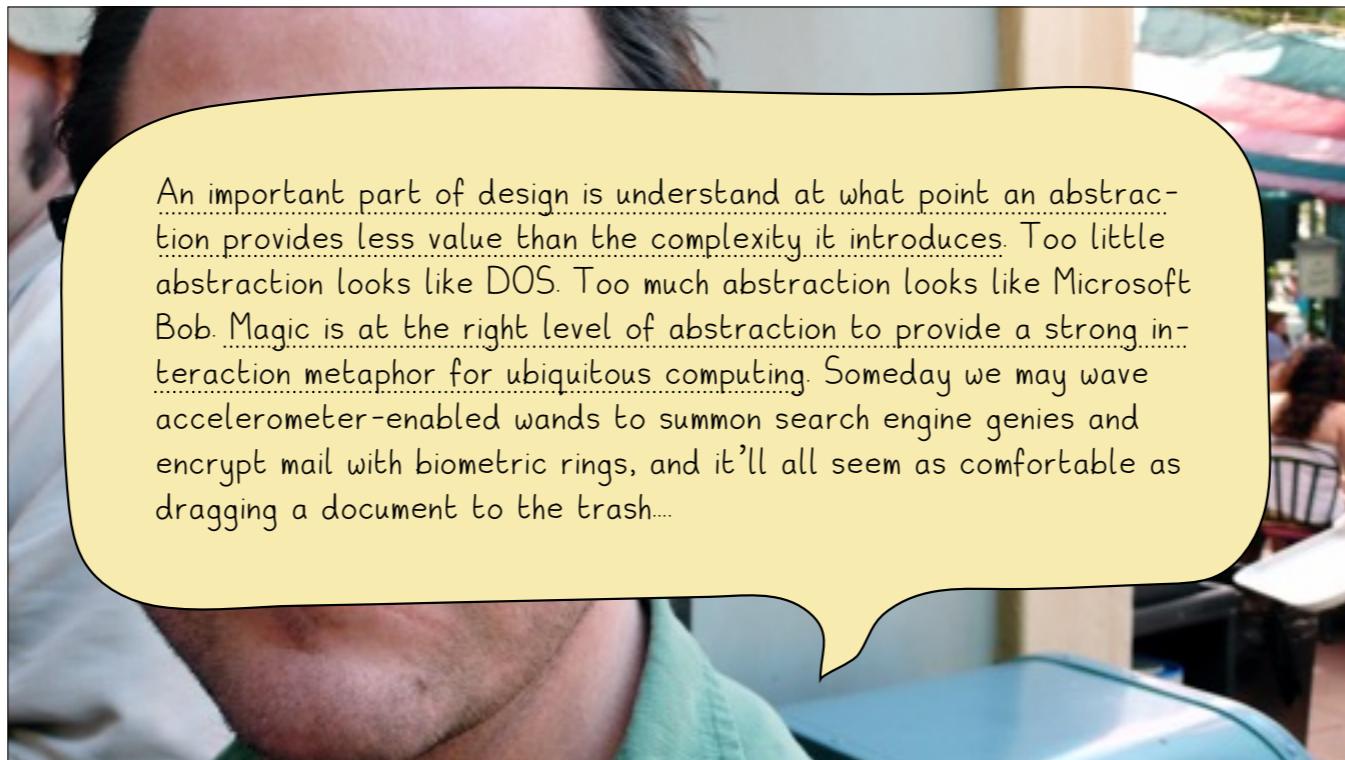
The second thing I'd say is that those thinkers particularly concerned with embodied interaction are often very focused on context of use, the environment surrounding the object and the abstract information about who owns it, who can use it, what information the object needs in order to be able to do its job most effectively. Dourish is very focused on the environment around the things, Rose very focused in the services around the objects. I think it's a mistake to think that their focus on better objects means less focus on better service layers.



And of course the world is full of very different kinds of objects with very different kinds of expectations surrounding them. In this video of my home, the lights are smart objects but they almost don't make sense to talk of individually - they're part of a larger system - my environment when I'm at home. What is it specifically that I connect with or touch or interact with to make them act in the world? The objects are definitely acting independently, but it feels like there's something that connects them. Again, it feels like something that isn't situated in the object, it feels like a service layer of some kind - a lot of the power simply doesn't come from dragging the network down into the physical thing, but with embracing the network and the object as complementary parts of the same system... [potential reference to light pulls and light switches as service layers?]



Another problem I have with the merging of the object and service is how that manifests in apparently ‘Magical’ or ‘Enchanted’ interfaces. This feels like a minor point, but it sticks with me for some reason. I remember two pioneers of this field, Adam Greenfield and Mike Kuniavsky having a very specific argument about this ten years ago at the O'Reilly Emerging Technology conference - way way before its time, but increasingly relevant now. The debate was whether or not describing something as magical hid or concealed how the thing actually worked. Did it interfere with our mental models in such a way that it made the thing more abstracted from the day to day and therefore less easily comprehensible, actually \*less\* easy to understand... This sketch is from Mike Kuniavsky in 2007, drawing analogies between an Ambient Orb available at the time and a Crystal Ball. He said at the time...

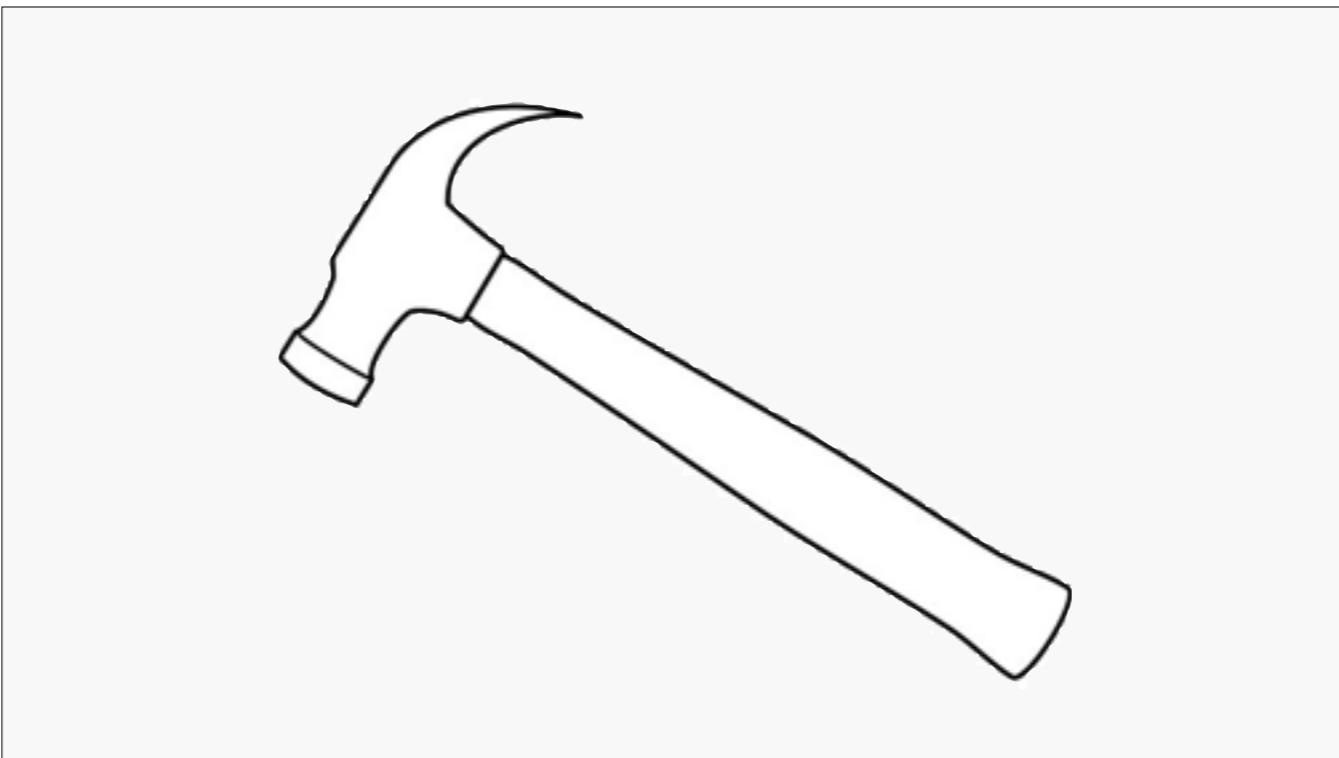


An important part of design is understand at what point an abstraction provides less value than the complexity it introduces. Too little abstraction looks like DOS. Too much abstraction looks like Microsoft Bob. Magic is at the right level of abstraction to provide a strong interaction metaphor for ubiquitous computing. Someday we may wave accelerometer-enabled wands to summon search engine genies and encrypt mail with biometric rings, and it'll all seem as comfortable as dragging a document to the trash....

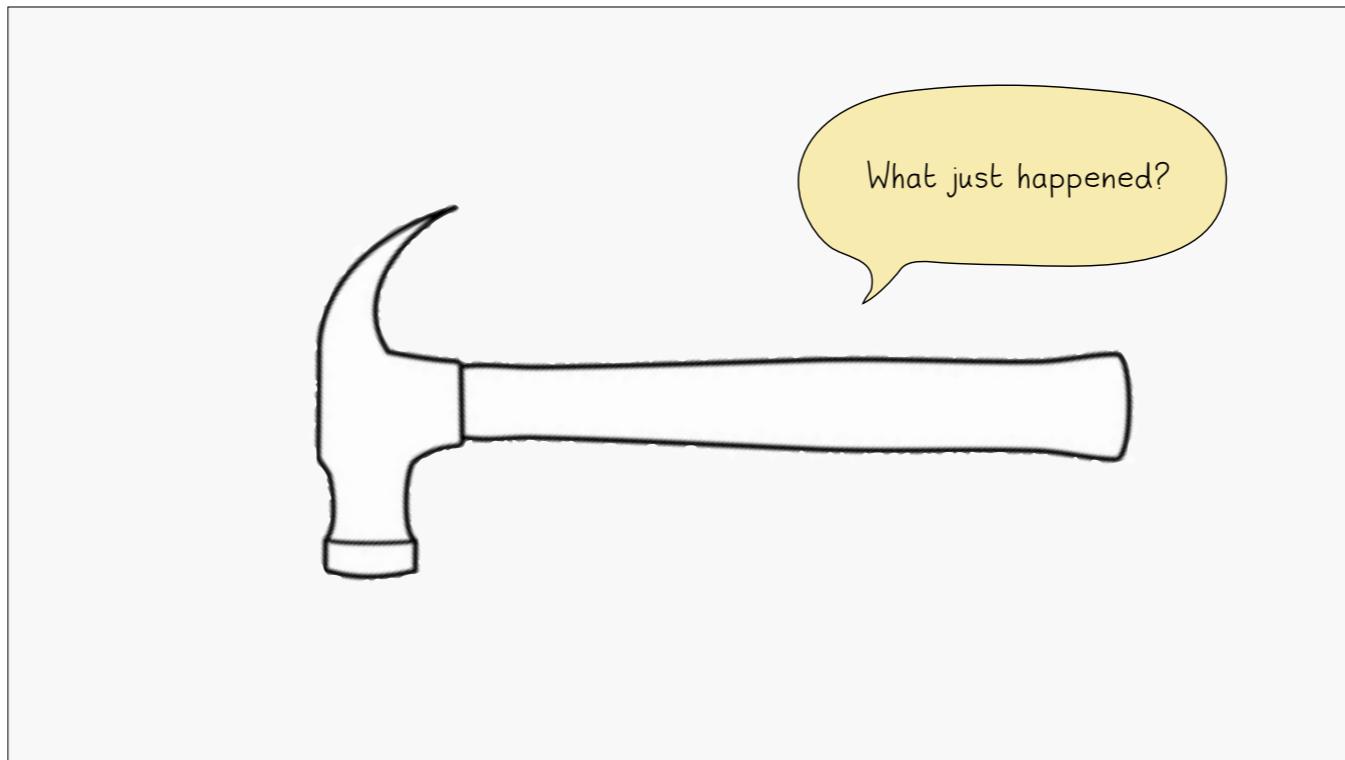
“An important part of design is understand at what point an abstraction provides less value than the complexity it introduces.

Magic is at the right level of abstraction to provide a strong interaction metaphor for ubiquitous computing. Someday we may wave accelerometer-enabled wands to summon search engine genies and encrypt mail with biometric rings, and it'll all seem as comfortable as dragging a document to the trash.”

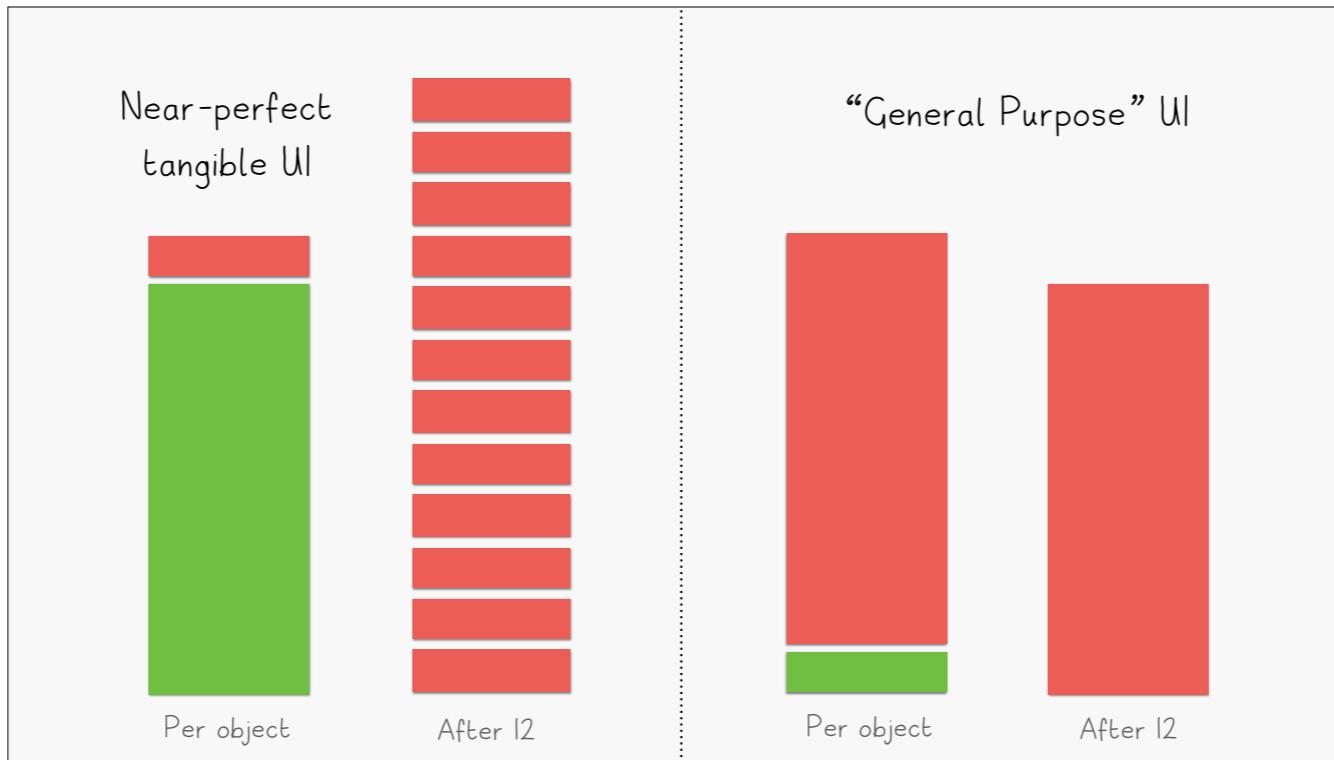
Now I know and love Mike, and I find it hard to disagree with anything specific he says here, but something about it just skeeves me out... To me, introducing magic into the world like this as an overt metaphor is obfuscatory - maybe even patronising.



But honestly, I think fundamentally, the biggest problem I have with the idea of merging the object and the service is this assumption that physical interfaces are inherently more intuitive than abstracted ones — that physical \*affordances\* alone will make it immediately obvious what a smart connected object is \*for\*. You pick up a hammer and you immediately want to hit something (or maybe that's just me) - but is that true of a smart hammer? Or whatever the equivalent would be... That seems to me to also be dubious - for every good product that makes more sense when embodied or made tangible, it seems another is likely to pick up some strange magical interaction metaphors that are less intuitive, or even counter intuitive.



With tangible interactions are we making things that are effortless, or are we simply creating a whole new vocabulary of interactions that people have to get their heads and hands around?



Perhaps the problem fundamentally is that in looking for the perfect, dedicated, specific interface for each thing in the world we make the first thing we use easier to understand but at the cost of having to learn each object anew.

Our cousins in computer engineering talk about General Purpose Computing - whereas as designers we're often tempted by the quest to find the ultimately specific interface for the thing in front of us. But each slightly different interface creates an extra cognitive load that when multiplied across every object in the world may be wildly less intuitive than a \*General Purpose Interface\* on a phone, or smart watch or computer whose abstracted rules we learn once and can then apply everywhere...

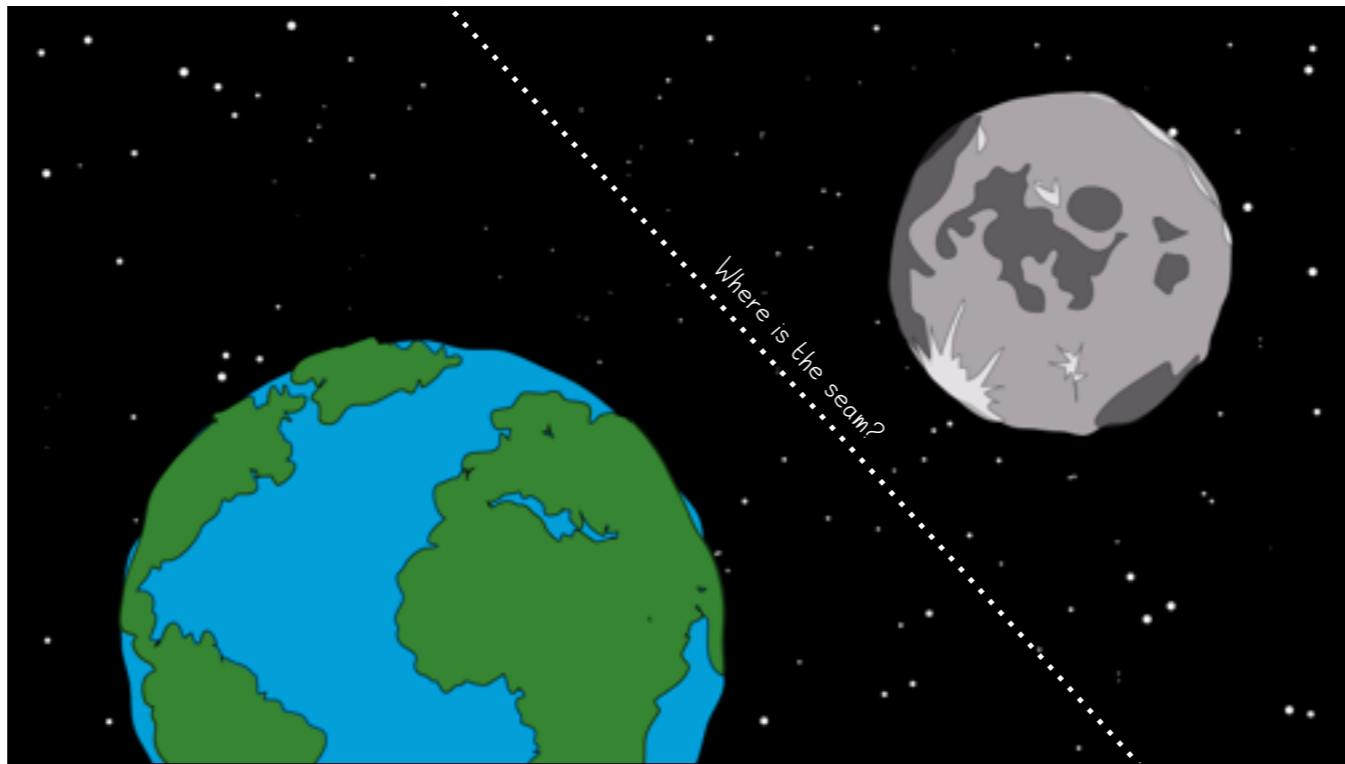


Okay, to summarize what I've touched on so far, while I think tangible computing and the merging of the service layer and the objects has potential and will - without doubt - happen more in the world and result in more interesting and powerful things...

... I'm much less convinced that it's the most significant interaction trend defining the future of connected objects, and how we'll interact with them.

In fact, I'd argue that it may be precisely the service layer - the part that sits in the cloud and manifests through phones or through the web or whatever - that is the place where the true innovation is happening, the true power is manifesting. (click)

In fact, I'd like to argue that the problem with the service layer is not that it's too large and too segregated from the things in themselves, but instead the opposite - that the problem is that it's too small.



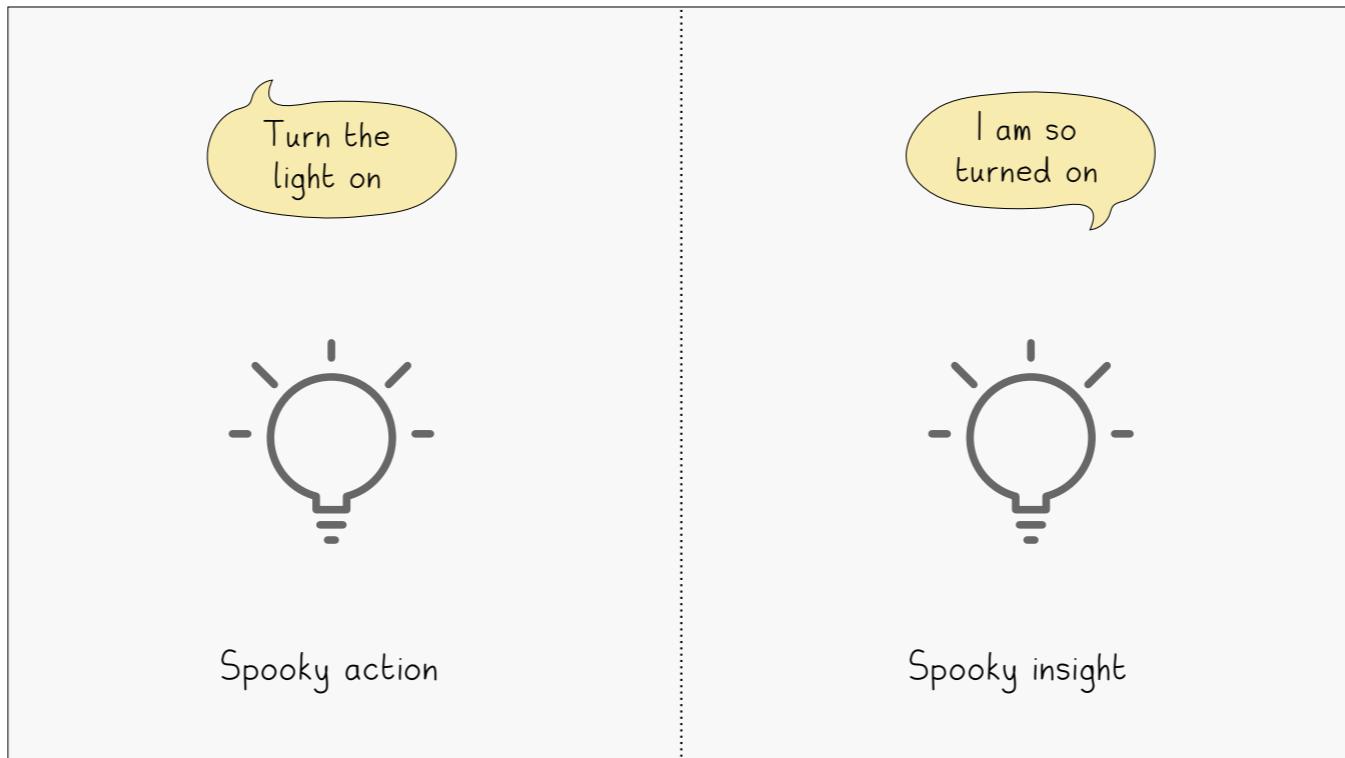
And that moreover, the future is not in bringing the service layer more and more closely into the object, but to clarify the relationship between the objects and the service layer - to use some of the jargon of our discipline, to move towards a **seamful**, overt relationship between the two.



Zipcar is an example of a service that I think expresses a lot of the benefits of a clear and distinct service layer. They make every car a part of the Internet of Things, albeit in a pretty limited way.

And yet the hardware of the car is no more or less than an RFID reader and a couple of switches, allowing the engine to start and the doors to unlock.

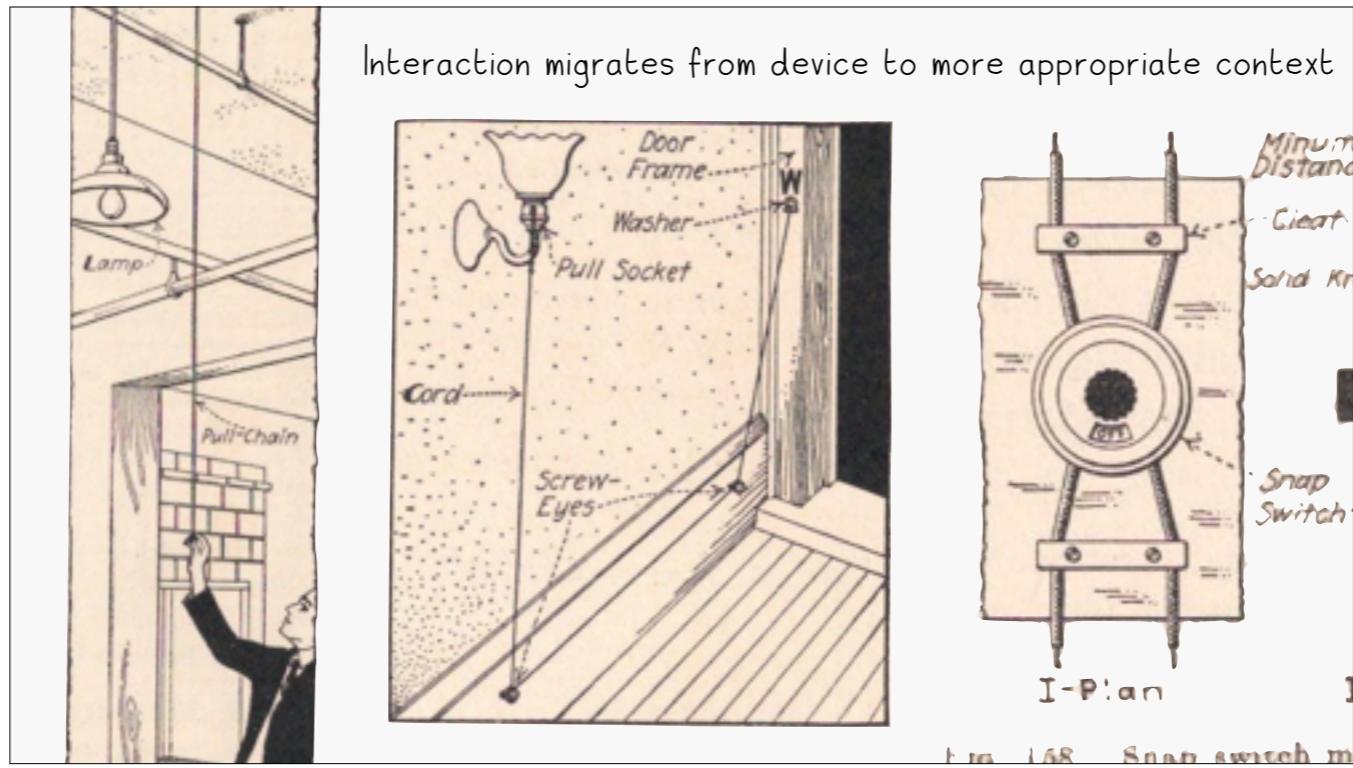
It's in the service layer that the value of this object truly lies - the context in which you book the car is probably different from where you'll pick it up, so you access the whole interaction on something else - probably a phone. And it brings in all those brilliant features of the internet that cars don't naturally have - an understanding of identity, payment, a sense of location, and from that interplay a beautiful and powerful service is born that makes thousands of cars in thousands of locations yours to spin up as a software engineer might spin up an EC2 instance.



Let's disaggregate that for a moment - first up you have what amounts to spooky action or spooky insight at a distance.

This seems ridiculously trivial - I can actuate or activate (click) something from far away, or find out the status of something from far away - but I would contend these simple functions are probably number 1 most important feature of the Internet of Things, and it entirely relies on the presence of some kind of totem, or surrogate, or sympathetic magic, or cosmic remote control service layer to happen.

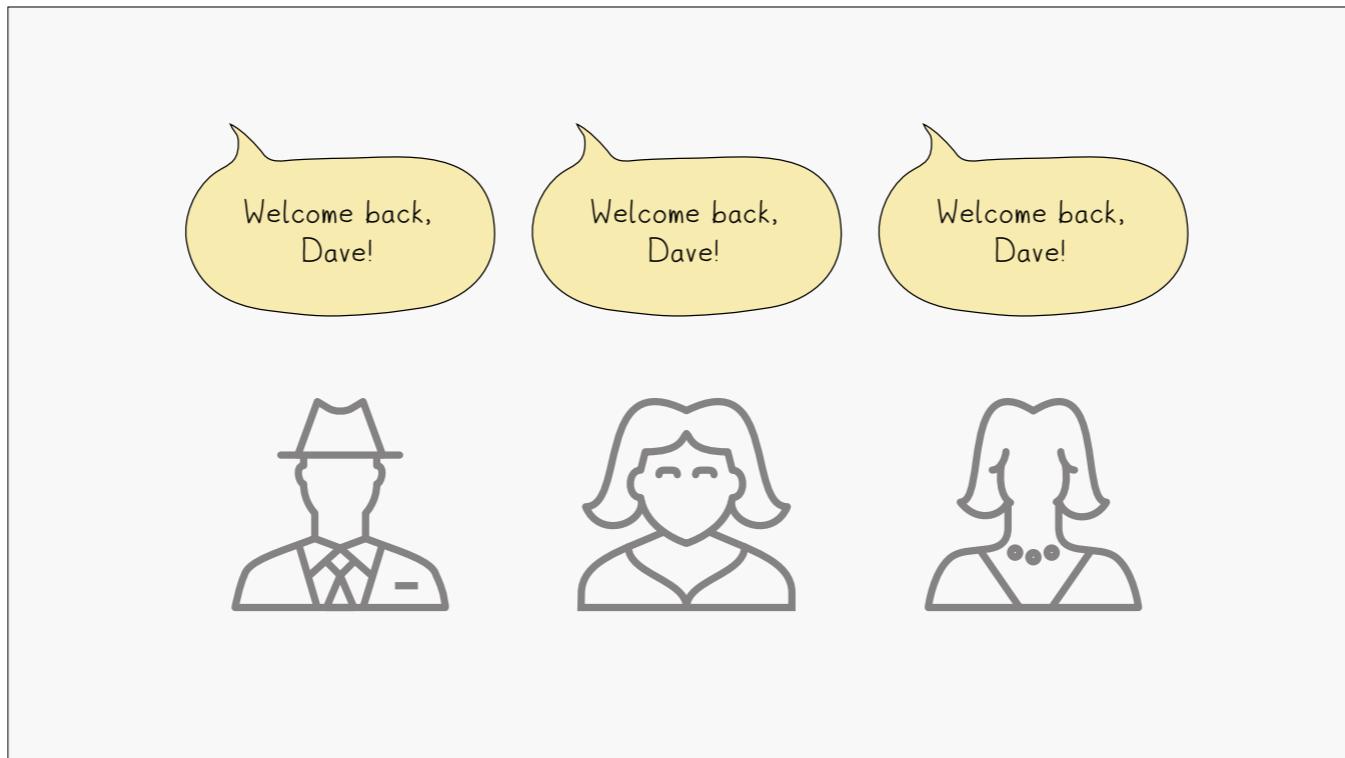
This is the home that tells you when something's wrong, or the parking structure that declares that it's full or the lights that turn on when you get home, or the machine that warns you when something needs replacing.



Interaction migrates from device to more appropriate context

By the way, if you think this is a new thing, what is this here except for an evolution of an idea of some kind of embodied interaction to something that more closely resembles a dissociated service layer producing action at a distance...

My business partner Matt Biddulph pointed this one out to me - Lighting started with controls directly next to the kerosene, oil or electricity light and gradually moved away from the object itself to the places they made most convenient sense - by the door that you walk in through.



A second feature that Zipcar does super well that I would argue belongs in a powerful service layer is their understanding of identity. For some reason this is something that is borderline invisible or totally lacking in almost all connected devices.

Let me give you an example. If you buy a nest thermostat first you install it in your home, then you create an account so that you and the thermostat are karmically connected. Then for every other person who lives in your house, or may come and visit and who you think might have to have some control over the temperature while they're there, you simply sign in as you on their phones too.

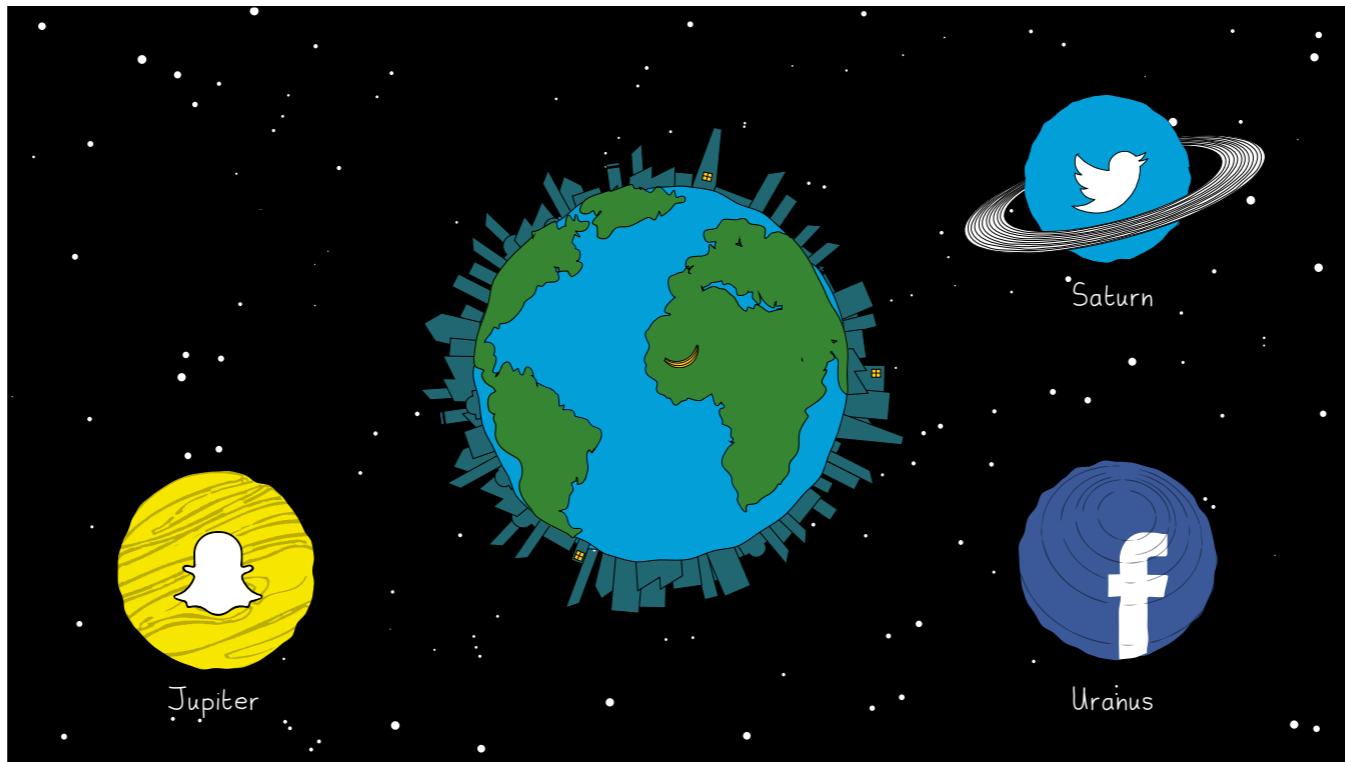
This, I might suggest, is CRAZY. (click) This makes it effectively impossible for it to react differently to different members of your family! It makes it impossible to know why a room is the temperature it is. It makes it possible for someone to come and stay at your house and then control the temperature in your house at long distance with you having little or no recourse.



If I sound ratty about this, it's because... (click) It has happened to me... (click) IF YOU'RE WATCHING THE VIDEO OF THIS TALK KNOW THAT I WILL NEVER FORGET, NEVER FORGIVE!!!



My point here, again, I guess is that our objects need a better sense of the context in which they live and work.



... and that the obvious place for this to happen is not in the physicality of the object but in the place that we mediate the rest of our social relationships - in the screen-based service layers of places like Facebook, Twitter, Snapchat and the like.

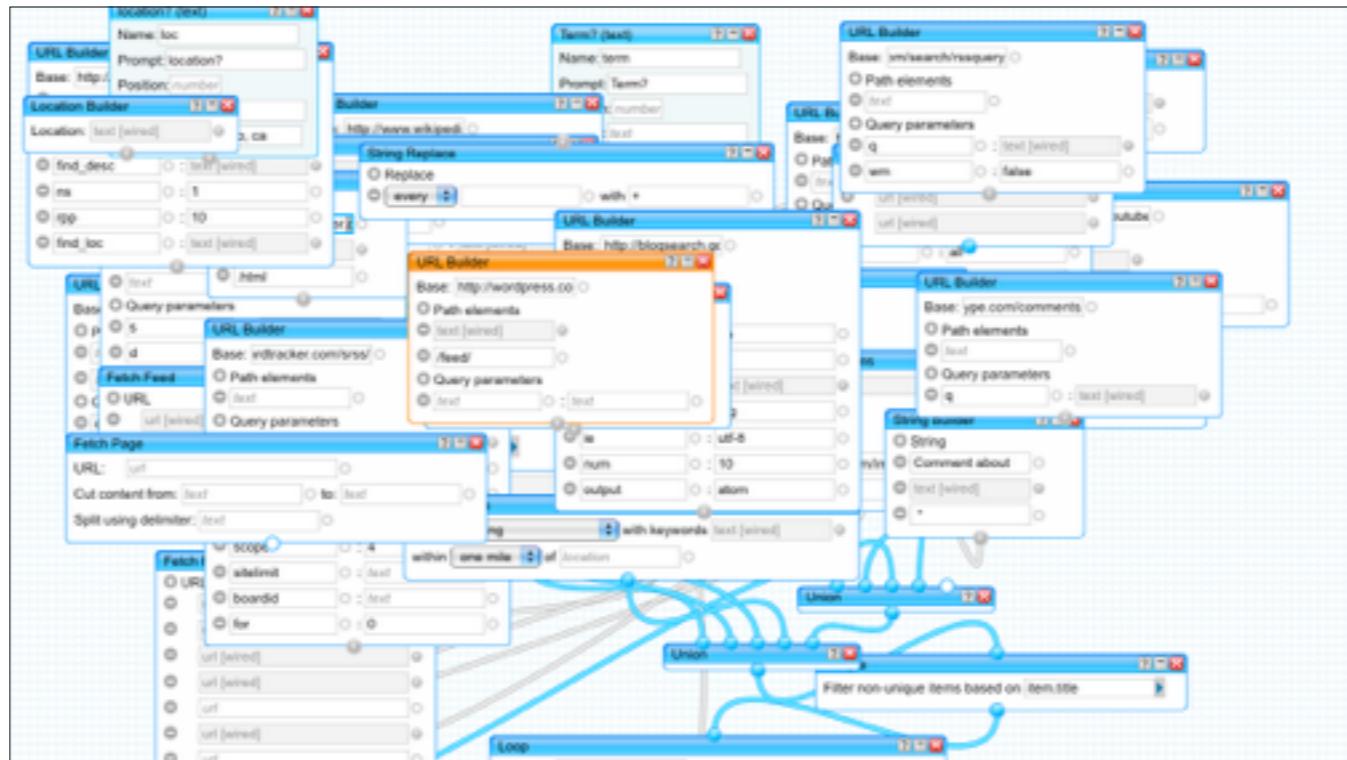
This by the way is something that the academics and designers we talked about earlier were well aware of - the importance of context, social and environmental, in the creation of powerful connected device ux was very much front of their minds. And this feels like something that should be part of any future service layer.

I think you know what the  
problem is just as well as I do



Another question we have to ask ourselves is about how we get the objects we live with to exhibit various forms of behaviour, reacting to things in our environment and doing stuff we find useful or pleasant.

This is an example of an attempt to make the service layer evaporate, or at least make it invisible - the nest is supposed to just learn how you live your life and make everything perfect for you by intuiting what to do next. I've interviewed dozens of people who have the nest and with only one exception they all turned its magical learning features off. It just wasn't doing the right things at the right time. It was making too many assumptions about their activities that were not immediately comprehensible by their users. So far, at least, that behaviour stuff doesn't seem to sit well in the object itself to any depth.



But this is a problem that I cannot claim has been sufficiently solved by a good service layer. I'm not even sure 100% where we should be looking to solve this particular problem. This is Yahoo Pipes, an older version of the kind of interface that you can use to process information and construct rules. It's unfair to suggest that this is what the interfaces for the internet of things are currently like, but they're not that far off - IFTTT is, in effect, lots of micro-instances of this kind of interface, mostly operating independently of one another. Whether the future of behavior making is in the service or in the object, it can't look like this...



One possibility for building behavior—and this is a digression—might be to find some way to merge the rule-making with the machine learning around objects that are more communicative, personable, understandable. This is a model I've been playing with a bit in my own life which I'd like to allude to briefly. This is a bit of a digression, so bear with me...



A few years ago as one of the experiments that my business partner Matt and I did to try and work out what to build for our start-up, I created a Twitter account called “House of Coates”. It’s a twitter account essentially narrativizes my house - using various off the shelf products and free online services to string together a story of what switches are pressed, what the temperature is, when I’m there or not, when there’s motion etc. etc.

After a little while I found myself really enjoying my little house talking to me on the internet. It weirdly felt like it helped me form a relationship with the building - a place that would normally be mute and distant (but which shielded me from the elements) suddenly had a voice that would let me know if something had gone wrong. I really liked that. And it turned out that a thousand or so other people liked it too. Soon it had a number of followers on Twitter some of whom would reply to things that it said...



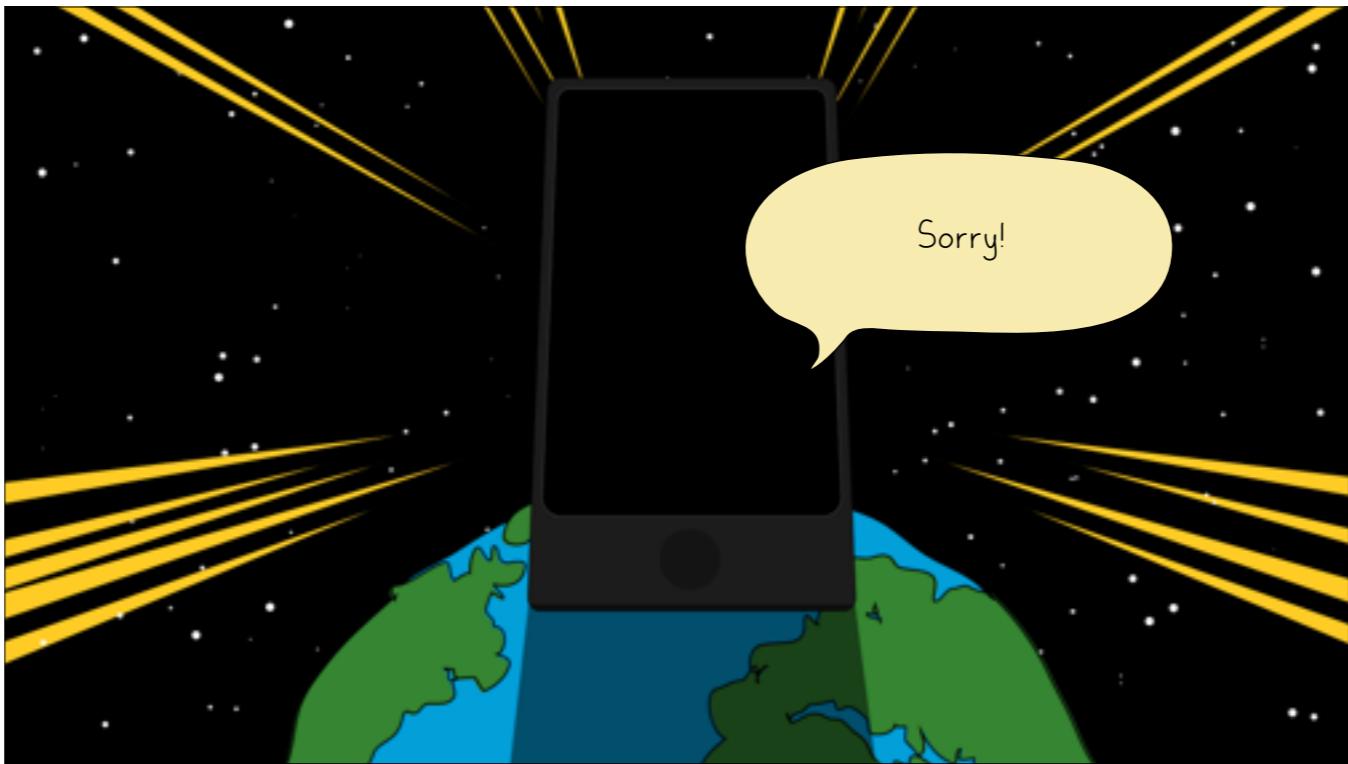
Much to my surprise, the idea took off a bit, with articles in MIT Tech Review, London's Metro newspaper, the New York Times, a TV interview for a Chinese broadcaster, a full day of filming with CNBC for their TV show 'Rise of the Machines' and much, much more...

Given that it was a bit of a small, side project, and probably not what I was most keen to be remembered for after my death I was a bit reticent but my business partner reminded me that we were going to have to get some funding at SOME point and some press wouldn't hurt...



I have to admit to being a bit embarrassed by the whole thing. Initially I thought they'd be pretty scathing and dismissive - fat, beardy man in San Francisco talks to his house over Twitter could make a pretty bizarre story. But on the whole a lot of people really understood the heart of the project - the connection, the communication with the devices, the sense that it implies of how you might interact with them.

This is, by the way, is an illustration about my tiny tweeting house as published in Wired and it's the illustration that I've based many of the other illustrations in this talk upon. I love this picture - I have it framed in my house for ultimate Inception-like recursive cool points.



I think a lot of this is because the devices are currently totally inscrutable -and when a thing starts doing stuff you don't understand you start trying to negotiate or shout at it, reason with it like it was a person. We've all done it. We all sit there swearing at our phone when it's not working going "WHY ARE YOU DOING THAT. STOP DOING THAT." [CLICK] We all attribute malice to our devices when they won't work, we negotiate with our cars when they're playing up - "If you just get me to the office I'll get you a nice car wash and a full tank of petrol..."

We don't do it for a bulb that fails. When they break they've just broken. When a car breaks down though it's doing it on purpose because it hates us. I find that interesting.

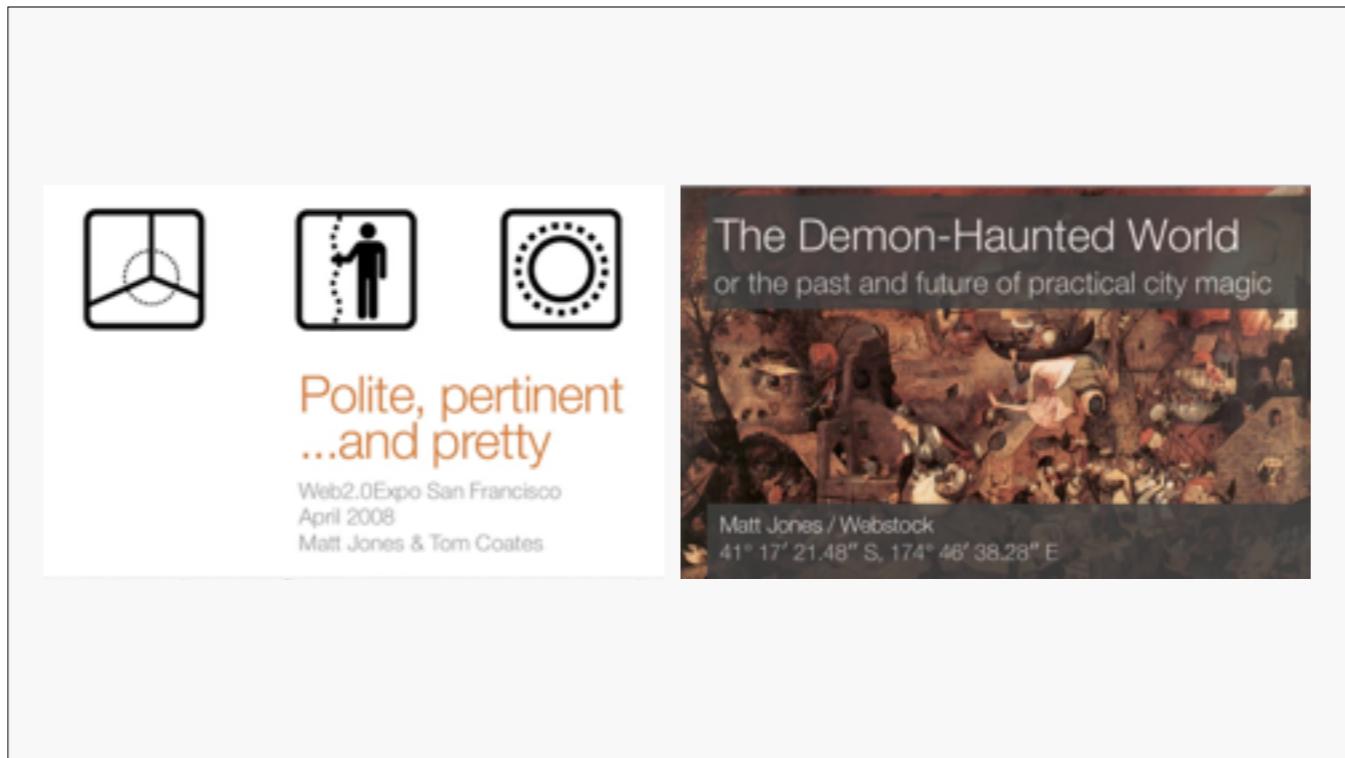
[\*\*animism\*\*](#)

1. the attribution of a soul to plants, inanimate objects, and natural phenomena.
2. the belief in a supernatural power that organizes and animates the material universe.

[\*\*the pathetic fallacy\*\*](#)

1. the attribution of human feelings and responses to inanimate things or animals, especially in art and literature.

In a longer talk, I'd delve into this a bit more - two very human attributes animism and the Pathetic Fallacy... and talk about why people do this and whether it's a thing we could tap into more to make this new world more comprehensible again,



And if you are interested in this area, I can suggest looking online for a talk I did with Matt Jones called Polite, Pertinent and Pretty, and another that's pure Jones called The Demon-Haunted World that I can highly recommend.

But I think for now it's best just to say that I think there's something here that may skirt around the edges of enchanted objects, but could actually be the foundation of something more useful. Either way, though, it again feels like it's an interaction that exists in parallel with the object, alongside it, near it, in a service layer.



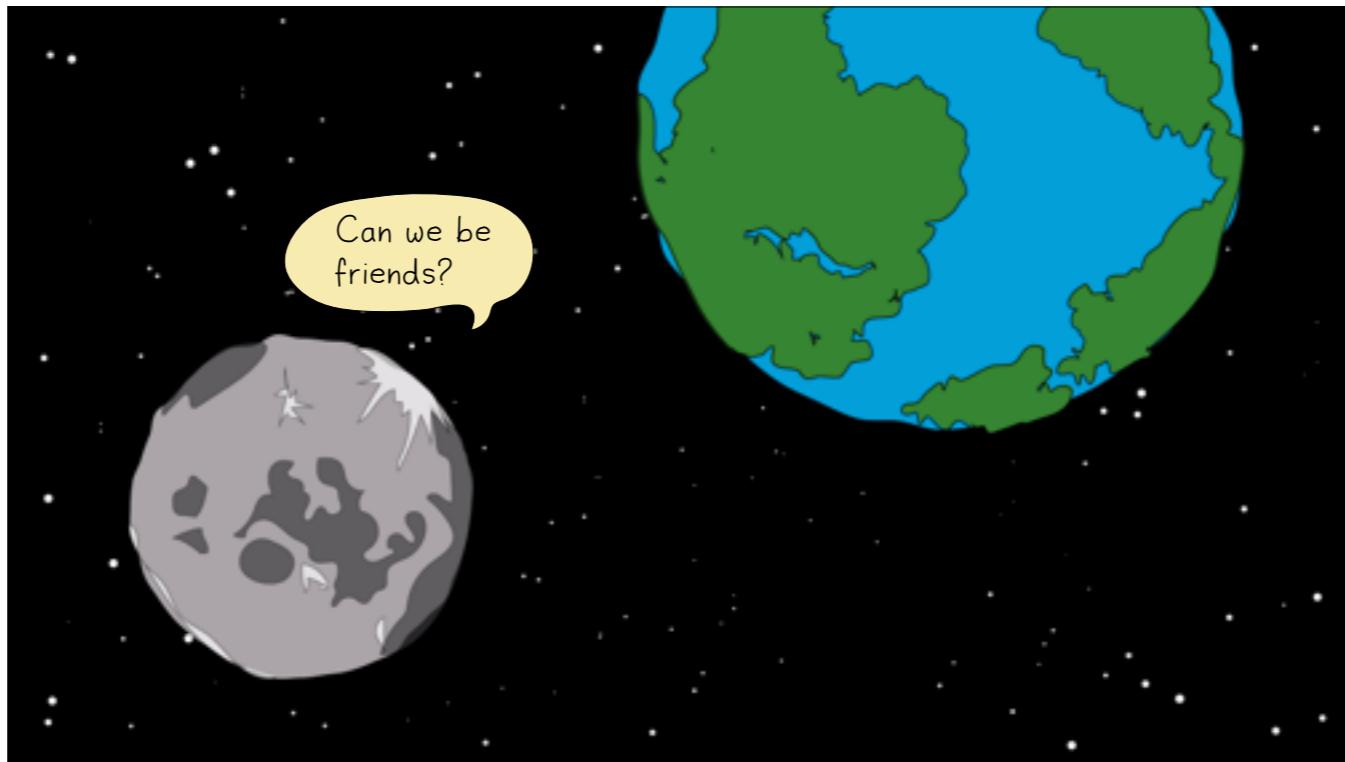
Although while we're on the subject I have to just stick this in too - This is a staple of science fiction - walking into a room and saying 'lights' and the lights knowing that you were referring to them in that instant and then which lights they should actually turn on and to what luminosity. So many of these interaction paradigms that seem effortless in movies sort of fall apart when you start to consider what the user would have to do in order in preparation to make them seem effortless - training devices about how you naturally like things, but in a way that they don't get confused when you have a friend staying on the sofa, or when someone in the room accidentally uses a key word in conversation.



It also seems likely to me that voice control would feel very rude and strange in a social environment. I don't know if it's just because I'm English, but shouting out into the ether a command for my environment is very definitely one thing when I'm alone, and a completely different one when there's someone else in the house that might think I'm talking to them, or be startled by my sudden shouting.

Voice control, on the whole seems to me to be something for spaces where you're alone and occupied with something else - which is possibly why Americans who commute by car are so keen on it as a concept...

And even then, again, they seem to need a lot of set-up to make them work - the service layer that becomes invisible or merged with the object seems to me, over and over again, to rely on screens behind the scenes, or a huge diminishment of the potential power of the thing itself.



Okay, so so far in this talk, I've gone through a few of the ways in which I think a focus on tangible interactions as the goal for IOT is an error, and I've also talked a bit about some of the things that should live in the service layer that often don't. And in the process, hopefully, I've managed to persuade you at least in part that the screen-based service layer isn't necessarily something to be overcome or got rid of, but something fundamental, a different context with different powers. An equal partner.



## Beautiful seams

What I've been advocating for, essentially is the idea two clearly distinct things, joined by beautiful seams. This is a concept that originated with Mark Weiser, which I encountered through Matt Jones. Can I ask how many of you are familiar with this idea?

The short version of it is that when we merge things into perfect seamless wholes we make endless decisions about what that thing *\*is\** or *\*is not\** about. If the thing we're making is simple enough to only really have one interaction, that's fine, but as we layer on more stuff, we can lose stuff. By making something seamless we plaster over the gaps in our model, rather than letting the user see and understand those gaps and work with them...

Rather than make something seamless, Weiser advocated making something *\*seamful\**, where things stood separate and clear next to one another, divided but effectively interoperating in such a way as to be understandable as separate entities but which work together perfectly. He described these boundaries as 'literally visible but effectively invisible'. That is a thing that seems to me to represent what we're trying to do here.

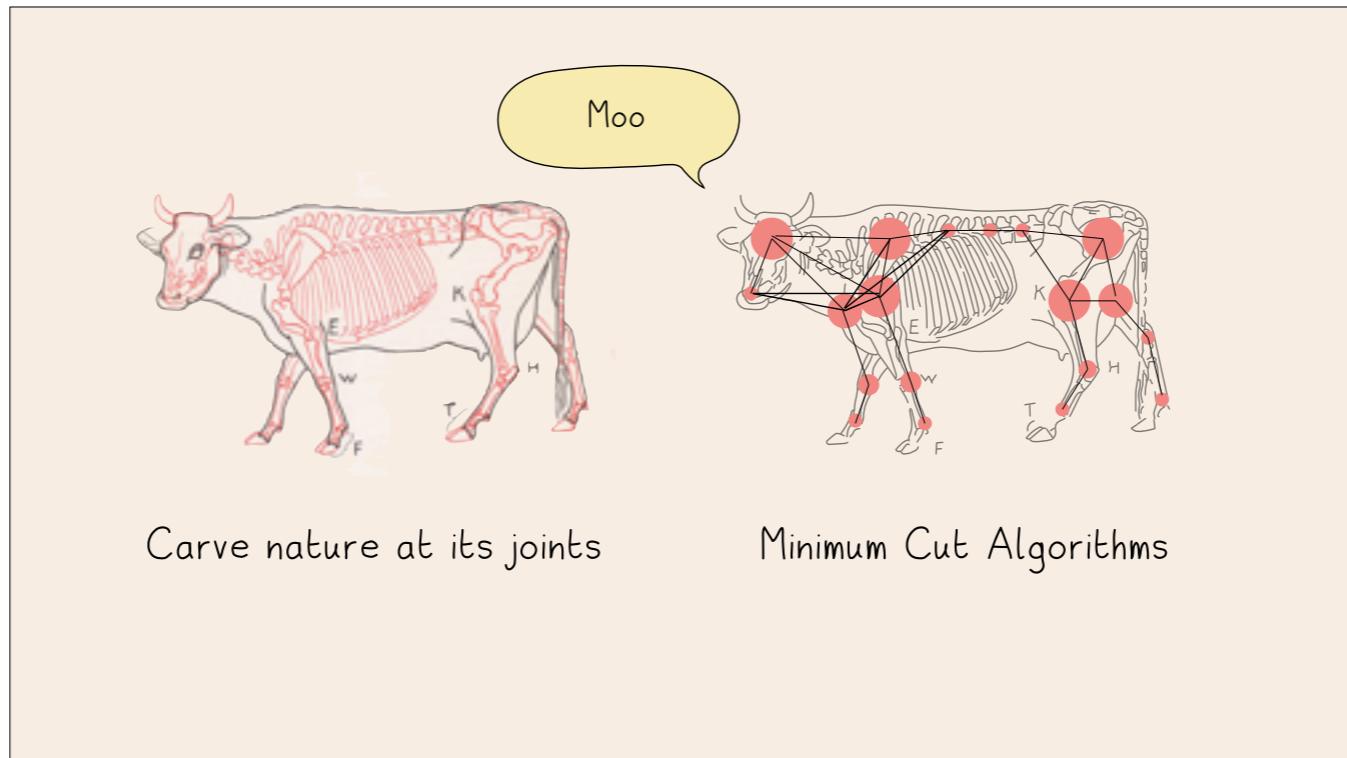


But this presents a new question - and the last of this talk - what features should end up in what place, on what side? What is object and what is service?

We've never had objects with such potent and flexible service layers before. When you seamfully graft the features of the internet together with the features of the physical device, what are the consequences - what's the best way for them to interrelate, and what features end up where?

I'm a designer and product guy fundamentally, and one process I've had to go through a number of times is feature clustering. It's like an old fashioned job that information architects and designers do to try and work out how a list of features and aspects of a thing naturally divide into sections.

What I'm showing you here is a gravity simulation of two galaxies smashing together. This is what that process can feel like. But the goal is to use the sort of conceptual gravity to find the natural places to put those seams. Some things will be obvious, others will not.



Let me put it another way - there's a phrase in Plato's Phaedrus about this, often written subsequently as 'carving nature at its joints'. It means that the best way to understand the right way to disaggregate a complex thing into simpler components is to look for the joins and connections and carve at those places.

There's a similar idea in modern graph theory called the Minimum Cut - which is where is the place in a network of relationships where you can cut it into with the smallest number of broken severed lines.

Again, a whole new set of abilities have appeared for objects in the world, and now we're trying to work out whether that keeps the objects as individual discreet objects, if they become part of a greater whole, or if they re-disaggregate into multiple things, possibly wildly differently than before...

τὸ πάλιν κατ' εἶδη δύνασθαι διατέμνειν κατ' ἄρθρα ἢ πέφυκεν, καὶ μὴ ἐπιχειρεῖν καταγνύναι μέρος μηδέν, κακοῦ μαγείρου τρόπῳ χρώμενον: ἀλλ' ὥσπερ ἄρτι τὰ λόγω τὸ μὲν ἄφρον τῆς διανοίας ἔν τι κοινῇ εἶδος ἐλαβέτην, ὥσπερ

That of dividing things again by classes, where the natural joints are, and not trying to break any part, after the manner of a bad carver. As our two discourses just now assumed one common principle, unreason, and then,

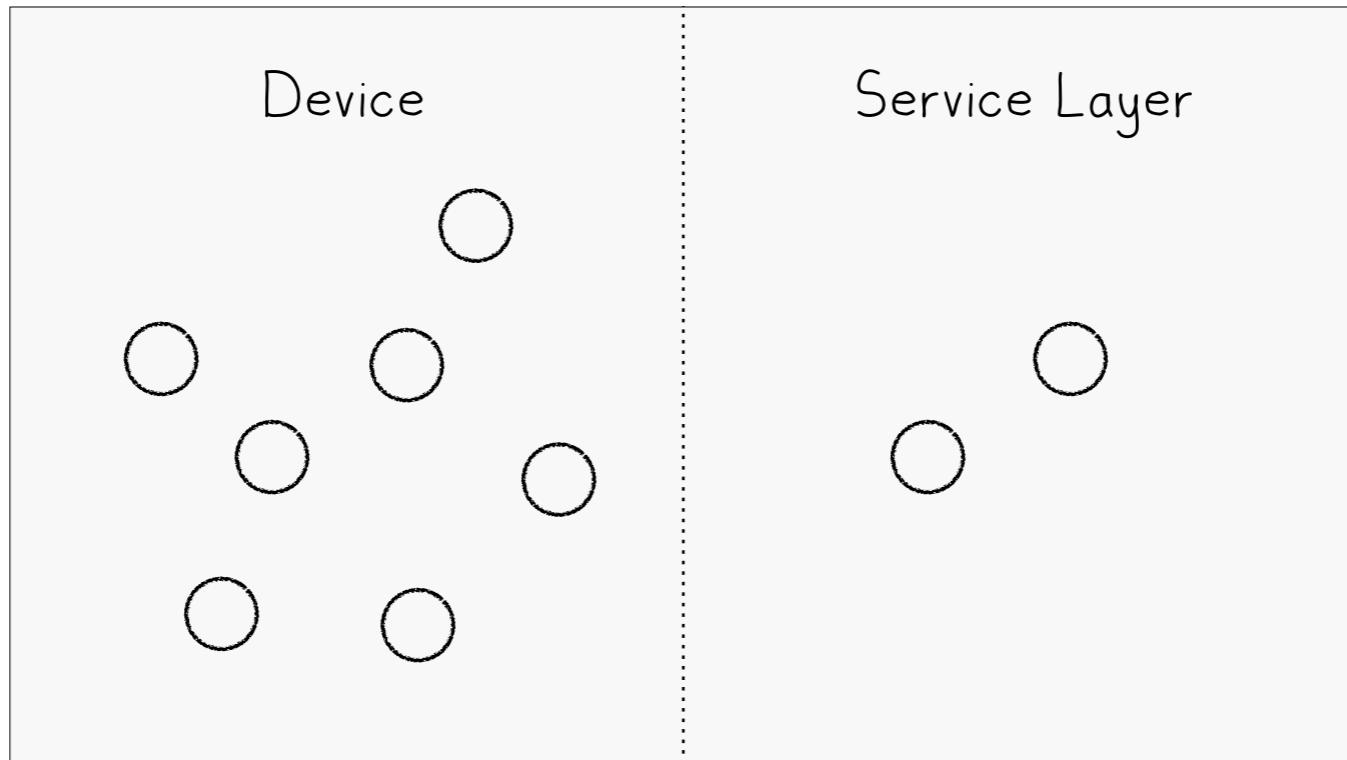


Specifically I want you guys to think about this as an opportunity to make the physical things we have in our worlds better, simpler and easier to understand. (click)

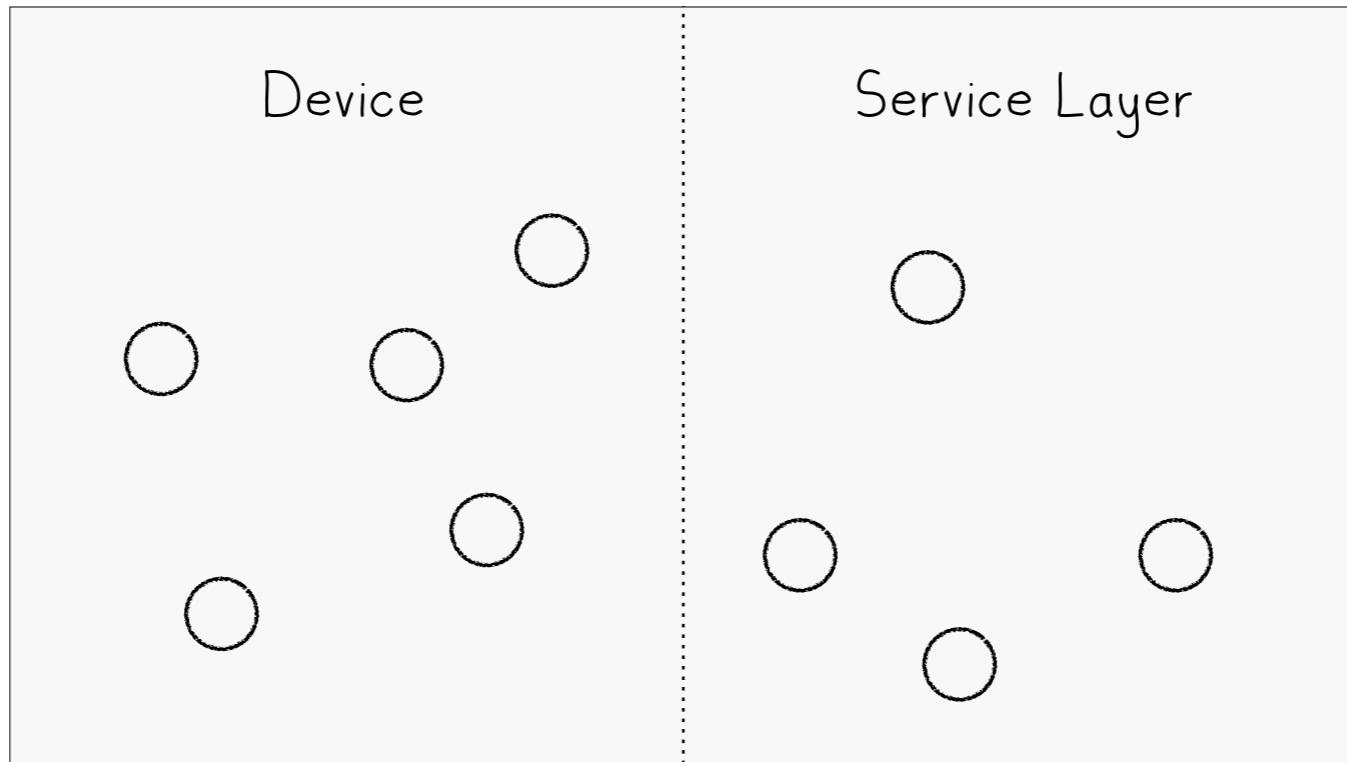
This is an actual Microwave that you can buy. Now in my experience most people use their microwave in the most trivial ways possible. They type in a time and maybe choose a power level and then press 'on'.

And yet once a year you discover that you bought some fish and it's frozen and people are coming around for dinner, or your christmas turkey has quite defrosted or you decide to do something really bizarrely weird.

And for all of these features, Microwaves have interminable racks of buttons or special features you access by pressing the 'magic button' 27 times while standing on one leg. And features that are borderline impossible to understand without the instructions, which you didn't keep because it's a bloody microwave. At least this microwave knows you won't use them - that's something I suppose, and so actually hides them behind the door. Of course what would be really useful for them is a UI space that isn't constrained, with scroll and search so someone could find exactly the programme that was right for them. A phone or secondary service layer would be the perfect place for features like that.



Essentially for the first time ever we're able to look at the features of a physical object, with all its buttons and controls and start to say to ourselves - maybe we could move that off the object.



This is a tremendously exciting time where what remains physical versus what is abstracted out into the service layer and what new power and value these new technologies can provide for our lives - it's all up for grabs.



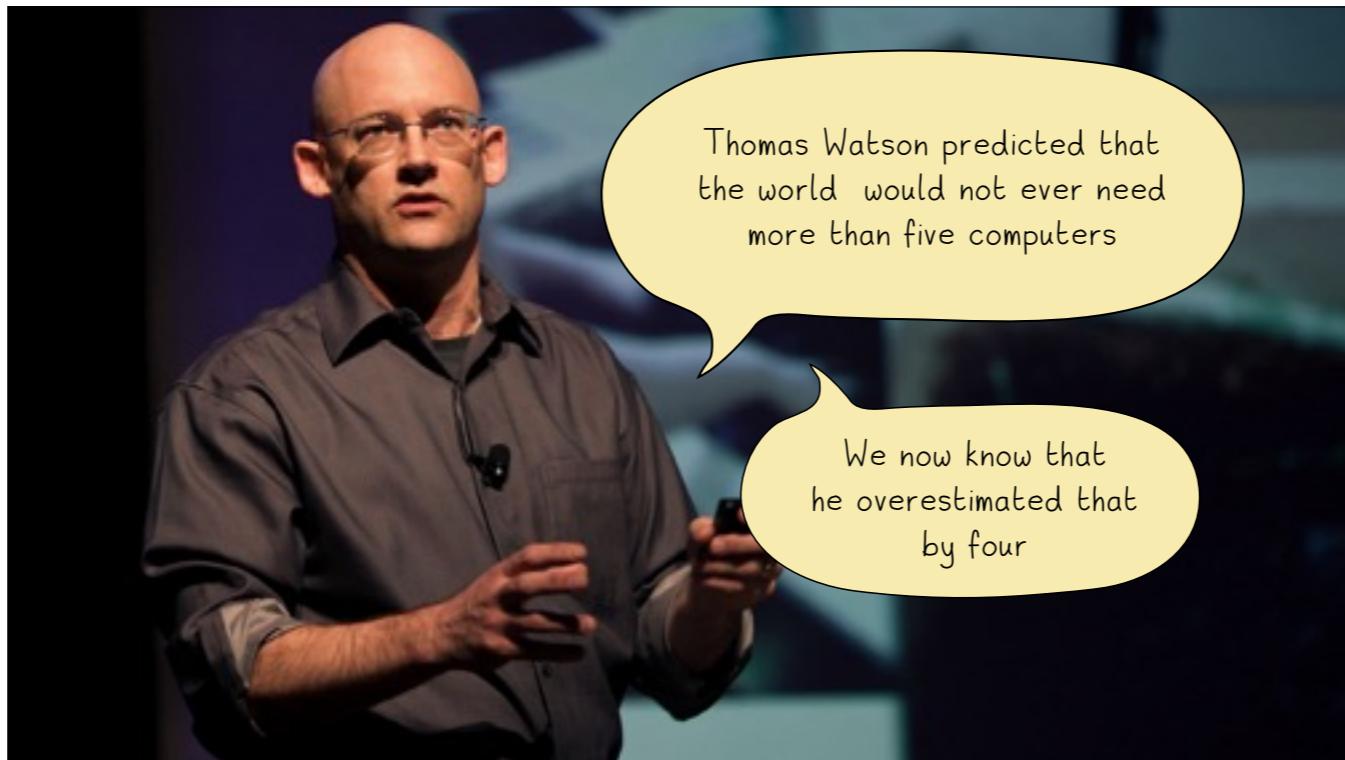
Okay - so that's my sense of the way these things are moving - in summary, I believe strongly that tangible interactions are far from the be all and end all of the internet of things, and in what we should be doing instead is thinking about shoring up the service layer, giving it more power and connecting it in a seamful way with the physicality of the thing itself. I also believe that this moment provides opportunities not just to enhance the physical objects with the digital, but to decide what stays physical and what is abstracted out into this higher layer.

But in the end whether you agree with me on the \*particular\* shape of the future - whether you think that it's the interplays between (a) service and object, (b) general purpose computing and tangible interfaces, (c) the physical and the digital — that will define our view of technology over the next few years - or whether ... you know (click) ... you don't, I hope you'll take one thing away with you today.

The design patterns and interactions for this future world are being formed right now, by people just like us, and they're going to have truly transformative effects on the world, perhaps encoding down into the very fibre of the environment around us ethics, belief systems, views on privacy and intrusiveness - perhaps we'll love them, perhaps not.



Hours / Weeks / Perhaps it was MONTHS ago, back at the beginning of this talk, I referred to the alleged misquote by Thomas Watson, the founder of IBM. I'm always reminded when I read this of Clay Shirky's response, referring to the internet...



Thomas Watson predicted that the world would not ever need more than five computers, he said.

We now know that he overestimated that by four...

To which I would add only add .. that every day, more and more, it's a computer we live inside...

So this is the time to get involved, to explore this space and find better patterns, better interactions, better models of how the future will work. This is the moment where we as designers can have the most impact, helping to define a User Experience, an ethical, powerful, transformative UX at quite literally a planetary scale. The world of tomorrow could be transformed for the better if we work to make it so, and I believe very strongly we have it in us to make it truly extraordinary. And that's all I have.

