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INTERVIEW

# Indoor Wayfinding: Interview with Christoph Hölscher and Ruth Conroy Dalton

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**Jakub Krukar**: *Both of you started your career in a slightly different field than the one in which you are now. Ruth, you have spent 10 years as a practicing architect; and Christoph, when I checked yesterday, your most cited paper on Google Scholar was still one from the field of human–computer interaction. Can you tell us a little bit about these earlier parts of your careers and what motivated your move to the field of wayfinding?*

**Christoph Hölscher**: In a sense I'm doing exactly what I've always been doing and in another sense I'm doing something very different. I moved into psychology because I was fascinated by cognitive processes. I was looking for an empirical way of how to address that—not knowing what 'empirical' was at that stage probably—and I was immediately interested in how people deal with complex surroundings. I didn't have that interest in architecture at that time and I was more interested in digital systems. And it very quickly became clear that a lot of the metaphors that are being used to describe digital systems come from the real world. That all the mechanisms that are being described in the human–computer interaction literature are heavily inspired by how people interact with real spaces and many of the activities that you have in the digital environment are very similar, right? You have to 'locate' yourself, you have to 'locate' objects, you have to make inferences, you have to make connections, you have to find 'a road' from A to B... all of those are metaphors but the underlying structure is quite similar; you have to make decisions, you have to memorise something, you have to bring to bear some kind of expertise. So all of these things reflect later in the work with architecture. To be quite honest I moved on from HCI [human–computer interaction] because I got quite bored with computers. I wanted to do something else and I was fascinated by the real world. Of course within a year or so I then discovered that any meaningful research 'on' the real world will require the computer again: for simulations, for virtual reality, for agent modelling and these kinds of elements.

**Ruth Conroy Dalton**: For me... yes I studied as an architect... and I think what drew me into the architecture originally was probably purely the creative side of things: I liked to design and I think I liked the idea of creating things that had an influence on people's lives. But as I trained I became far more aware that I had a very personal, emotional response to the built environment around me. So then you start to become aware, as an architect, that you're potentially designing an environment that might deeply affect the people in it. But in all of my training as an architect we never were given any guidance as to how to quantify or predict what effect our design decisions might have on the end user. So I think I became increasingly aware that it was important *and* increasingly aware that I didn't know how to predict it. And then I came across Space Syntax where they show you a very simple mechanism whereby you can predict something the end user would do. That something, in the case of Space Syntax, was pedestrian movement. So that's the link into wayfinding—through Space Syntax and being able to predict pedestrian flows. But the missing link, if you like, was that Space Syntax was good in predicting people *en masse*: at the aggregate or the population level. And after performing a specific type of

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Space Syntax analysis, you can examine a route-junction and the analysis will predict that '80% of people are likely to go this way, 20% of people are likely to go that way' and increasingly I found myself thinking '…but what would make *one individual* walking down this street choose to go one way or another, what would make me turn left rather than right?'... It was bringing it back to the individual that I found fascinating.

**JK**: *For your generation of researchers, what is in your view the biggest difference in the theories and methods that you can use for studying wayfinding and human behaviour inside buildings, compared to earlier approaches before you were doing research, so say to the 70s or the 1980s?*

**CH**: I think with respect to the basic theoretical perspective not that much has changed. We have better tools now and they have gradually developed. If you look at the first generation—late 60s, early 70s, then the 80s, the computation means were so primitive–elegant but primitive... and everything was done by hand or as a thought exercise and fairly simple experimentation.

**RCD**: And all the observations were done by hand, that's an important part...

**CH**: ...And now we can much more easily record large datasets. We can simulate environments. We have analytic tools, like Space Syntax that has also matured so much over the years and became much more accessible. I think when we started out in the early 90s that was the first big improvement step. Virtual Reality was the big breakthrough that you could 'do something' with and people had much lower expectations of it. And there was the backlash when people realised that it's so artificial and so far-removed... only in the last few years we've seen again the second generation of maturing of VR [Virtual Reality] and now everyone is picking it up. You see it discussed a lot more by people outside of academia, even in the trade journals you find it a lot. I'm not sure how much it really sinks into architectural practice yet, but it happens in parallel to other important developments. This movement towards Building Information Modelling—BIM, is a huge opportunity for us. It doesn't provide us with new theories but it provides us with making stuff feasible. If we want to link this with application of our research, then we have to find an inroad into real projects and this is only possible if we can work at the timescale of the professional field and not at the timescale of the academic field. This is where we just piggyback on a number of engineering developments such as BIM, such as ready-made, consumer-grade Virtual Reality. Now there is also an infrastructure of people who can generate these models—it's becoming much more common.

**RCD**: I just want to emphasise that when I started my PhD in '96 the zeitgeist was all about VR. There were movies on the topic of VR, such as The Lawnmower Man (1992), Ghost in the Shell (1995), it was frequently discussed in the popular press, it was very much 'out there' in the public. I remember talking to people and saying that I was doing my PhD in VR and it was 'so exciting'. I did a number of my PhD experiments in places like The Institute of Contemporary Arts in London and just taking along a VR headset: it was the first time anyone had seen a headset like this. I had people queuing up to take part in my experiments, it was just 'the next big thing'. And then almost nothing has happened for 20 years. I think, as Christoph said, the reality of it just never really lived up to the expectations. The field of view was very narrow, the renderings were very clunky, the environments were very uninspiring. Particularly as the game technology started, around the same time, to mature, everyone had an expectation that virtual environments would be like videogame environments (i.e. the first Tomb Raider was released in 1996) and they just weren't. It's so interesting now to see how VR is again becoming popular in the press and you turn on the TV or you're listening to something on the radio and they're talking about VR again. It reminds me of that level of excitement that was there 20 years ago when I was doing my PhD so I'm really excited to see what's going to happen in this second wave.

**CH**: And at the same time there has been of course a lot of progress. There is now a second wave of what looks appealing and commercial but after the first enthusiasm waned, the more serious researchers still kept on using Virtual Reality but for different questions. Not so much for trying to convince practitioners but our colleagues in psychology went more for simple environments and tried to unravel some of the basic cognitive aspects of orientation, navigation and interaction with the built environment. This has not been so visible outside of psychology but it definitely has given us important building blocks and important frameworks which allow us to run more complex experiments because we now have a sense of how to tear apart the underlying mechanisms.

**RCD**: I think also what became very evident in the early days is how much real-world fidelity you can simply offload, just ditch, and yet still begin to elicit behaviours that correlate with real-world behaviours. Even at the lowest pixel resolution, basic spatial models are very effective for doing behavioural experiments. And possibly even more so, because you don't have all this 'noise' that you get in more realistic environments.

**CH**: For example, what makes an environment complex? This can be about structure, geometry and configuration but can also be about landmarks and how they are related to each other. There are so many levels of realism that could be relevant and for estimating the impact of landmarks you can get away with highly artificial environments. Because there you have very good control of the saliency of the landmark, or of the semantics of the landmark,

semantics relative to the context, etc. Which are dimensions a designer might consider, but not in such a 'pure' form, when they are integrated into a more synthesized design decision-making. A number of the studies that we have done over the years have been effective *because* they abstract so much. They don't look great, they are not much fun for participants but there we can tear apart the role of structural landmarks from object-landmarks, from semantics... Because there we don't have the conflation that you would have in the real world. And now that we have those more realistic renderings it very often becomes the problem that people expect complexity. That makes it very difficult to have experimental control.

**RCD**: The other reason that the real world is 'noisy' and unpredictable is that it's full of other people. And again, we couldn't even dream of having virtual environments populated by others—be they 'real' others, I mean other people being represented as avatars in the virtual world—or simply by 'simulated people'. And I think we're just at the cusp of being able to do some interesting experiments in virtual environments that are now populated. So that you're not just the one person left standing, alone in the world, 'after the apocalypse'.

**CH**: Which also links to what is the future. I strongly believe that the deficit of much of the experimental research on the impact of environmental structure—and landmarks are the most prominent example of that—are in the fact that we often try to study all of that in isolation and in spaces that don't have other people. This interaction of how other people impact on the relevance of a landmark, the visibility of a landmark, the saliency of a landmark—all that we only now are beginning to understand. Because people distract, right?

**RCD**: ...not only 'distract' but 'attract' attention. I'm not an evolutionary biologist but I think there must be a very primitive mechanism in our brains: to immediately evaluate someone in a scene—'are they friendly/are they hostile?' We're just hard-wired to immediately attend to other people in the environment before we attend to anything else.

**JK**: *You already mentioned complexity of buildings and a lot of your research (jointly or separately) concentrates on indoor wayfinding. But some could say that buildings are not very complex compared to all other situations in which we have to navigate. We could argue that some indoor structures are almost predictable. If so, why should we study wayfinding indoors? Is it really that problematic and is the concept of indoor landmarks of any use to us, given those structures are not that complicated?*

**CH**: Well, I think indoor structures are inherently complicated. There's research stemming from the 70s and 80s on how people who work in a complex building, even after many years can't draw a useful map of it, or can't give you a good route description from A to B. Because they only learn certain elements that they use daily and whenever they are confronted with a novel situation they run into trouble. Just pragmatically, if the hospital is complex in its internal structure, people lose time and staff loses time and energy by having to explain to people how to find their way. Maybe commercially the most relevant scenarios are transport terminals which also tend to become inherently complex and there's nothing to be done about it. If I have 40 tracks and 200 shops in a train station, then there is no simple solution to allocating this, it's a constraint satisfaction problem. Likewise, in a shopping mall there can be a cost function associated with getting lost or being unhappy or spending time there... Because the main function of these buildings is *either* to get through them very quickly in the specific sequence of things you have to do there *or* to have maximum pleasure in strolling through them and buying products. Given that there is complexity involved in the design of these buildings, there is a tangible cost associated with such buildings.

**JK**: *Do you think that this can be optimised in some 'ultimately perfect' way? That there are cost functions between how people feel happy in a shopping mall and how easily they can get lost at some point and how much choice they have—do you think there can be a 'perfectly-sized' shopping mall, with perfectly easy navigation optimised somewhere in between?*

**CH**: That is a very basic question in design theory, right? 'Is there an optimal solution'? As a positivist-at-heart I of course believe that it *does* exist, it may just not be *knowable*. So aiming to find it might be futile. Practically, very often the optimum is not reachable because we have no way of identifying it. We have ways of identifying the *difference* between design alternatives and I think we have good ideas of how to *evaluate*, how to use evidence for *improving* design. But very often when things are interesting, pure optimisation is not feasible. You can tweak, and you can get some bumps out of the overall design but it's very difficult to know whether somewhere in the 'cost function', across the next 'hill' in the 'cost function', there is a better solution. That's always a problem in design and it also holds for the design of spaces.

**RCD**: Going back to the beginning of your question, one of the things you said implicitly or explicitly is that buildings are predictable and urban environments are not. I'd actually suggest that it's the other way around. If you think of most cities, you have streets that for the most part tend to be linear—tend to be long and thin. They tend to have buildings, for the most part, on either side—and those buildings tend to be constituted with windows and doorways. Streets tend to meet other streets either at a right angle, as in the T-junction, or at a very oblique angle. Bill Hillier has written some good papers on this phenomenon. The more integrated streets tend to meet

at more oblique angles and the more segregated streets will tend to meet at more right angles. And streets tend not to change very often. If you look at the street layout of pretty much any European city and you compare it to the street layout a 100 years ago, there will be very little change. Whereas the lifetime of a building is about 25 years and *yes*, there are certain heuristics and truisms that we know about buildings, but quite often these are either accidently or deliberately broken by the architect. Sometimes in order to be a bit more challenging, to make their design a bit more 'edgy'... And buildings of course are also organized on multiple levels. One heuristic that we have is that we tend to assume that floors in multi-level buildings are all the same on every level. So as soon as you get an architect who deliberately subverts that, as in the case of a building we've studied recently, the Seattle Central Library, suddenly the strategy of learning the layout of one floor does not help you at all when you go up to the next floor, as every single floor is different. I would argue that there's much more potential to make buildings far more challenging environments for wayfinding then actually in the city.

**CH**: Cities are bigger, they are at the larger scale, but there you can talk a lot more about *self-similarity* and an *inherent* structure. While in buildings, it seems to be a bit more arbitrary. They also have a different history. Cities *evolve*. Very often the cities that seem to be problematic for us, with respect to orientation and wayfinding, are *planned* and not *evolved*. This is where everything looks the same, very modernistic urban design, et cetera... Likewise, urban environments that have a suburb structure in North America—they also make for a really bad orientation because 'it makes no sense'. But a functioning urban environment grows over time and there are feedback loops that stabilise cities into certain types of forms that we also have learnt to deal with. They start out simple, become complex, but there is a lot of feedback...

**RCD**: And they only make small, incremental changes...

**CH**: Yes, so you could argue that by *growing*, something large and complex, it develops in a fashion that is still very manageable for people. By contrast, if buildings evolve then the process of evolution almost always makes things worse. You have a building, then you have another building or an extension, you have something that is 'tacked on', there's a connection to be made, and then somebody makes another connection on an upper floor, adds another storey... Things grow in an organic fashion, but they grow not for movement but mostly for allocating specific local functions. And then, step by step, you have longer, more complicated pathways. So over the lifetime of a building, 'stuff' gets tacked on. And the additional 'stuff' might still be nicely designed but at some point—when it starts interacting with the existing building—things often get messy and that seems to be much more a feature of buildings than of cities.

**JK**: *In that case, can landmarks help us navigate in these complex, illogical buildings that make no sense otherwise?*

**CH**: In principle *yes*, but... What do we mean by 'navigate'? I think—and our joint research also goes in this direction—that there's at least two types of navigation. One *exploratory*, or going somewhere for the first time; versus *learning* the environment and then being able to flexibly move around it. One is about spontaneous use, the other is about learnability and memorability. And you have the same in human–computer interaction: 'walk-up-and-use' user interfaces that have to be *intuitive* versus interfaces and information spaces that have to be highly *learnable*. For 'walk-up-and-use', for initial intuitiveness, landmarks have to have different characteristics from landmarks that are made for learning. So answering the question of how useful a landmark is, is always tied to 'for what kind of a task'. Clearly, a landmark by definition is something that structures the environment, that adds uniqueness. That cognitively this would be a good thing is obvious, *unless* when it mis-matches with the task or doesn't support the task.

**JK**: *In that case, when we have defined tasks that we know people will face in the given environment more often than others, do you think landmarks can be designed by an architect during the design process of a building? Or do they have to 'occur' naturally?*

**RCD**: I think that most architects would not explicitly ever think about designing landmarks. But intuitively many good architects would have a strong sense of—perhaps not what constitutes a landmark—but certainly what makes a navigable building. In our earlier study, one of the things that we discussed was that architects considered very strongly symmetrical buildings to be a challenge for navigation. Our supposition was that they recognised that there were areas of what we would call self-similarity, locations with very low architectural differentiation. One corner might resemble another corner, which might resemble another corner... And the architects intuitively recognised that such locations might be challenging to a user. So I would like to imagine that good architects would attempt intuitively to 'design out' areas with strong architectural self-similarity and low architectural differentiation, but that's quite different from saying 'would they design landmarks'. I don't think they *would* but they could do a lot to perhaps remove the need for as many landmarks.

**CH**: We have worked with roboticists and this question of landmark *recognition* came up. This is more of a computer vision problem, but in robotics you often solve this by just providing the robot with artificial landmarks that are uniquely sensible to the agent, for example having a beacon as a landmark. But where do you place those? How many

landmarks does one need, relative to the size of a building? One can of course have some heuristics and in some sense that is equivalent to the 'museum guard problem'—for any subspace you probably need at least one to make them unique. But you might think of ways to reduce the number beyond that. To do this you would need to give guidance as to where are the most prominent locations in the building layout, that really have to be designed to be landmarks. If you assume that designing is a collective exercise by a team of people and that there is a person who is particularly good at making specific building elements memorable, you might want to guide that person towards paying specific attention to certain locations. And I believe that most architects have a very good *intuition* about that. They might not have a *theory* but they intuitively approach much of that.

**JK**: *In your research, you often emphasise the importance of views from the inside to outside. What is there so useful outside that, when we see it, can help us navigate inside?*

**CH**: A reference object. Some kind of reference, be that a reference direction, or something recognisable... You could also have the same effect probably without any outside views. I remember with Kate Jeffery we once discussed that if you had a distinct colour for one orientation of a wall, you could have a global landmark *in* a building. I always liked that idea.

**RCD**: So for example, the North wall is always blue...

**CH**: ...or orange! That would be amazing from that functional point of view. Might still be architecturally a bit 'challenging' or dubious as a strategy but might help. So it's not so much the fact that it is something *outside*, it is the fact that it is something that is *distinguishable from various positions*. Because one of the challenges in indoor navigation, in my belief, is when the space is divided into many small sub-spaces, you have lots of changes of direction to get from A to B, and many of the choices become a bit arbitrary. That is exactly the kind of thing that Space Syntax variables, such as *step depth from the entrance* or *integration*, tend to pick up. So one big, open space probably is a really unpleasant place to have as an office, but it is very easy for surveying and orientation. But because of the functional differentiation, of *what we do* in a building, things become folded on top of each other. Corridor systems provide more choices and, at the same time, limits to visibility. Weisman's category scheme of architectural differentiation, of complexity, of science and maps, is really unique to indoor environments because the question of *views outside* is essential. Urban environments tend to be more benign than indoors so having a stable view to the outside is a good compensation.

**RCD**: At the most fundamental level it's about maintaining a consistent orientation: knowing which way you're going. It's interesting that there are no words for losing your orientation within a building other than 'being a bit lost' or 'a bit confused'. But there is this phenomenon in caving known as 'being turned around'. When you think that you're going in one direction and actually you're heading in the opposite direction. Obviously in a cave environment you have no cues outside at all. That's the most exaggerated version of what you're trying to avoid doing in a building: of becoming 'turned around'. Except, we don't have an equivalent word for it within a building.

**JK**: *There's clearly also the problem with the fact that in public or semi-public buildings the customer who's paying for the project is not the final user of the building. Do you have a feeling that regular users of public buildings know or can tell a difference between good and bad wayfinding? That this is something they could demand in a building or that this is something that could be improved as they spontaneously realise that wayfinding is a bad 'feature' of a given building?*

**RCD**: The general public is becoming more empowered to give their voice and their opinion about... well, about *everything*, but in particular bad services and bad designs. In an earlier study we were looking at the use of social media and to what extent people were spontaneously giving feedback about the usability of a building. We were amazed at how much evidence we were able to amass that people seem quite willing to give their opinion about whether they find a certain aspect of a building usable or not. Being able to tap into that willingness is critical and I don't think we have quite found the way of doing it yet, in a structured way. But if we can only find the right mechanism—and there's a lot of initiatives going on with crowdsourcing feedback about the urban design—we can try to elicit feedback about buildings too. So I think we're not quite there yet but I think we're on the cusp of some really exciting developments. And again, it's back to the technology: if you're in a building and you're finding some aspect of it disorienting or bewildering, the fact that you might just stop there and immediately post a review about how frustrating you find that part of a building—I think is fantastic.

**CH**: I agree but I think there's many buildings the users don't have a sense of who to even complain to. There are some exceptions—there were recently complaints that were picked up by newspapers in Switzerland on the navigational problems in the newly-extended main train station in Zürich. It is now very complex and its signage systems needs improvement—everybody involved is aware of that. But the very fact that people complained, which was then picked up by the media, has prompted Swiss Rail to react. And now they are actively addressing the problem, both by design and by better communication to the users. So there is potential, but at the same time one should not overestimate this. I think we're all very good at *spotting* when a setting or a situation is uncomfortable, but that does not

mean that we have idea of how to rectify it. Or maybe we have ideas of how to rectify it in a *simple* manner but architecture is often about solving a problem in an elegant and sophisticated manner—and that is clearly not available for the general public.

**JK**: *You have already mentioned the role of technology. One recent example, the in-car navigation systems, really changed the way we navigate through our cities. It seems that signage that tells you which turn to take to go to a different city lost some importance. And indoor, it seems, the technological limitations are disappearing. Tracking indoor is now possible. Do you think this will change how we navigate through our buildings? Will we all be looking at our smartphones while we walk through them? Will we be listening to our individual instructions instead of relying on external aids and seeing what other people do?*

**RCD**: I don't think we can do away with indoor signage quite yet. Although I think every architect's ideal is to design 'the perfect building' that is so immediately clear and understandable that you need have no signage at all. But I'm not entirely convinced that that ideal is an attainable goal. I think there are two really interesting areas that are under-researched at the moment, and one is signage *placement*. There has been a lot of work done on signage in terms of what font or what colour your signage should be, from what distance they're legible, but very little on where signage is placed. A lot of the idea of signage placement is very much a black art and is still done intuitively. Quite often *after* a building is occupied there's still a little bit of tweaking that goes on with the signage. So I think signage placement is important. Second, as most populations are becoming far more diverse there are many more languages spoken and, in general there is much more of an aim towards an inclusive design, designing for people with a range of physical and cognitive needs. So how do you provide signage for people for whom, in our case English, is not the first language, or maybe people with cognitive impairments who can't read a regular sign. This is where technology comes into place, a dynamic signage that maybe can recognise the person approaching it and can infer what information they might need, and how that information should best be presented, before they even get to the sign. I think that this is something that we might be able to move towards in the future.

**CH**: Coming back to the question of navigation devices, they seem to be working quite well outdoors and my intuition is that it's *easier* to make them work outdoors. That has to do with the fact that indoors stuff looks very similar to each other and it's more difficult to maintain global orientation. A lot of the systems that work intuitively tend to be at the outdoor, streetscape level. Indoors, this whole match between a map and the environment is trickier. It's not so clear what is the right amount of panning and zooming that you'd need. The handheld devices tend to be fairly small, which limits the readability. In our studies, the main challenge is of course indoor localisation. That is improving, but needs instrumentation of the building and it might really take a while before we have any sufficient standardisation that would lead to a major pick-up. So to some extent many of the commercially available Indoor Maps, as interesting as they are, have also been quite disappointing. It's a lot better than nothing but it also is a long shot from what it could be and from what we're used to for outdoor navigation. There are also all other small practicalities like the capacity: corridors are smaller, having people with and without mobile devices walking on them clogs them up more quickly than a normal sidewalk. You would have to stop more often because you have more turns so you have more interactions with the mobile device per unit of time than you would have in the city-scale. If you were walking through the city and every 30 metres there's an intersection, that would become tedious, too. Normally, outdoor navigation works quite well because the routes you're travelling are quite nicely structured and you get a preview... All of that I don't see for handheld indoor navigation. There is a lot of work to be done before that becomes as intuitive. To design it well, I believe, we have to get yet a better understanding of what are the differences.

**JK**: *And my final question: what are you working on now, together or separately? Why do you think these are research questions worth pursuing at this moment?*

**RCD**: One thing we're working on is *social navigation*. We already talked about the role of *others* in the built environment. This is a very under-researched area...

**CH**: And trying to make better inroads to practice. I have just started an extended research stay in Singapore, where we started a project as part of the Singapore ETH Centre, the Future Cities Lab, on cognition, behaviour and perception in urban environments. The main thrust of this is to understand how wayfinding is impacted when you have not only a *complex* built environment, but also a highly *populated* built environment. There's a lot of people moving around who might be in a hurry, not necessarily in an emergency situation—this could also be one element—but just a normal way of being in a shopping mall, going for the local train, going for the bus... We need better understanding of what is the impact of crowding on people's navigation strategies, on their perception, or on their emotional response. We have different kinds of variables beyond the traditional route-choice measures and memory measures to better understand this. Namely, eye-tracking for visual attention, and also physiological response, like heart-rate variability. For getting a grasp of crowding, density and social interactions, I think we need to take these elements into account and there's not enough research yet to say how it's going to map—we have to find that out. One of the reasons why we're doing this in

Singapore is that it's a location where the government and the local agencies have understood that it's a topic worthy of investigation. And they've also understood that we can't just do basic research in the lab on it—although that of course is part of what we do—but that we need their support in getting access to sites, getting different types of data. Because we're also coming to the limitations... The data that we can collect in a typical psychological experiment is high-resolution data with small samples but there's a tendency in the whole smart cities and responsive cities movement of getting access to big, often less structured data, that we can complement. I think that is really going to be a big source for us. There is also SeaHero Quest—a video game project, where we also have the opportunity to get access to really large-scale data but also use the same technology to run very targeted experiments in a controlled setting.

**RCD**: On a different topic, entirely, Christoph and I have often talked over the years about what we've often called 'double perspective talking'. When an architect designs a building, they do two separate things. One is to try to imagine themselves potentially in the shoes of their user. So classic 'perspective talking' from a psychology point of view; but also imagining themselves moving around a finished building, in that literal 3-D perspective, to move around the imaginary, as yet unrealised, building. Our intuition has always been that good architects were able to do both. They're actually able to imagine moving around the, as yet unbuilt, building, but equally imagine themselves in the shoes of the other. One thing that we've perhaps touched on very little over the years is the concept of *empathy*, or *empathic design*. And certainly something I am quite interested in at the moment is to look into empathy a little more—is there a connection between people's ability to *empathise* and when an architect designs, their ability to put themselves into the shoes of the building user. I'd be quite interested in taking that a bit further, so looking a little more into tests of empathy and whether we can subject some practicing architects to tests of empathy.

**CH**: I think we have been concentrating for a long time on the very *functional* question of wayfinding and orientation. But that has various levels—there's the functional level to it, but there's also the *well-being* and *stress* level to it which was always there. In the Evans & McCoy's paper on the health of buildings that is emphasised but was never really translated into empirical research. And I think now we are at the point where we can do it. When we talk to government agencies or to practicing architects, we don't want to be there just as 'the people who optimise the flow'. That's the capacity planning problem, that's a classic traffic engineering problem that you'd just bring to the pedestrian scale. I believe we want to go beyond that. I think we want to be able to capture different qualities, and empathy would clearly link in here. What is it that makes people feel at ease in a navigation task or in the built environment? What is the level of crowdedness that people can deal with? If you're going to a rock concert, crowdedness is amazing. If you're going to a club late at night, crowdedness is amazing. If you're in a rush and everyone is just blocking your way... that's amazingly unpleasant. All these context factors, this semantics, we have to understand better. And it has to go beyond the question of whether blue or green is the more calming colour of the wall... There's a lot to be done.

**JK**: *Thank you very much for your time.*



**Christoph Hölscher** is a psychologist by training and Professor of Cognitive Science at ETH Zürich since 2013, with an emphasis on Applied Cognitive Science. He served as honorary senior research fellow at UCL, Bartlett School of Architecture, and is a visiting Professor at Northumbria University Newcastle. The ETH Cognitive Science group is investigating basic and applied questions of complex cognition, i.e., understanding how humans tackle complex tasks in real-world task environments. Such complex tasks range from interaction with computer system to finding one's way around a large building or urban environment. The group is reaching out to engineers, architects and designers, emphasizing a human-centred perspective on technology and environmental design.

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