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SLOW HCI
Designing to promote well-being for individuals, society and nature

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Today we are addicted to speed, cramming more and more into every minute. Every moment of the day we seem to race against the clock, trying to get over a finish line that we never seem to reach. You can do everything at speed – from speed dating to Speed Yoga (a bit of a contradiction, don't you think?). This culture is taking a toll on everything from our health, diet and work to our communities, relationships and the environment.

The Slow Movement is about seeking to do everything at the right speed – savouring the time spent on an activity rather than counting the hours and minutes. It's about quality over speed. The Slow Movement seeks to mix the fast with the slow to support people to work, play and generally live better.

Is it possible to change attitudes so we start to view 'slow' as something positive? It may be hard, but change is possible. Once people understand the limits of the human brain, it should become easier to kick the multitasking habit. Some companies are starting to encourage staff to focus on one activity at a time and wall themselves off from the barrage of electronic interruptions whenever possible. Look at Karen and Judith's article on email behaviour to see what we are currently up to.

In this issue our articles look at designing for happiness, learning and to facilitate slowness as well as review two HCI research groups who are both looking beyond productivity.

As you attend the HCI conference, I encourage you to take time to reflect and even ponder on the Slow HCI Research promoting well-being for individuals, society, and the natural environment.

Lynne Coventry

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HCI 2012

Dave England, the Chair of Interaction, welcomes you to HCI 2012 in Birmingham, UK, and invites dialogue and collaboration throughout and beyond the conference.

Welcome to Birmingham and the 26th HCI 2012 People and Computers Conference. I hope you enjoy the conference and take the time to reacquaint yourself with old friends and make new ones. I'm sure Russell, Ben, Chris Bowers and Chris Baber will put on a fine show, and our conference committee will have chosen a high quality selection of papers and other presentations for us to enjoy.

Challenges ahead

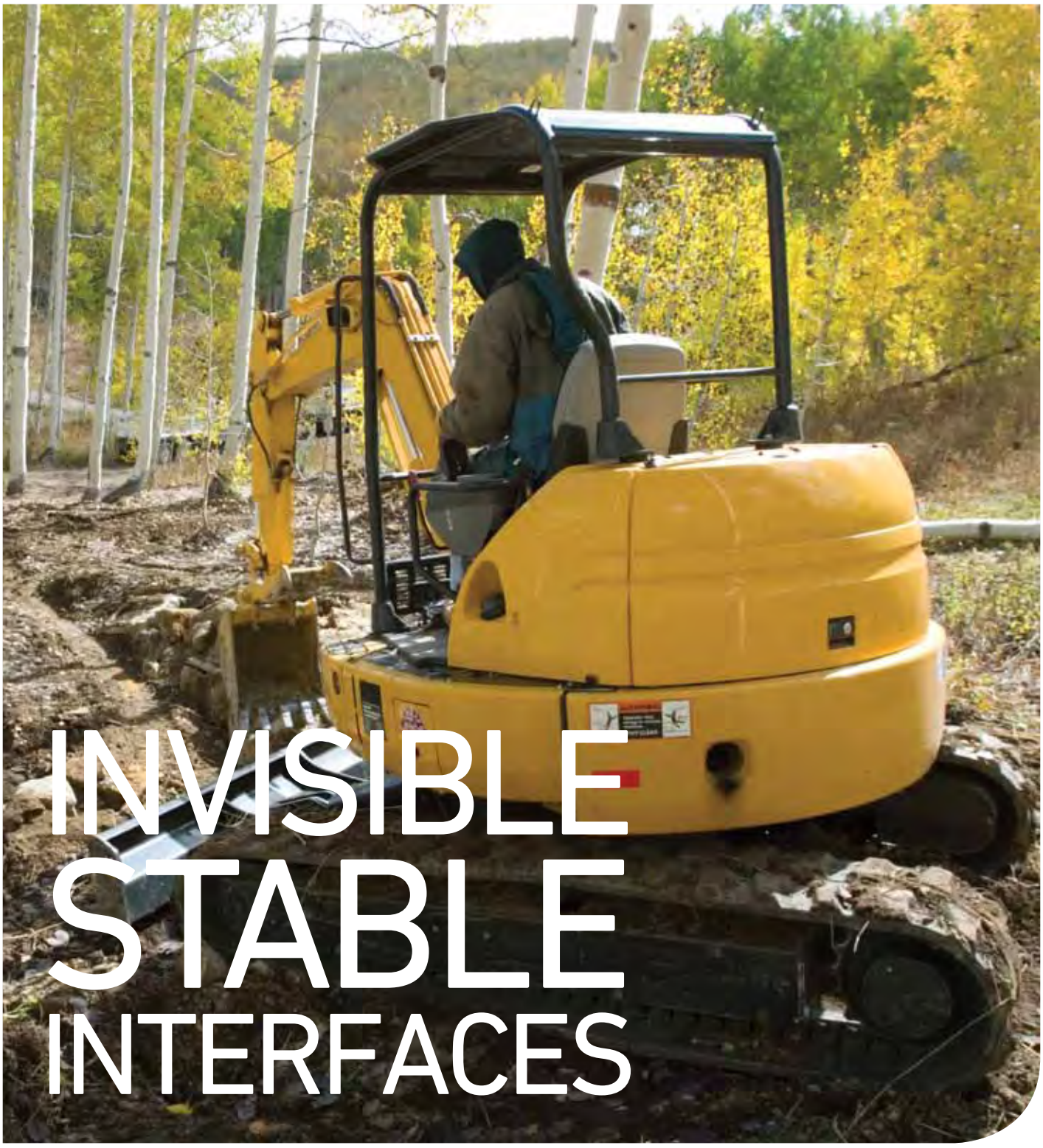
The conference is also the time for the Interactions group AGM and we look forward to new faces volunteering to take the group forward. In the UK the group faces many challenges; there is the changing nature of UK Higher Education, especially the new fees regime in England; and there is the challenge of the Research Excellence Framework (REF), where cross-disciplinary work like HCI can sometimes struggle to be recognised.

However, we can be assured that UK HCI research is internationally leading and punches above its weight – as outlined in the previous edition of *Interfaces*. The continued submissions and attendance by our international colleagues at HCI 2012 is proof of the international standing of the conference.

Promoting usability

Though the main focus of the conference has been on academic research, it is also a forum for academics and practitioners to meet and exchange ideas and perhaps plot the next joint project submission. It might also be the time to renew our joint efforts in pushing for professional recognition of Usability Professionals. Tom McEwan and John Knight began this with their UX2010 workshop and we need people to take this further. Indeed the incoming chair of the UPA has called for greater collaboration between all the bodies that cover User Experience. As part of the BCS, we can promote this collaboration, in part, by promoting more Human Factors skills within SFIA – The Skills Framework for the Information Age, **www.sfia.org.uk**.

At the conference we can engage in dialogue around events like the HCI Educators workshop, **www.hcied.org** – discussing, amongst other topics, the relevance of the HCI curriculum to professional practice, and the changing nature of HCI as it embraces the broader topic of user experience.



INVISIBLE STABLE INTERFACES

Kai A. Olsen, University of Bergen and Molde University College, and **Alessio Malizia**, Universidad Carlos III de Madrid, explore the importance of maintaining stable interfaces for efficient workflow and ask companies to consider how to minimise disruption to experienced users when bringing out new versions.

Have you seen experienced operators handling excavators? It is as if the machine is a part of their body. We get some of the same feeling when driving a car; it feels like the steering wheel and pedals become extensions of our own limbs. To achieve this 'nirvana state', we need an excellent interface that gives us full control. The excavator has levers and joysticks that become natural to use. While the first automobiles were steered with a tiller, the steering wheel was soon introduced – a more natural control for making a turn. Since the basic functions are similar for all cars, we can transfer our experience to any model. Similarly, the handling of an excavator is simplified by interface standards, ensuring that an operator can move directly from one machine to the other.

Studies of people using tools show that control of the tool is partly determined by the interface, but also by routine or practice. The practice part is how we use the tool. It is often idiosyncratic, influenced by the functionality and design of the tool itself, but also by previous experience and customs. If we use a tool often, we perform tasks efficiently. With a good tool, and experience in using it, we have the possibility of coming to a point where the tool becomes 'invisible'. The operator of the excavator does not have to think

about how to get the desired action; neither do we when driving. The additional requirement for letting the tool disappear is that the interface is stable. This is often the case with mechanical interfaces, but with computer systems one has the opportunity to make something very different for the next version. As we shall see, this is where the invisible interface becomes very visible.

Achieving efficiency through consistency

Most of us send emails, write documents, chat with friends, enter data into a spreadsheet, make a call from a smartphone, and scan photos using computer equipment, all without thinking about the tool. The advantage is that we can fully concentrate on the task. Initially, of course, we had to explore the user interface and even read a user manual! But with experience we reach the stage at which the interface seems to disappear. This is the stage at which we become very efficient, when all mental resources can be focused on the task; for example, not focusing on the word processor at all, but solely on writing the document. In some cases, a good tool may even help us attain the mental stage of operation that psychologists call flow, where we are fully immersed in an activity; in other words we do not want to change our 'digital recipe' (Newman et al, 2006).

Modern graphical user interfaces, with forms, command lines and icons, help us reach this stage. Until they change, that is! While the steering wheel has been with us since 1898, the current user interface of a very important tool, the word processor, has only been around since 2007, at least for those of us who use Microsoft Word. In that year, Microsoft introduced its 'Fluent User Interface', which represented a dramatic change in the interface for their Office package. They had good reason for making this change. When users were asked what they missed from previous versions of Office, many mentioned functions that were already there. Though let's not forget that the number of commands has increased from 100 in the first version of Word to around 1500. The aim of the new interface was to better present what the system could do. The drawback was that every function was moved to a new location in the Graphical User Interface. As professionals, we had to accept that part of our practice and routine with this tool had disappeared. The invisible tool suddenly became very visible, while the known parts seemed to disappear.

Changing location disrupts flow

Location is an important feature for organising things. We find things – a book on the shelf, a document in the office – because we remember where we put them. The importance of location is manifested in keyboard layout. Even if the Dvorak layout has proved more efficient, nearly all keyboards have the traditional QWERTY layout. The cost of changing is too great. With larger displays and graphical user interfaces, location also becomes important on the computer screen.

Change may come at a high cost. When using a new interface, we fall out of our streamlined processes. Suddenly we have to stop and think. Where is the print command? How do we select a special paste? Where is the macro facility? How do we change the save options? Commands

that were embedded in practice in the old version, which could be performed with a subconscious mouse click, now require attention and learning. Suddenly we concentrate more on how to use the new interface than on what we are writing. Instead of devoting all of our mental resources to the writing task, we have to spend time searching the interface. The flow is broken, and efficiency is reduced. It is as if someone had removed the steering wheel.

A paradigm of user interface design is that recognition is better than recall (Norman, 2002). Microsoft would probably argue that the new Office interface advocates recognition. This may be true, and may be to the advantage of a novice user. However, assuming that the user already knows how to perform a task, the display of visual commands will be superfluous. As professionals, we do not want to see the interface; we want the invisible tool, or at least invisibility should be achieved by different levels of transparency depending on users' experience (Tanimoto & Levialdi, 2006). In some cases, this is achieved by giving shortcut commands, such as Ctrl-P to print. In other cases, it is achieved by subconsciously clicking on the right button.

It is not just Microsoft that creates these situations. In one Nokia software update, Nokia used the occasion to change all the icons. The new ones may be cooler than their predecessors, but now we have problems finding the applications. While the icons have changed on the screen, we still retain the old version in our brain. If you want to annoy your customers, this is a good way of doing it. Apple uses the same scheme. The first iPad came with a side button that was used to lock the display in landscape or portrait mode; that is, to turn the rotate function on and off. In newer versions of the software, this button has a very different function: it is used to control the sound. This change was performed automatically with a new update of the software. In our case, after many months, we still try to use this button as it was first intended – by resetting the function of this button.

Learned behaviour versus innovation

Is this just conservatism? Have we stagnated in our old-fashioned patterns and customs and become unwilling to learn anything new? To some extent this may be true, but we do welcome new technology and new user interfaces in many other areas. The mobile phones that we use today are very different from those we had a few years ago. We are using touch tablets for reading email and browsing the web. In all these cases, we have to conform to a new interface. We even assume that there are situations when we have to accept a dramatic change in the interface, such as when we get new solutions to old problems. For example, we have accepted that the choke lever in many cars has disappeared, and many people now use automatics without a gear shift. Graphical displays or touch screens come with new interfaces, but in these cases the disadvantages of having to learn something new are surpassed by the advantages of the new technology (Norman, 2010).

Every time a change is inflicted on practice, the tool asks for attention. These interruptions should be kept to a minimum.

While the new software is installed on top of previous versions, replacing them, the new 'practice' is installed next to the old in our long-term memory. So, in addition to using unnecessary memory, which we don't have a lot of in the first place, we have two competing versions in the brain. At some point the current version will take over, but this will not happen until we have made numerous mistakes.

We experience something similar when we move into a new apartment. Again and again we pull out the wrong drawer, go to the wrong room, look for a light switch in the incorrect place, etc. Several psychological experiments support this view. Our previous experience produces what is called a schematic intrusion (Kleider et al., 2008). This may be unavoidable when we move to a new apartment, but usually we have something to counterbalance the cost of changing the 'interface'. We know experienced computer users who go to great lengths to avoid these costs; for example, by running virtual machines just to retain the old interface of an operating system. This method squanders a considerable amount of system memory, but saves the user's own human memory (we must admit that we are still running the 2003 version of the Office package).

We feel that the tool developers – Microsoft, Apple and the like – are overly focused on making things new and exciting when they present a new version. It may be a good strategy for new users, but most users these days are experienced. As professionals, we are not interested in the tools *per se*, but in how we can use them to perform tasks. Is it not the same as with a new car, when gadgets and design may fascinate? Even in the case of a car, most of these brand-oriented parts are distinguished from the functional parts. For example, we can rent a car and drive away immediately, perhaps using the car for days without noticing the brand or model. For new versions of software products, we will be thankful for all improvements and new functions, but please do not violate the practice part! Every time a change is inflicted on practice, the tool asks for attention. These interruptions should be kept to a minimum.

Solving the problem

There are two solutions. One is to use continuous improvement. Amazon uses this approach. It has brought its customers along from the very first, primitive, text-based interface in 1994 to the advanced interface of today. Most users welcome new functionality and improvements, but developers must take care to have the users follow along. The other solution is to let users retain the look and feel of the old interface.

Does this imply that the world will never change? Clearly we must accept new tools with new interfaces whenever there is a significant change of technology. At one time, we may have had experience with using a typewriter, but we cannot and should not take this experience with us into a word processing system. However, in these cases, since the new system is so different from the old, we will not confuse the two systems. Experience with each will be stored in our long-term memory, but due to the disparity in usage patterns these will not interfere with each other.

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DESIGN FOR HAPPINESS

Anna Pohlmeyer, Delft University of Technology, translates positive psychology into positive design and outlines 20 opportunities to design for happiness.

The pursuit of happiness is valued as a natural, human right. Happiness should be appreciated as an ongoing process itself and as a life resource (Diener & Biswas-Diener, 2008). Based on a comprehensive literature review, Lyubomirsky, King, and Diener (2005) found compelling evidence that happy people are healthier, more sociable and active, show more prosocial behaviour, have more satisfying relationships, are more creative, and are more productive on the job. Most of us would probably agree that living a happy, fulfilling life is a desirable goal. Then why not aim high? Why not design for happiness?

In the following, a framework – the Design Well-Being Matrix – will be presented that combines theoretical aspects of positive psychology and a taxonomy of design roles, illustrating numerous design opportunities. There is no single, direct way to happiness, but every contribution that can be offered in this pursuit is worthwhile. User experience (UX) research sets the stage for future research in design for happiness.

From less pain to pleasure

In the past decade, UX emerged rapidly as a new paradigm in the field of HCI. As Hassenzahl and Tractinsky (2006) outline, it extends the task-oriented approach of usability and goes beyond the instrumental, views emotion and affect as core qualities of an interaction, and emphasises the experiential.

Furthermore, while traditional HCI was very problem-oriented, UX is a positive approach to HCI, looking for rich experiences rather than solely focusing on usability problems (Hassenzahl & Tractinsky, 2006). Minimizing the flaws of a product might solve the problem at hand and thereby ensure a state of 'not bad'. However, to achieve a truly good solution, a different strategy might be required.

Directing one's attention to a positive perspective and to the promotion of a desirable state can widen the spectrum of solution possibilities and can thereby also

lead to new, fulfilling experiences (Hancock et al., 2005; Desmet & Hassenzahl, 2012). The basic idea stems from positive psychology, indicating that the promotion of well-being is a valuable and necessary addition to the attempts of preventing pain (Seligman & Csikszentmihalyi, 2000).

From pleasure to happiness

UX has succeeded in offering engaging, pleasurable interaction experiences. It seems that HCI has reached a level of maturity to go even one step further: to design for (user) happiness. This focus is related to the currently prevalent field of user experience – however, design for happiness aims to achieve a long-term effect and moves from satisfaction with a product (use), pleasurable interactions, and sensory delights to broader concepts such as overall life satisfaction.

> **The field of positive psychology at the subjective level is about valued subjective experiences: well-being, contentment, and satisfaction (in the past); hope and optimism (for the future); and flow and happiness (for the present).** Seligman & Csikszentmihalyi, 2000, p.5.

Positive design is the attempt to support positive psychology through design.

Having a happy day vs living a happy life

What makes you happy? Is it sunny weather, watching your favourite soccer team win a match, getting presents for your birthday, or perhaps a cheerful tune? Without doubt, these are all pleasurable moments that contribute to our well-being. However, if the question had been 'what makes you *really* happy?' you might reply: spending time with friends and family, achieving long-term personal goals, or helping others in need.

When speaking about design for happiness, it is important to have a common understanding of what is referred to with the term *happiness*. It is being used in a number of ways with differing meanings.

A multi-componential concept

Generally, happiness researchers agree that the concept entails an affective and a cognitive component. One indicator of happiness is a positive affect balance, i.e. frequent experience of pleasant affect (e.g. enjoyment) combined with infrequent (but not absent) experience of unpleasant affect (e.g. sadness). In addition, a cognitive component, i.e. contentment and the rather enduring notion of life satisfaction, is also taken into consideration when evaluating one's happiness (Diener & Biswas-Diener, 2008; Lyubomirsky, 2010; Veenhoven, 2011).

Partly due to the strong association of the word happiness with emotions and the disproportionate influence of current moods on happiness ratings, Seligman revised his Authentic Happiness Theory (2002) to a Well-Being Theory (2011). The goal is no longer to increase life satisfaction, but to increase flourishing, i.e. optimal human functioning (fulfilling one's true potential).

Similarly, two perspectives on well-being, i.e. hedonic and eudaimonic, can be differentiated (Ryan & Deci, 2001). While hedonic well-being is achieved through the fulfilment of desires and pleasures, eudaimonia refers to a virtue-oriented approach to well-being that can be achieved through psychological growth.

In the following, the terms *subjective well-being* and *happiness* will be used interchangeably, but in both cases referring to the multi-componential concept that incorporates hedonic as well as eudaimonic aspects of well-being.

Five elements contributing to well-being: PERMA

Certainly, positive emotions are one aspect of happiness. However, they do not account for the entire story. In Authentic Happiness Theory, Seligman (2002) differentiates three elements of happiness: *positive emotions*, *engagement*, and *meaning*.

People who seek pleasures through increasing positive emotions live a 'pleasant life', while an 'engaged life' is enriched by moments of being in a state of 'flow' (Csikszentmihalyi, 1990), hence, in an intrinsically motivated, absorbing activity that optimally challenges a person's skills and talents. A 'meaningful life' does not need hedonic pleasures nor an engaging activity – it is a life that is enhanced by a purpose or contribution that is greater than the self. In Well-Being Theory (Seligman, 2011), two further elements are added: *positive relationships* and *accomplishment*.

All five postulated elements of well-being – positive emotions, engagement, positive relationships, meaning, and accomplishment (abbreviated as PERMA) – are said to be pursued for their own sake and to be independent of the other elements (criterion of exclusivity) (Seligman, 2011). Thus, while well-being can be enhanced by all elements, not all have to be fulfilled in order to thrive. A practical consequence for design is that each element can be addressed separately, as well as in parallel, when aiming to support human flourishing.

Limited view on the role of design

There is noticeable scepticism in the literature on happiness with regard to whether products can have a lasting influence on happiness. Two assumptions that underlie this disbelief are based on limiting views regarding the role and the goal of design. These will be refuted in greater detail below. In short, evoking positive emotions ('the pleasant life') is only one of a number of possible goals in design for happiness, and secondly, products do not necessarily have to be the direct cause of happiness themselves.

Design opportunities

Taking an extended view on the role of design, the Design Well-Being Matrix illustrates various starting points to design for happiness. With five elements of well-being (**P**ositive emotions, **E**ngagement, **R**elationships, **M**eaning, and **A**ccomplishment) and four roles of design (Source, Symbol, Enablement,

Support) as will be described below, the matrix includes 20 cells. These equate to 20 opportunities for design (a few examples of products will be provided in the following paragraphs). In principle, this offered spectrum is open to further extensions. Yet, already at this stage the matrix shows that there are substantially more opportunities than are usually associated with design and happiness, i.e. to directly evoke positive emotions through the product itself: **cell 1** in the matrix.

Beyond hedonic pleasures

Subjective well-being theories generally emphasise the multi-dimensional nature of well-being. They address, among positive emotions, elements such as personal growth through engaging in optimally challenging activities and achieving personal goals, striving for meaning, and cultivating interpersonal relationships (Lyubomirsky, 2010; Seligman, 2011; Ryan & Deci, 2001). This diversity should also hold in the understanding of design for happiness. There is no need to reduce design to the offering of hedonic consumption. Instead, one can intentionally design for all different elements of well-being.

Materialism and experientialism

Most importantly, products should neither be limited to their material value. The pursuit of happiness is not about achieving material wealth, but about psychological wealth (Diener & Biswas-Diener, 2008). In fact, people who view possessions as central to their life and well-being are less satisfied with their lives than less materialistic people (Richins & Dawson, 1996). Similarly, an increase in economic wealth, beyond material sufficiency (Diener & Biswas-Diener, 2008), does not seem to be in a linear relationship with an increase in life satisfaction. Money is no guarantee for happiness. On the other hand, what people do with it (e.g. donate) can make them happy (Diener & Biswas-Diener, 2008).

The distinction between *doing* (experiences) and *having* (possessions) and its effect on happiness was examined in a series of studies by Van Boven and Gilovich (2003). The findings indicate that experiential purchases (e.g. admissions, travel) make people happier than material purchases (e.g. clothing, jewellery).

However, products and experiences do not have to be mutually exclusive. To the contrary, interactive technologies have an enormous potential to enable activities and provide experiences (Hassenzahl, 2010).

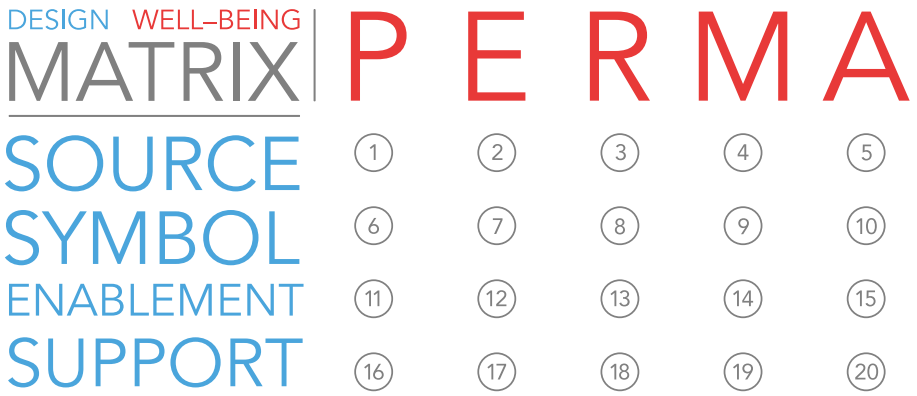
Direct and indirect influence

A product itself can be the direct **source** of pleasure: **cells 1 – 5**. In addition to satisfying hedonic pleasures, products can also, for instance, be meaningful for a greater good: **cell 4**. An example is the learning thermostat 'Nest', which automatically adapts to one's preferences and thereby saves energy. It is even possible that a product is literally the source of a relationship, such as 'Paro', the therapeutic robot seal, which is being used in hospitals and care homes in particular with dementia patients: **cell 3**.

In addition, products can also indirectly affect our well-being by **enabling** activities/experiences: **cells 11 – 15**. Some examples are interactive games (**11/12**), communication channels to stay connected like (video-) phones and social media sites (**13**), training facilities such as flight simulators to improve one's skills (**15**), and tools that are necessary for certain engaging activities, e.g. a musical instrument (**12**). In all cases, it is not about the product itself, but about the related activity and how the user experiences it.

A cognitive approach to enhance well-being is to direct our attention, interpretation, and memory to positive aspects of our lives (Diener & Biswas-Diener, 2008). Accordingly, another indirect effect of products on well-being can be achieved by **symbolic** representations: **cells 6 – 10**. These can be subtle reminders of something personally meaningful and/or positive, such as a wedding ring or a screen saver with a picture of friends representing relationships (**8**) or a trophy symbolising achievement (**10**). Furthermore, products may be useless in a functional sense, but can still have personal, nostalgic value (e.g. souvenirs, gifts).

A number of activities and thinking strategies (e.g. expressing gratitude, acts of kindness, savouring, optimism,



committing to one's goals) have been shown to lastingly increase happiness (Lyubomirsky, 2010; Seligman, 2011). However, these might require a change of cognitive and/or of behavioural habits and thereby effort from the individual (Diener & Biswas-Diener, 2008; Lyubomirsky, 2010). Design solutions can **support** happiness-enhancing behaviour and thinking: **cells 16 – 20**. For example, on a meta-level they can serve as a coach, encouraging the user to employ according activities and thinking styles. 'Tinytask' is such a solution – a variety of happiness-enhancing strategies are written on key chains, thereby serving as prompts to break with routines (Ruitenberg, 2010). In addition, tools can be designed that facilitate such activities (e.g. a camera to capture and later savour precious moments). Seligman (2011) himself provides an example of support through technology: he increased his physical activity with the help of a pedometer to monitor his progress and with the support of a group of walkers who reinforce one another in an internet forum.

Conclusion

To conclude, scepticism about whether products can have a substantial effect on our well-being, and therefore scepticism as to whether design for happiness is possible at all, might be appropriate if design is viewed as restricted to the offering of materialistic, short-lived pleasures. However, design can also play a pivotal role in the pursuit of subjective well-being by supporting its other elements. In addition, the contribution of a product should not be restricted to the direct influence of the device itself. Instead, the experiences it enables, the support it can offer for happiness-enhancing activities and beliefs, as well as the indirect influence it can have through directing our attentional focus open up additional opportunities.

The Design Well-Being Matrix can be used as a starting point in a design for happiness process. Multiple cells can be combined. However, subjective well-being is by definition a subjective matter. Therefore, individual differences, personal preferences, and foremost the user's strengths and skills (Seligman, 2011) and the personal fit (Lyubomirsky, 2010) must be taken into consideration. Further areas of positive design to look into lie beyond the subjective, on a group level – what impact can design have for the good of our society? Empirical research is needed to verify and differentiate the effects that design can have on our well-being. It is up to the HCI community whether or not to accept the challenge to design for happiness and to extend the role of design.

Design is not limited to		but also open to
problems	→	possibilities
material wealth	→	psychological wealth
products	→	experiences
frequency of positive affect	→	diversity of positive experiences
short-term pleasures	→	long-term subjective well-being
source	→	symbol, enablement, support
positive emotions	→	engagement, relationships, meaning, accomplishment

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BIRDS OF A FEATHER

Email is recognised as a major productivity disabler. **Karen Renaud**, Glasgow University, and **Judith Ramsay**, University of the West of Scotland, present a flighty perspective on emailers' behaviours.

Email has become an indispensable tool to organisations throughout the developed world. It is undeniably powerful and a very useful mechanism for organising and transmitting information in real time. However, many researchers have been raising concerns about the effects of email usage on individual users' productivity (Phillips & Reddie, 2006; Cameron & Webster, 2005).

Understanding email behaviours

We carried out a set of semi-structured interviews with people who use email as part of their working life. We wanted to hear the individual voices of these emailers, to gain an understanding of the good and bad aspects of email. Our ultimate goal was to assist organisations in formulating email management policies so that the positive effects of email usage could be embraced while the negative emailing behaviours were either discouraged or regulated. We have published our recommendations in Ramsay and Renaud (2009).

Our participants were very positive about the speed of emailed communication and a number of them mentioned that they would not be able to do their jobs effectively without using email. They especially liked the facility of sending documents quickly. However, a number of recurring concerns were raised. Some of these concerns were related to their own emailing behaviour and others were related to the behaviour of other emailers.

Lack of balance

With respect to their own behaviour, there was a sense that they felt that they were unable to maintain a reasonable balance between other activities and email. For example, many of our respondents were only too well aware that they checked email obsessively. They often justified this, claiming that they needed to keep on top of things, or that they dreaded a bloated email if they were going to be away from work for a number of days. One respondent told how he had checked his email while in hospital for a serious illness. Most ruefully admitted that this behaviour was something they found it hard to control, but since they were able to justify it they were quite comfortable continuing with the behaviour.

Another sign of this lack of balance was evidenced by the fact that many of our participants seemed to be overwhelmed by having to keep on top of their emails – reading, responding, dealing with problems raised in emails, etc. Even though our participants acknowledged that they could cope more sensibly with email, this did not seem to be a cause for great concern amongst many of our participants. It seemed that other people's emailing behaviour was the thing that really got under their skin.

Causes of annoyance

For example, many of them pointed to email-related activities by other people that bloated their inboxes and exacerbated their own feelings of being overwhelmed. These behaviours included broadcasting, back-covering and nagging.

A major annoyance was the tendency for people to pass the buck by email. Buckpassing has always been a problem for organisations but before email people would have to face the person

they were passing the responsibility to and this made it somewhat harder to do. Passing the buck by email costs the buckpasser nothing and the anger and frustration experienced by the recipient is understandable but hidden from the buckpasser.

The use of blind copying was another matter of annoyance, particularly when this was done to deceive the recipient. Participants did not mind people sending emails to multiple recipients and using BCC to hide email addresses but they did mind emails being copied to people in authority without their knowledge. They felt it was deceitful.

Acceptable use

So, such is the lot of the emailer. Surely, however, employees and organisations can take recourse to their own guidelines on how to use email? Although any 'Email Acceptable Use Policies' focus on legislating against the kind of emails that could result in legal action being taken, our participants did not really consider this to be a problem in their workplaces. It could be that people have now matured in their use of email and now actively work to accommodate the 'leanness' of the medium, so that they no longer send messages that can easily be misinterpreted or lead to legal action. Most of our respondents mentioned that they would re-read their messages to minimise the chances of misunderstandings occurring.

Loss of contact

Finally, many of our participants expressed concerns about the waning of inter-personal contact. They spoke nostalgically about the days when people actually spoke to one another. They also felt that, with the variety of different ways people could be contacted, they had little control over their own availability.

Recommendations

At the conclusion of the interviews we felt that we had gained a better understanding of the positive and negative effects of email on our participants. In light of this, we can add to the list of recommendations we published previously (Renaud et al., 2008): our emphatic recommendation would be that emailers work to become more aware of their own emailing behaviour and better protect their own personal space. For example, they should resist the temptation to monitor work email from home, and should make time to speak to people personally rather than taking the 'lazy' emailing option every time. Reflecting upon behaviour is one thing, of course, but strategies for adapting behaviour are another altogether, and therein lies the focus for our future research.

Categorising emailers

Finally, on a lighter note, we now provide some emailer classifications. Plant (2002) characterised mobile phone behaviours by likening them to stereotypical bird behaviours. This analogy seems particularly apt in the emailing context as well. In similar vein, the behaviours we identified might similarly be categorised as follows:

Reading

- *Compulsive Woodpecker*
  People who can't resist reading their email at all hours of the day and night.
- *Hibernating Poorwill*
  People who read their email only occasionally.
- *Incommunicado Ostrich*
  Reads emails but doesn't reply to them. Often to be seen with the *Hibernating Poorwill*.

Sending

- *Caterwauling Peacock*
  People who broadcast emails to all and sundry, claiming that people 'need to know' when actually they are grandstanding.
- *Pesky Crow*
  People who 'lean' on others by means of email, sending multiple versions of the same document, or sending multiple emails about the same topic. This bird inspires fear and loathing in the hearts of other birds.
- *Buckpassing Cuckoo*
  People who pass the buck by sending emails to others, thereby reneging on their responsibilities.
- *Back-covering Emu*
  People who send emails in order to be able to prove, at a later date, that they did indeed give the information to another person, or inform the person of some state of affairs.
- *Camouflaging Woodcock*
  Using BCC to copy emails to other recipients without the main recipient's knowledge.
- *Echoing Mynah*
  People who acknowledge all emails. For example an exchange something like: 'thanks', then 'my pleasure', then 'thanks again'.
- *Boorish Parrot*
  People who send abusive or inappropriate emails.
- *Echolalia Mockingbird*
  People who send chain emails and online petitions.
- *Night Owl*
  The midnight emailer, who admits to no work/home boundary, and fails to understand that other people do wish to have 'time out'. This bird flocks with the *Lightning Response Hummingbird*.

Organising

- *Hoarding Magpie*
  Keeps hundreds of emails in the inbox.
- *Lightning Response Hummingbird*
  Treats email as a synchronous communication medium and expects an immediate response to emails. Hence this bird monitors the inbox almost continuously.

Finally, there is the bird species which simply does not allow email to dictate. They read email in a constrained fashion, keep their inbox down to a manageable size, and behave in a genteel manner in all email communications. Most importantly, they take the time to speak to people whenever possible so as not to depersonalise work and personal life. This bird is the *Popular Robin*, favourite amongst all the birds.

It is likely that you, reader, will be able readily to identify some of your email correspondents in this list (if not yourself!).

Conclusion

Our research has identified a number of archetypal emailing behaviours. Since self-awareness must precede correction of misbehaviours, we use allegories to raise awareness of possible propensities and tendencies. We hope that this will help readers to modify their own emailing behaviours so that email is a tool rather than a tyrant.

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FUTURE HCI

Daniel Gooch and **Ryan Kelly** from Bath University reflect on a future for HCI where interactions are slow and reflective, more intimate, creatively and innovatively combining aspects of the physical and digital world to promote fulfilling experiences.

The field of HCI was born of a desire to meet our everyday wants, needs and desires through more productive interactions with technology. Since the dawn of personal computing, HCI researchers and practitioners have had to continually reflect on the efficacy of standard techniques and measures, particularly when moving from workplace settings to the context of the home. Reliable measurements such as time taken, number of steps, and errors, can take on new meaning in the everyday world. Slower interactions could be evidence of enjoyment in a ritualised process; intricacy in operation could be more engaging; and so-called 'errors' could be a sign of playful creativity.

These considerations reflect our field's willingness to question and reinterpret accepted metrics while redefining best practice and provoking new avenues of research. Herein, we use the aforementioned concepts to sketch three ongoing strands of work that we believe will be important in expanding future HCI research. We first discuss the potential for 'slow' technologies designed for durability and lasting value. We then consider how user generated systems will enhance value in digital products while empowering users to customise their tools. Finally, we consider how the juxtaposition of physical and digital platforms could lead to new and valuable experiences.

Slow technologies

We often think that technology needs to be as fast and efficient as possible. An alternative viewpoint currently gaining traction within the research community concerns the value of interactions that may be deliberately inefficient. This movement argues that the increasing presence of technology in contexts outside of the workplace requires us to move beyond tools that make people's lives more efficient to the creation of 'technology that surrounds us and therefore is part of our activities for long periods of time' [6, p. 161]. Such systems, termed 'slow technologies', may take the form of everyday objects that have been augmented with additional functionality to provoke new, ongoing experiences.

Some very recent examples in this space were designed to deliberately combine physical and digital components in a novel yet clearly 'inefficient' manner. For example, Photobox [8] is a system intended to provoke reflection over photographs. The system comprises a writing box containing a concealed Bluetooth printer, with the sole functionality of randomly printing a photograph from the user's Flickr collection. The intention is for the user to discover the photo when accessing the box for other purposes, thereby creating a serendipitous experience of reflection as memories about the photo are recalled.

On the other hand, ChronoTape [2] is intended as a note-taking system for genealogists. The device is constructed from a paper spool and a digital reader. The user can take notes on the paper and the electronic reader augments the writing with digital information. As a tool for capturing notes and ideas, Chronotape is much less efficient than a purely digital system. However, the extra time spent during note capture is intended to allow for 'peripheral activities including story telling, reminiscing and daydreaming' [2, p.2], all of which might not occur during interaction with a rapid, easy-to-use digital system.

Notice that the slow technology movement is not a call for systems that are lax, unreliable, or of poor quality. Instead, the idea is to refocus away from constant technological turnover to the creation of systems that stay with us for extended time periods. Such a move might also be useful from a sustainability perspective: any shift from throwaway, consumption culture towards one where possession is valued and important will be beneficial, particularly as many products require rare components, the acquisition of which can often be environmentally damaging.

A challenge in this space will be to understand what it is that leads us to retain possession of certain objects while discarding others. Odom et al. [9] use a theoretical framework to shed light on the complex nature of possession and engagement with objects. Their studies highlight *engagement* and *augmentation* as important factors, both of which relate to personal investment in the process of artifact creation. Such investment frequently leads to prolonged possession and use of objects. Thus, one possible way of encouraging long-term possession of digital systems might be through new ways of empowering people to invest and co-create their own tools.

The ongoing challenge for combined interfaces will be to understand how the physical and digital can be combined synergistically, such that they can be better than either is individually.

User Generation

User generated content is a staple of online life, with sites like YouTube, WordPress, Flickr and Wikipedia allowing us to progress from being content consumers to being content creators. Alongside user generated content creation, we have also witnessed the beginning of

growth in popularity of User Generated Systems. These are programs coded by individual users rather than dedicated teams of developers. Linux could be considered as the most famous example, but products such as Scratch, **scratch.mit.edu**, and Lego Mindstorms, **mindstorms.lego.com** offer users the opportunity to create their own customised applications with minimal investment.

Perhaps more exciting is the concept of User Generated *Devices*, where users undertake the creation of the object with which they will interact. For example, Costanza et al.'s system [3] allows users to print and construct three-dimensional paper shapes that, through the use of a webcam and some software, become a physical interface for controlling music. Gooch and Watts' hotHands system [5] allows intimate couples to co-create a device for one-to-one communication. One partner creates a clay imprint of their palm, which the other partner then augments with a heating element and customises to replicate the sensation of collocated handholding. As examples, these systems serve as early forerunners of how the field might evolve – we can imagine something on the scale of Instructables, **www.instructables.com**, but aimed exclusively at interaction techniques and technologies.

What we see as important about user generated systems is the personal investment and time required in creation, which, as shown by hotHands, may occur is a collaborative act with one's partner or friendship group. Such investment will not only fuel a move away from consumption towards cherishment and retention, it will also allow users to personalise and customise the objects they use while simultaneously feeding a DIY aesthetic [1].

Physical/digital interfaces

Since their conception, computing systems have generally operated through a digital interface, navigated through with a keyboard and mouse. The digital world has not really come into conjunction with the physical world – although printers create tangible objects, the messages themselves can be considered as separate from the digital realm in which they were conceived.

We see novel combinations of physical and digital interfaces – as seen in ChronoTape – as an avenue for future work. Bleeding the margins in this way leads to some exciting possibilities. Some work has already been done in this area: The Magic Sock Drawer [4] is a communication device aimed at remote couples. By using custom software and mini-printers, the system allows people to create digital notes and send them electronically. The notes are then printed surreptitiously and can be retained as physical notes. The idea is to harness the convenience of digital technology without losing the intimacy of receiving a paper token of affection.

A separate set of possibilities relates to altering our use of tangible media in novel ways. For example, Postcrossing, **www.postcrossing.com**, is an online system that randomly connects users for the purpose of one-way postcard 'crossings'. Users send physical postcards through the mail system, and for each card a member sends, a random stranger will send them a card in return. A recent study of the Postcrossing community [7] highlighted the various aspects of postcards that are valued by users, including tangibility, personalisation, and nostalgia. The study also showed how the combination of the physical and digital elements led to new experiences – including anticipation and serendipity – which would not have been possible otherwise.

Developing the research we have described will not be without challenges. For slow technologies, context of use will be important: clearly some situations, e.g., those that are time- or safety-critical, will always require efficient equipment, so perhaps technologies designed to provoke reflection are best left outside the workplace for the time being. For user generated systems, we must consider how we can best harness the experiences and creative skills of the population as a whole. Having done so, how do we test the utility of any one idea from the vast number created? An additional challenge will be to encourage, and possibly incentivise, the dissemination of these systems for the collective good. The ongoing challenge for combined interfaces will be to understand how the physical and digital can be combined synergistically, such that they can be better than either is individually.

Conclusion

The field of HCI is extremely diverse, and it is likely to remain so for some time, particularly as computers continue to pervade every aspect of society. In this article we have briefly described three strands of research which we consider to be both exciting and interesting; our choices were based on aligning our own research interests with current discourse in the HCI community. Of course, these are not the only areas in which HCI will develop. We strongly believe HCI research will have an important role in addressing the major societal, environmental, and economic challenges of the 21st century. Whatever the future holds, we can rest assured that HCI will be there, trying to change people's lives for the better.

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THE ITT GROUP

Professor Lynne Baillie provides an overview of her team, the Interactive and Trustworthy Technologies Research Group at Glasgow Caledonian University, and some of their current projects.

Glasgow Caledonian University's Interactive and Trustworthy Technologies Research Group investigates new technological challenges and opportunities, and the impact that they have on people and society in terms of factors such as convenience, performance, and security. Our expertise is diverse and we work across various fields of computing including the following research areas:

- Multimodal interaction
- Computer security and digital forensics
- Mobile applications and networks
- Interactive information retrieval

Our work builds on the user-centred design tradition where end-users are seen as active co-constructors of functionality. The group is part of the Department of Computing, Communications and Interactive Systems, within the School of Engineering and Built Environment.

Who are the ITT Group?

ITT group director, **Professor Lynne Baillie**, has been involved in the user-centred design of home and mobile technologies for over 10 years and has worked with several companies such as Orange, Bang and Olufsen, Motorola, Telefonica, Vodafone, and Telecom Austria. Before coming to GCU, Lynne worked for six years with the Telecommunications Research Centre (FTW) in Vienna, including two years as a Marie Curie fellow.

Group associate director, **Dr Mike Just**, has worked on computing technology and policy in industry, government, and academia for almost 15 years, including six years with the Canadian government. His research focuses on computer security and its relationship to human behaviour. In addition to his role at GCU, Mike is an Honorary Fellow at the University of Edinburgh. Mike received his PhD in Computer Science from Carleton University in 1999.

Dr Martin Halvey is a lecturer in human–computer interaction since May 2012. His research interests include novel touch-based interfaces, interactive information retrieval and intelligent user interfaces. Before his recent arrival at GCU, Martin worked with both the GIST and IR groups at the University of Glasgow. Martin received his PhD in Computer Science from University College Dublin in 2007.

Dr Michelle Govan is a lecturer in digital security and forensics since September 2008. She completed her EPSRC-funded doctoral thesis in 2003 on control engineering theory with the Department of Mechanical Engineering at the University of Glasgow. From 2003 to 2008 she commenced a Knowledge Transfer Partnership (KTP) project and subsequent research fellowship in conjunction with Glasgow Caledonian University and Ecebs Ltd. The project involved the development of multimodal biometric algorithms for authentication within embedded systems, and used control theory to develop novel feedback and feedforward approaches for fingerprint authentication, extending to non-authentication areas (e.g. utilising biometric traits to establish intoxication).

Fiona Fairlie is interested in the development of technological solutions to support students educationally during their time at University but in particular during the transition from school or college to University.

Diane Joyce has a background in graphic design. She is also interested in the development of technological solutions to support students during their time at University but in particular during the transition from school or college to University.

In Autumn 2012 we will be joined by **Dr Gunes Kayacik**, an EU FP7 Marie Curie Fellow. Dr Kayacik is currently a machine learning researcher at Nominum Inc. and has a strong theoretical background

in machine learning with extensive practical experience in computer security. Gunes received his PhD from Dalhousie University in 2009, and till 2011 he was a postdoctoral fellow at Carleton University. He has also held research positions at both Swisscom and CA Labs.

Our team currently includes a number of researchers: Stephen Uzor (rehabilitation games), Lee Morton (wireless sensors and motion capture), Mobolaji Ayoade (wireless sensors and their application for the rehabilitation domain), Nicholas Micallef (multimodal authentication), and David Beattie (mobile audio).

Some of our projects

Envisage

Led by Professor Lynne Baillie, several members of the group (Stephen Uzor, Lee Morton, Mobolaji Ayoade) are currently playing key roles in pioneering research that could improve rehabilitation after stroke, speed up recovery from joint replacements and prevent falls in older people.

The £1.5 million project involves engineers, scientists, designers and healthcare professionals from across the UK joining forces with members of the public to convert powerful biomechanical data into simple, computer-generated animations to help patients visualise how their bodies move. The technology will enable healthcare professionals to communicate movement information that was previously only available in graph or table form, helping patients to improve their own mobility and prevent injury. The system will also improve feedback of results and, ultimately, help diagnose patients' physical problems in complex conditions. The group is developing a portable system of motion capture for use in health centres, the community and the patients' own homes.

The four-year project, led by Professor Phil Rowe at the University of Strathclyde, is being developed in partnership with

The Glasgow School of Art, Glasgow Caledonian University, Glasgow University, Newcastle University, the University of Southampton, and the NHS in the West of Scotland. The project is funded by the Lifelong Health and Wellbeing programme – a cross research council initiative in partnership with the UK Health Departments. The project is funded by the UK research councils (e.g. MRC, EPSRC and ESRC) through the Lifelong Health and Wellbeing programme (October 2009–October 2013).

EMMI

Members of the group (Lynne Baillie, David Beattie and Lee Morton) are working with mobile operator Orange, investigating novel ways of interacting with our mobile devices, from sensing technologies to effective media.

The main aim of the project is to explore completely new and untried ways of interacting with our mobile devices in order to discover new experimental methods of interaction and to see if these new methods make using the device more enjoyable and engaging. The project is funded by Orange Mobile Labs (Orange Telecommunications and France Telecom).

Co-Guide
A unique opportunity has arisen due to the advent of the Commonwealth Games in 2014 to re-examine Glasgow's heritage with regards to the place of sport. One of the aims of the games organisers is to produce a lasting legacy of engagement in sports for future generations after the games has finished and one of the most prominent reminders of that legacy will be the venues that are refurbished, extended and created.

Researchers in the ITT group are working in collaboration with local schools and communities to design and build a mixed reality mobile guide of this legacy. The result of the work will be *Co-Guide*, a user centred guide to Glasgow's collective sporting heritage of the Glasgow Commonwealth Games 2014.

The group members involved in this project are Diane Joyce, Fiona Fairlie, Lee Morton, Stephen Uzor and Lynne Baillie.

The project is funded by Heritage Lottery Fund (September 2009 – November 2012).

Multi-level, collaborative information retrieval
Dr Martin Halvey is leading this project involving information access where information access is not equal across all participants. For example, a doctor, patient, insurance company, or family members may be allowed access to various differing information about the patient and have different interests. This type of collaboration is difficult, as any system must ensure that there is no information contamination and/or inadvertent disclosure of information, while still allowing for collaboration. The aim is to create novel systems to support multi-level collaborative information retrieval with varying depths of mediation, i.e. interface and algorithmic levels to support degenerate and asymmetric information flow for collaboration. Some of the outcomes may have wider implications beyond collaborative information retrieval; e.g. algorithmic findings may have implications for data sharing in social networks.

Thermal interfaces for mobile devices
During his tenure at Glasgow University Dr Martin Halvey was involved in a project investigating the use of thermal interfaces, and this work is continuing at GCU. Thermal stimulation is a rich, emotive and salient feedback channel that is well suited to HCI, but one that is yet to be fully explored. To address this shortcoming a set of robust guidelines for the development of mobile thermal interfaces which take into account factors such as mobility, clothing and environmental conditions have been developed as a result of this research.

Work has also begun looking at more rich interactions using thermal interfaces, including creating thermal icons and using thermal interfaces to augment multimedia presentation. The end goal of this research is to create real, interactive and engaging user experiences through thermal interfaces.

Data movement in cloud solutions
Dr Michelle Govan is studying the strength of data evidence in the face of a user interacting with a cloud-based environment via multiple computing devices. In particular, this project examines the effects of natural data movement in push-based cloud solutions, focusing on innovative solutions for data capture, and establishing possible sources of data contamination and the origins of data. The project will address challenges such as uncontrolled data transfer, data contamination, and the unintended prospects for obstructing and obscuring investigations for law enforcement and corporate forensic examiners.

Active behaviour demands active security
Starting in Autumn 2012, Dr Gunes Kayacik, Dr Mike Just and Professor Lynne Baillie will embark upon a project which aims to mitigate some existing threats against mobile devices. The project will involve building application, system, and user behaviour profiles on mobile devices, and then methods of machine learning will be used to cluster and analyse the collected data. The resulting behaviour model will be designed to detect deviations from established patterns. For example, if the user's typing and touch gesture characteristics deviate from the established behaviour, this may indicate a 'new' user. Similarly, if the device initiates unusual network connections or employs abnormal system calls, this indicates an abnormal behaviour which requires attention as it may be malicious code or a legitimate update. The project will investigate the use of interactions with the user as one method of dealing with alarms raised by the behaviour models.

Practical authentication
Dr Mike Just is leading several related activities whose aim is to reduce the impact of authentication on users and administrators. Some of the activities relate to improved methods of authentication, and take into account features and constraints of the computing environment, e.g. multimodal authentication for mobile devices (with Nicholas Micallef). Other work (with the University of Edinburgh) involves the modelling of different authentication processes in order to better quantify properties such as security, user experience, and costs (e.g. attack costs, implementation costs) in order to support improved implementation and use.

Publications
The group's published research spans HCI, mobile application design, games and technology design in the home. Please visit the publications page on our website: **www.itt.org/publications.php**.

The group has worked with Orange, Alcatel-Lucent, Siemens, Vodafone, the Austrian Research Council, RCUK, National Museums of Scotland, NHS 24, NHS Glasgow and Deutsche Telekom.

What's next?
We are actively looking for new staff and PhD students. Please contact us at **itt_group@gcu.ac.uk** or check out our website, **www.itt.org**.

NEW CENTRE NEW CHALLENGE

Lorna McKnight, University of Oxford, introduces a new research centre exploring assistive learning technologies and reflects on the difficulties and value of researching this area.

> **Over the past decade, evolving technologies have revolutionized the way we do business, communicate, make war, farm, and provide medical treatment. New technologies are also transforming education, and in no domain more dramatically or successfully than in the education of students with disabilities.**
> Rose et al., 2005.

In November 2011, a new research centre was established at Kellogg College, University of Oxford: the Centre for Research into Assistive Learning Technologies. The aim of this centre is to explore new developments in the use of digital technologies to support learning for young people in school, further or higher education with a wide range of learning difficulties and special educational needs.

A variety of tools

Assistive learning technologies can take many forms, depending on the needs of the users and the educational goals they are being used for. Commonly used software in schools and at universities might include speech-to-text and text-to-speech tools to help learners who have literacy difficulties access information and express themselves more easily. Screen readers might be used by people with visual impairments, or they might use more specialist devices such as Braille notetakers. Mind-mapping and scheduling tools might be used by learners who struggle with organisation and time-keeping or who have attentional difficulties. A wide range of augmentative and alternative communication (AAC)

devices might be used by learners with communication difficulties.

Learners with complex needs may need to use a range of these in their daily lives. While national and international legislation mandates that people of all abilities are entitled to equal access to information and to learning, given the wide range of products available and varying levels of provision across different stages of education, learners may be using any number of tools for support, and it can be difficult to determine the best approach to take.

Literature review

One of the first tasks of the new Centre was to conduct a substantial review of research literature on the topic of assistive learning technologies and digital tools to support learners with special educational needs. This review took place over six months, covering over 100 research papers and reports from a broad range of disciplines.

Interdisciplinary approach

Many researchers in the field stress the need to take an interdisciplinary approach: following a review of literature on providing access to assistive technologies for persons with disabilities, Hoppestad (2007) states that 'no one profession should have a monopoly on research for computer access', while Langdon and Thimbleby (2010) stress the importance of taking an interdisciplinary focus to inclusive design, encompassing cognitive science and engineering, as well as understanding the social, environmental and individual factors.

A UNESCO report on innovative practice in educational technology for people with disabilities recommends that 'ICT in education for people with disabilities must be considered a "trans-sectoral" field' (Watkins, 2011). This means that any assistive technology approach must be considered at least in terms of

1 the user and their needs,
2 the technology being used, and
3 the educational context and goals that the technology aims to support.

Unsurprisingly, given the range of disciplines that might feed into this topic, one of the challenges faced by researchers in this field is the wide spread of information available from different backgrounds, and often with different expectations and terminology. Edyburn, who has produced many reviews of literature on assistive learning technologies, has often voiced the concern that researchers in the field may suffer from information overload (e.g. Edyburn, 2004).

For this reason, the Centre has set up a steering group of experts in the field who can provide support and guidance in the early stages of work. This steering group is drawn from not only interdisciplinary academics, but also teaching professionals, educational technologists and experts in supporting learners with disabilities. The Centre will draw from the wealth of their experience.

Further challenges

There are, however, other challenges to overcome when conducting research in this area. Several researchers have commented on the need for more academic rigour across the discipline (Maor et al., 2011; Gersten & Edyburn, 2007; Stevens & Edwards, 1996), and for more longitudinal studies and evidence of change that lasts beyond a short intervention (Maor et al., 2011; Hourcade, 2008; Gersten & Edyburn, 2007). It is important to consider the user, to actively involve them in the research, and to consider their context of use by also involving parents, teachers, and other gatekeepers of technology (Alper & Raharinirina, 2006; Watkins, 2011).

Assistive technologies in use

Alongside the literature review, the Centre has also been conducting initial studies of assistive learning technology use in practice. This has included visits to schools which use assistive technologies to support learners with a variety of special educational needs, and interviews with pupils and teachers, in order to build up a richer picture of how these tools can affect learning and help to build independence. Plans are already in progress to conduct more in-depth case studies of how technological solutions are being used at different stages of education and to support a range of disabled and disadvantaged learners.

Building links

Although a challenging area of research, the field of assistive learning technologies has the potential to make a significant impact to the lives of young people and a lasting effect on their future well-being, so it is a challenge we are more than willing to approach. As the Centre is still in its infancy, however, we are keen to make links with other established researchers or practitioners in this field, and we would welcome input from readers of *Interfaces* with an interest in this topic.

For more information on the Centre and for contact details, visit our website at **www.kellogg.ox.ac.uk/researchcentres/alt.php**.

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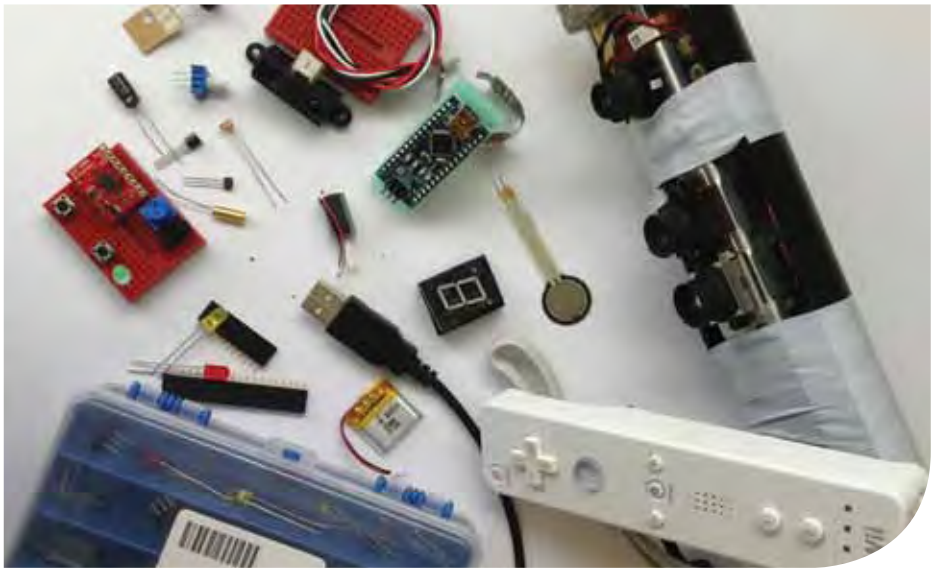

ANDREA BELLUCCI: PROTOTYPING NATURAL INTERACTION

In the HCI field many advances have been made in hardware (small and large multi-touch surfaces, smartphones with embedded sensors, Microsoft Kinect) and software (algorithms for touch, gestures, body movement detection and tracking). Now that we have the computational power and devices to do everything, the question is – *what should we do*? For the HCI community, answering this question means to design new interactive systems that are intuitive, lower users' cognitive burden and enhance the user experience. All of this is dubbed the Natural User Interface (NUI).

Whereas the classical Graphical User Interface (GUI) is operated via mouse and keyboard, NUI systems make use of heterogeneous I/O devices (motion sensors, cameras, touch surfaces, etc.) and interaction techniques (touchless, multi-touch, and tangible). In traditional desktop systems, we are accustomed to interact in an environment that inhibits our innate capabilities [1]. NUIs allow more expressive power (by reducing constraints in interaction) and therefore they are expected to provide users with better tools to think, create and communicate [2].

However, all the benefits advocated by the NUI paradigm come at a price: the design and development of new interactive systems raise challenges both of a conceptual and a practical nature. In particular, researchers in interaction design who deal with new technologies need to know different related subjects involving both software and hardware technologies. For example, they should have programming skills, know some basic electronics and also know hardware drivers, signal processing and communication protocols in order to develop prototypes for tangible and physical interaction. Mastering different areas of knowledge can be difficult and time consuming and there are very few (if any) Leonardo da Vincis out there. In my PhD thesis I address this issue, focusing on the design and development of a software framework that enables researchers and designers to rapidly create interactive prototypes for NUIs.

NUI systems

A NUI system communicates with the real world by means of sensors and emitters. Sensors convert real world inputs into digital data, while emitters are mostly used to provide digital or physical feedback (e.g. a speaker emitting sounds or a blinking LED). From the experience I gathered in implementing multi-modal interaction systems [3], [4] and [5], employing such a variety of hardware devices in a real application can be difficult because their use requires knowledge of the underlying physics and many hours of programming work. For example, a digital 3-axis accelerometer is a sensor that gives you acceleration on the three dimensions. Once you get these data, you should interpret them in order to extract some meanings. It is not so straightforward to get the rotation along the y-axis (pitch) from the raw gravity data provided.

Furthermore, integrating data from different devices can be cumbersome because any device vendor uses different programming interfaces and communication protocols. This holds true for the same device from different vendors. Imagine that you spend many hours programming the behaviour of the accelerometer of a Nintendo Wii Remote Controller and want to use the same routines in a new project with the accelerometer of an Apple iPhone. That is almost impossible, because of the different interfaces and protocols used by each sensor. These examples illustrate that there is a need for toolkits and frameworks that lighten the prototyping of interactive systems.

Prototyping

Prototypes have a fundamental role in HCI and design: they can be used to evaluate a design in its early stages, but also to foster innovation and creativity, by enabling the exploration of a design space [6]. While prototyping tools are common for classical GUIs, prototyping interaction for NUIs is still an issue [7]. Many frameworks and platforms have been built in recent years, all of them trying to ease the development of natural interaction [8, 9, 10, 11]. Surveying the existing literature, I found that existing frameworks suffer from one or a combination of two main problems:

- they target a specific device or interaction technique, and
- most of the time, they are specifically meant for developers, due to the high programming expertise needed to use them (with some exceptions [11]).

In the development of my framework, I took inspiration from the results of two research projects that try to solve these problems: d.tools [12] and squidy [13]. Both systems reduce the programming burden by offering a visual programming environment, and by supporting a wide range of input devices. Nevertheless, d.tools is not organised in a framework rationale. Moreover it does not provide support to camera sensors, such as RGB and Depth (RGBD) sensors, which are pivotal in today's vision-based NUIs. Squidy does provide a general framework and data abstraction, but not an abstraction in terms of devices.

Programming interface

At this stage of my work I aim at providing access to sensors and emitters by means of a unified, high-level programming interface that supports the rapid prototyping of interactive systems and the reuse of software components in different applications. Programming environments such as Processing (**processing.org**) and

Wiring (**wiring.org.co**) are intended to facilitate the development of interactive artefacts by providing an API for handling visual and conceptual structures as well as the communication with physical components.

However, although they provide a good level of abstraction, I noticed that they do not provide a general high-level API to communicate with different hardware components. You can interface with a sensor and get data from it, but it will only provide raw data, which you have to analyse and interpret to get some results. This is not a difficult task for a user with sufficient programming skills, but it could represent a serious obstacle for the end-user (e.g. an interaction designer or a digital artist) who simply wants to use the sensor capabilities in her project.

In this case, programming libraries written by expert users can be exploited to interface with hardware devices. For example, currently, there is a Processing library for interfacing with the Microsoft Kinect RGBD camera and there are also many code samples for getting data from other specific sensors (e.g accelerometers, gyroscopes and compasses). Nevertheless these are only examples of isolated efforts to provide libraries for managing sensor data. They do not follow the rationale of a reference architecture or framework and, for this reason, they cannot be structured in a functional API.

To this end, I have defined a general framework and a set of APIs that can be directly used by the final user (developer, researcher or designer) in her projects. Sensors and emitters are viewed as a bridge between the real world and the digital world, and the framework abstracts from the low-level details of specific devices. In this way it provides unified access to sensors and emitters, independently of their implementation or communication protocols. It defines a general and modular hierarchy where the top-level classes allow for flexible and generic access to device features. I also considered output channels for feedbacks. For example, LEDs can be employed to create ambient displays giving visual feedback, and small motors can provide haptic feedback (via a rumble feature).

Next steps

Preliminary studies with 16 Computer Science Masters students at Universidad Carlos III de Madrid, Spain, highlighted that the APIs do reduce the programming effort, measured in terms of number of errors per lines of code and task completion time. However, even if good APIs suit the needs of programmers, they are not useful for non-technical people. Now that I have the software architecture, I am designing a visual programming language for the framework, informed by interviews with product designers at Cardiff Metropolitan University, UK. The research challenge is to define visual elements corresponding to desired abstract devices and functionalities that can be used by designers for prototyping.

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MY PHD

If you are a PhD student, then we would like to hear from you. We are currently accepting one to two page summaries from PhD students in the UK and across Europe with a focus on being open and accessible to everyone in the HCI community. To submit or for more information please contact:

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INTERACTING WITH COMPUTERS

Current issue
All volumes of *Interacting with Computers* can be accessed via the ScienceDirect or Journal websites **www.sciencedirect.com/science/journal/09535438**; **www.elsevier.com/locate/intcom**.
The ScienceDirect page also gives access to accepted *Articles in Press* awaiting printed publication. These papers can be cited with a doi, and can be downloaded in full. Recently accepted papers are notified on the journal's Facebook and LinkedIn groups' pages.

The latest issues of *IwC* are part of Volume 24:

Volume 24, Issue 4 (July 2012)
Special Issue: *Presence and Interaction*
Editors: **John Waterworth**, **Eva Lindh Waterworth**, **Fabrizia Mantovani** and **Giuseppe Riva**

Forthcoming Special Issue
Organic User Interfaces
Editors: **Audrey Girouard**, **Roel Vertegaal** and **Ivan Poupyrev**
IwC Shepherd: **Kasper Hornbæk**

Special Issues
Two Special Issues are currently in preparation:

The Social Implications of Embedded Systems
Editors: **Stuart Moran** and **Irene Lopez de Vallejo**
IwC Shepherd: **Javier Bargas-Avila**

Context-driven Human Environment Interaction
Editors: **José Bravo**, **Diego López-de-Ipiña** and **Ramón Hervás**
IwC Shepherd: **Panos Markopolous**

We are not, for the moment, accepting any further proposals for new Special Issues but will start considering proposals once again in late summer 2013.

IwC news
The major news for the journal is that, from January 2013, we will have a change of publisher. *Interacting with Computers* will no longer be published by Elsevier Science but, at the behest of BCS, will join *The Computer Journal* in being published by the esteemed Oxford University Press. Arrangements for the transfer are in hand and the new site for the journal will be up and running very soon. For a notification update, see **highwire.stanford.edu/lists/future.dtl?journalcode=iwc**.

We will continue to run the Elsevier EES system in parallel until all papers submitted there before the cut-off date are processed and will widely announce the date, URL and instructions for the new *IwC* site as soon as it is available.

I welcome these new and returning Advisory Board members: **Jean Vanderdonckt**, **Andrew Dillon**, **Margaret Burnett**, and **Carson Reynolds**.

Access *Interacting with Computers* online and see the latest papers, most downloaded articles, citation statistics and calls for submissions.

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Junior Reviewers: see *Interfaces 89*

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Journal	Impact factor
ACM Transactions on Computer–Human Interaction (TOCHI)	1.833
Human Computer Interaction (HCI)	1.480
Interacting with Computers (IwC)	**1.233**
Human Factors (HF)	1.187
International Journal of Human–Computer Studies (IJHCS)	1.171
ACM Transactions on Information Systems (TOIS)	1.085
Computer Supported Cooperative Work (CSCW)	1.071
Behaviour and Information Technology (BIT)	1.011
Personal and Ubiquitous Computing (PUC)	0.938
International Journal of Human–Computer Interaction (IJHCI)	0.681

Impact factor
I am very pleased to announce the latest Impact Factor for *Interacting with Computers*. We have increased our IF to **1.233** for the year 2010 (from 1.192 for 2009) and our 5-year factor is now **1.455**.

For the first time ever we have overtaken *IJHCS* and *Human Factors and* are now third amongst the major computing journals in the table shown on the left.

Overall, in the Thompson Reuters Computer Science/Cybernetics category, we are now ranked 8th, having moved up two places since 2011.

This is great news and reflects extremely well on our authors, reviewers and editorial board members.

Many congratulations to all involved.

MASSIVE OPEN ONLINE HCI

Alan Dix, Talis and University of Birmingham, describes some of the inspirations and challenges he faces as he prepares to run a massive open online HCI course.

In the Autumn of 2012 I will be running a large-scale open online HCI course. No-one with an eye on the technology or education media can have failed to hear about the proliferation of massive online open courses (MOOCs) and other large-scale online education: Stanford-based Coursera and Udacity, MIT and Harvard's $60-million investment in edX, P2PU (peer-to-peer university), and of course Khan Academy. In the UK, Edinburgh University have recently signed up with Coursera and the Open University are building on 45 years of experience in distance education as they run a MOOC on the design of open learning (nicely circular).

Bigger picture

I am partly running the course with an author hat on, promoting HCI in new ways; but it is also because Talis are interested in the infrastructure that surrounds these courses, and how it contributes to a bigger picture of the Open Education Graph interconnecting people and learning materials.

For me there are many new challenges. I have been filmed a few times when delivering lectures, but I have never spoken 'to camera'. My first attempts used the built-in camera on my laptop, which meant that I seemed to stare at the viewer, when in fact I was looking at slides on screen, and then every so often my eyes would shift randomly away. Now I have a second camera, so I shift attention between speaking 'to camera' and speaking 'about slides'.

There are also technical issues setting up a micro-studio area in a small house (read large foldable white screen balanced precariously on the back of a chair). I note that when Sebastian Thrun and Peter Norvig started their AI class, they turned Thrun's basement into a mini-studio that was big enough for a team of 14 support staff ... there are some advantages to US-sized houses; my 'studio' is just two square yards!

Complementary education

Most online courses are aimed principally at independent learners; indeed part of the ethos is to open up education beyond institutional boundaries. This is important, and certainly something I hope to achieve, but I am also interested in the ways online education can complement traditional education. So I am actively encouraging other academics to use parts of my material within their own face-to-face courses. This may simply involve suggesting their students use online units as supplementary material. However, I hope that some will make it a more integral part of their own classes, maybe skipping lecture slots and instead telling students to study units in the online course.

Of course, delivering 'information' is the easy bit of education, just what books do well and lectures do efficiently (200 student contact hours per lecturer contact hour!). The most difficult (and expensive) parts of education are around laboratories, problem classes, seminars, exercises, formative feedback ... and summative assessment. The last of these I will avoid, but we will be looking at ways to use combinations of peer discussion and perhaps peer assessment for formative learning.

Make contact

You can sign up for the course at **hcicourse.com**. If you are interested in using it as part of your own teaching, sign up yourself, but please also get in touch directly so that we can work out ways to support you.

CALLS AND COMMUNICATIONS

Call for Participation

Ergonomics & Human Factors 2013

15–18 April 2013
Cambridge, UK

Ergonomics & Human Factors 2013 is an annual international conference and a forum for discussion and exchange of ideas and information on the latest research, development and applications in ergonomics and human factors.

We invite both academics and practitioners to participate and submit proposals for papers, case studies, short symposia, tutorials, workshops, posters/demonstrations and debates.The scope of the conference includes, but is not limited to, the following topics:

Industrial accidents	Nuclear industry
Human Factors Integration	Education
Advances in transport	Training and competence
Military equipment and defence	Future technologies
Healthcare and patient safety	Work and ageing
Green issues	Safety culture
Systems approach	Accessibility and usability
Methods and tools	Innovation and creativity
Complex systems control	Design techniques and approaches

Submission deadline: 1 October 2012

www.ehf2013.org.uk

Call for Papers

HRI 2013

4–6 March 2013
Tokyo, Japan

HRI 2013 is the 8th Annual Conference for basic and applied human–robot interaction research.

Each year, the HRI conference highlights a particular area. HRI 2013 is devoted to exploring the theme of Holistic Human–Robot development. Robotic solutions are increasingly applied to real world problems such as our ageing society, renewable energy, climate control, emergency response, education and exploration. These societal problems require a holistic approach to the design and development of robots that meet human needs, address technical challenges, and foster acceptance in everyday settings.

HRI seeks to showcase the very best interdisciplinary and multidisciplinary research in human–robot interaction with roots in social psychology, cognitive science, HCI, human factors, artificial intelligence, robotics, organisational behavior and anthropology, and we invite broad participation.

Submission deadlines

10 September 2012	Papers, Tutorials, Workshops
3 December 2012	Late breaking reports, Videos

humanrobotinteraction.org

Call for Papers

C&T 2013

6th International Conference on Communities and Technologies

29 June – 2 July 2013
Munich, Germany

This biennial meeting serves as a forum for stimulating and disseminating research on the complex connections between communities – both physical and virtual – and information and communication technologies.

C&T 2013 welcomes participation of researchers, designers, educators, and students from the many disciplines and perspectives bearing on the interaction between community and technology. The conference program includes competitively selected, peer-reviewed papers, workshops, panels, posters, a doctoral consortium, and invited speakers.

C&T focuses on the notion of communities as social entities comprised of people who share something in common: for example geography, needs, interests, practices and organisations. ICTs can interact with communities in many complex and different ways.

Submission deadlines

1 Feb 2013	Full papers, Workshop proposals
1 May 2013	Workshop papers, Posters, Doctoral consortium, Student volunteer applications

www.ct2013.cnss.de

Call for Papers

CHI 2013

31st Human Factors in Computing Systems

27 April – 2 May 2013
Paris, France

The ACM SIGCHI Conference on Human Factors in Computing Systems is the premier international conference on human–computer interaction. CHI 2013 is about changing perspectives: we draw from the constantly changing perspectives of the diverse CHI community and beyond, but we also change perspectives, offering new visions of people interacting with technology. CHI brings together students and experts from over 60 countries, representing different cultures and different application areas, whose diverse perspectives influence each other.

CHI 2013 welcomes works addressing research on all aspects of human–computer interaction (HCI), as well as case studies of interactive system designs, innovative proof-of-concept, and presentations by experts on the latest challenges and innovations in the field. In addition to a long-standing focus on professionals in design, engineering, management, and user experience; this year's conference has made special efforts to serve communities in the areas of: design, management, engineering, user experience, arts, sustainability, children, games and health. We look forward to seeing you at CHI 2013 in Paris!

Submission deadline: 19 September 2012

chi2013.acm.org

CALLS AND COMMUNICATIONS

Call for Participation

Tiree Tech Wave 4

25–29 October 2012
Isle of Tiree
Scotland, UK

The Atlantic fringe was the haven of scholarship through the Dark Ages and is the haunt of wind-surfers today. Those of us at the edge of the digital wave do not risk cold seas and bodily injury, but there is something of the same thrill as we explore the limits of code, circuit boards and social computation.

Tiree Tech Wave offers a time to step out momentarily from a target-driven world, to experiment and play with hardware and software, to discuss the issues of our new digital maker culture, and above all to make things together.

Bring your soldering iron, and Arduino boards, your laptop and API specs, your half-written theses and semi-formed ideas, your favourite book or even well-loved eReader. The format will be informal, with lots of time to work hands-on, and the opportunity for short talks, demos and how-to sessions.

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BCS Interaction Group is served by representatives from a broad range of academic and industrial centres of HCI interest. The sub-groups liaise informally every few weeks to progress work, and all participants are committed to promoting the education and practice of HCI, and to supporting HCI people in industry and academia. For contact details of the person most relevant to your needs please see below.

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