Uncomfortable Interactions

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ABSTRACT
We argue for deliberately and systematically creating uncomfortable interactions as part of powerful cultural experiences. We identify the potential benefits of uncomfortable interactions under the general headings of entertainment, enlightenment and sociality. We then review artworks and performances that have employed discomfort, including two complementary examples from the worlds of entertainment and performance. From this, we articulate a suite of tactics for designing four primary forms of discomfort referred to as visceral, cultural, control and intimate. We discuss how moments of discomfort need to be embedded into an overall experience which requires a further consideration of the dramatic acts of exposition, rising action, climax, falling action, and dénouement. Finally, we discuss an ethical framework for uncomfortable interactions which leads us to revisit key issues of consent, withdrawal, privacy and risk.

Author Keywords
Discomfort, pain, suffering, visceral, culture, performance, rides, live art, entertainment, control, voyeurism, ethics

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INTRODUCTION
HCI's engagement with cultural experiences such as art installations, performances, guides and games has inspired some unconventional approaches that turn traditional interactional design on its head. Notable examples include celebrating the role of ambiguity rather than clarity [15], provoking interpretation rather than giving information [33], and transforming system limitations into resources through 'seamful design' [5]. In this paper, we explore a further unconventional approach that arises in cultural experiences – deliberately engineering discomfort as a way of creating intense and memorable interactions and

engaging with dark and challenging themes. Discomfort is generally considered 'bad', being a mild form of pain (physical or emotional) and traditional usability-focused interaction design would try to minimise it. In contrast, we shall argue that *uncomfortable interactions* – carefully and ethically managed – are an important tool in a designer's armoury that can help realise positive long-term values related to entertainment, enlightenment and sociality.

Our initial motivation for writing this paper arose from many years of working with artists to create, tour and study interactive artworks, during which time we were often questioned about their seemingly 'dark' nature, and our own ethical position. In what follows, we draw on this experience, literature from HCI and performance studies, and also on two recent projects, to reveal how discomfort can be creatively engineered across a range of experiences from highbrow art to mainstream entertainment. In so doing, we answer the following key questions:

- What are the potential benefits of uncomfortable interactions?
- What forms can such interactions take?
- What tactics can be used to create discomfort?
- How can uncomfortable interactions be embedded into an overall cultural experience?
- What ethical frameworks can guide us when employing discomfort in these ways?

These questions, taken in turn, define the structure of our paper. Our contribution in answering them is to sensitise HCI to the potential value of uncomfortable interactions as part of designing cultural experiences while also providing guidance as to how this can best be achieved in practice.

WHY UNCOMFORTABLE INTERACTIONS?
Uncomfortable interactions are those that cause a degree of suffering to the user. This may be physical suffering such as physical stress, tiredness or pain, but might also involve mental suffering due to fear and anxiety, either experienced directly or empathically on behalf of others. Our core argument is that these kinds of uncomfortable interactions may be usefully designed into cultural experiences, rather than merely being accidental side effects of them. This is not to say that the overall aim of such experiences is to create discomfort, but rather that uncomfortable interactions may be a useful 'means to an end' – a way of promoting certain other benefits, values or worth [6] as we

now discuss. Specifically, we propose that uncomfortable interactions can benefit cultural experiences in three ways: entertainment, enlightenment and sociality.

Entertainment

Many of us have a fundamental need for stimulation, arousal and excitement and this has fuelled the development of increasingly varied, and debatably ever more extreme, forms of entertainment for many years. It can be argued that such entertainments fill the void created by the "civilising process" [12] in which we are increasingly removed from the direct experience of violence and related suffering in our everyday lives. Uncomfortable interactions can enhance entertainment in several ways. First, physical discomfort may be an important part of thrill, for example for rollercoasters or 'sports' such bungee jumping that involve extreme accelerations, sudden drops and inversions. In such cases, feelings of thrill may arise from a combination of fearful anticipation, followed by an extreme physical sensation, and then the euphoria of relief at having survived [35]. Narrative-based entertainments often rely on the uncomfortable feeling of suspense that arises through the anticipation of dangers to come (especially when known to the viewer but not the protagonist), again a temporary sensation that is followed by a more pleasurable resolution. Such experiences demonstrate a complex relationship between pleasure and suffering that, if carefully designed, may stimulate powerful emotions. Moreover, we suggest that discomfort may naturally tend to focus the participant's attention inwards onto their own feelings, increasing the subjective intensity and memorability of the experience. We propose that this may serve to heighten the deep focus or singled-minded immersion that is associated with the psychological state of flow in experiences [7]. Put simply, the 'fun' of entertainment relies on a far richer gamut of sensations that just pleasure alone.

Enlightenment

While they may certainly entertain, artistic experiences tend to reflect values other than raw excitement, and uncomfortable interactions may bring benefits here too. Human suffering is a powerful and recurring theme among art works, and as such works become more interactive, so there is the question of whether our interactions with them should somehow reflect this discomfort. We propose that uncomfortable interactions may help establish an appropriate tone for engaging with dark themes, demanding a deep personal commitment, reducing the risk of trivialisation, and in turn, promoting empathy and respect.

Another way in which discomfort may lead to enlightenment is through interpretation. Sengers and Gaver have discussed how interactive artworks tend to provoke interpretation rather than directly giving information [33]. One way of achieving this is through the deliberate use of ambiguity, including 'ambiguity of relationship' in which the participant's relationship to the experience becomes subject to interpretation [15]. Experiences involving discomfort naturally establish an ambiguous and provocative relationship with their participants: is this meant to be a pleasurable or painful experience? How do I judge an experience that is presented as being dangerous in some way and yet must surely be safe given its context (an arts venue or theme park)?

Widening our perspective, there are important areas of human endeavour in which suffering is related to personal enlightenment, including religious and spiritual practices such as abstinence, fasting, asceticism and mortification of the flesh. Discomfort can be an important factor in self-expression, from the extreme postures and movements in some dance and sports in which the body is seen to be stretched to its limits, through to self-expression through body art such as tattoos and piercings.

Sociality

Confronting and sharing discomfort may be a powerful social experience and driver of social bonding, not least through shared rites of passage. Initiation rituals that involve enduring social or even physical discomfort are to be found in many settings and cultures. In an everyday entertainment context, studies of theme park visiting have highlighted how some families treat first thrill rides in which a young rider passes through an uncomfortable experience as a rite of passage that needs to be documented and celebrated [10]. Others have stressed how watching horror movies can be a rite of passage for groups of adolescent boys [16]. The same principle can be seen in team development activities in which groups must work together on unusual tasks, often of a challenging physical nature. Social bonding around discomfort extends to audiences witnessing the public discomfort of others. While this could reflect the baying of the crowd in a gladiatorial arena (or modern sports stadium), there is also scope for more personalised and empathic approaches, as demonstrated by a wearable telemetry system that enabled friends and family members to tune in to an individual rider's personal experience of an amusement ride [31].

Having extolled the potential benefits of designing uncomfortable interactions, the remainder of this paper will explore the detail how this can be achieved in practice. We will need to draw upon a range of examples to illustrate our discussion, and so the following section first undertakes a brief review of uncomfortable interactions in HCI and the performing arts, and introduces two illustrative examples in greater detail.

EXAMPLES OF UNCOMFORTABLE EXPERIENCES

Traditionally, HCI has espoused the cause of usability and its sub-goals of time to learn, speed of performance, rate of errors, retention over time, and satisfaction [32]. In exploring the tradeoffs among these, some have argued that deliberately disadvantaging users in some ways may actually bring benefits in others (e.g., introducing delays may promote planning [29]). In its recent turn to the arts and entertainment, HCI has broadened its focus to cover aesthetic and emotional design values associated with the 'user experience' [24], including 'fun' [26]. In turn, this has

lead to proposals for new design approaches involving ambiguity [15] and provocation [33] as noted earlier. However, while delaying interactions or provoking interpretation could be thought of an introducing a mild degree of discomfort in the form of frustration, the general approach of deliberately and significantly discomforting users has not been widely discussed within HCI – even though it has been practised.

There is, however, a longstanding tradition of employing quite extreme forms of discomfort within the arts, especially the performing arts, and it is to those that we now turn for examples to inform our discussion. The performing arts have always contained elements of discomfort due to their origin in ritual which often included sacrifice. However, it was in the 1930s that Bertold Brecht explicitly announced that theatre should contain some level of *Verfremdung* (alienation), causing unease or discomfort by encouraging the audience to look at something or someone from another's perspective, thus raising political awareness of social and power structures that would otherwise have been overlooked [4].

In the latter part of the 20th century one sees a series of landmark performances that pushed the boundaries of discomfort. Marina Abramović's *Rhythm O* (1974) was a six-hour performance in which the audience were encouraged to use a series of objects on Abramović's body that included a gun, a bullet, a pocket knife, an axe, and matches. While the physical discomfort in this case was primarily experienced by the performer, who was cut, denuded and even had thorns pressed into her flesh, emotional discomfort was experienced by the audience, whether they acted on Abramović's instruction or simply observed others performing the piece. More recently, the artist Stelarc has created a series of performances in which audience members observe his suspended body being moved and controlled by machinery, and in one case remotely controlled his body via electric stimuli [34]. Other notable works used physicality in a way that required the audiences themselves to take risks and experience discomfort such as Abramović and Ulay's, *Imponderabilia* (1977), where the audience had to enter the gallery by pushing through the narrow space created by the naked bodies of the two performers who stood against opposing walls facing each other. Yet others have invited audiences to take risks and experience discomfort and even fear, such as Vito Acconci's *Project for Pier 17* (1971), in which he invited the audience to individual night time meetings on a derelict pier during which he confessed to them something he had never told anyone before.

Closer to home, various HCI-related papers have described interactive performances that would appear to involve elements of discomfort. Themed on the first Gulf War, *Desert Rain* (1997) involved militaristic briefings, participants being lost in a virtual world, and then having to decide whether to leave a colleague behind [20]. *Uncle Roy All Around You* (2003) led participants to be lost and alone in a city and then required them to take apparently risky decisions such as getting into a strange car as part of an engagement with the themes of trust and surveillance [2]. *The Meatbook* (2007) was an interactive artwork that required users to touch and manipulate rotting raw meat [21]. *Fairground: Thrill Laboratory* (2008) employed a wearable telemetry system to enable spectators to tune in to the experience of riders on extreme fairground rides [31]. *I Seek the Nerves Under Your Skin* (2010) required participants to run increasingly fast to the limits of their endurance in order to listen to a frantic punk poem [22]. Through the use of an instrumented physical suit, the performance *Mediated Body* (2011) transgressed conventional social norms by requiring participants to touch and stroke a performer's body in public view in order to explore an interactive soundscape [18]

While artistic performances such as these may push the boundaries, discomfort is also to be found in mainstream entertainment. An obvious example is thrill rides in amusement parks which often involve stressful movements and extreme accelerations. A further discomfort lies in the fearful anticipation of the ride, often deliberately hyped up while queuing, and which may also spill over to spectators, especially when parents watch children. A series of computer games has employed controllers that deliver electric shocks to players including: joysticks used in reaction time and duel games; electrified arm and elbow pads for an arm wrestling game; and an electrified shock ball that is passed from player to player in a 'hot potato' game [11]. Within HCI, there is a growing thread of interest in exertion games that involve physically demanding and potentially uncomfortable interactions such as punching, kicking and hanging from the ceiling [27]. Finally, as with artistic performances, games and rides often reflect dark themes, and so may cause discomfort through fear or perhaps more likely through engaging with (or being seen to engage with) material that is morally or socially problematic, for example involving people being killed or tortured.

Even this very brief look into the realms of the arts and entertainment is sufficient to remind us that discomfort is routinely employed within all manner of cultural experiences. It also suggests that discomfort is a complex phenomenon, involving combinations of physical, cultural, psychological and social factors. In order to properly ground a more in-depth exploration of discomfort in relation to interaction design we now introduce two illustrative examples that address different combinations of the benefits that we identified earlier.

Breathless
Our first example, *Breathless*, focuses on entertainment and sociality in the mainstream setting of an amusement park. At its heart is a novel interaction technology that is deliberately designed to create a new element of fear and discomfort into rides – a gas mask that is enhanced with respiration sensors and Wi-Fi so that visitors can interact

with rides by breathing. A previous study of a bucking bronco ride that was controlled by via a chest-strap breathing monitor had highlighted the potential of using breathing to control rides and especially how this requires riders to simultaneously battle the ride and their own bodily response [23]. *Breathless* extends this approach by embedding the breath sensors into a gas mask which is used to drive a large powered swing. A selected respiration monitor transmitted breathing data to a ride control computer which in turn, actuated a rope swing, pulling it backwards when the rider inhaled and forwards on exhalation. Due to the natural pendulum nature of the swing, this required a human to breathe in harmony with the swing's resonant frequency to make the swing go higher. The swing length was chosen to resonate at a comfortable breathing rate of 12 breaths per minute. This core idea was embedded into an overall ride experience whose design was inspired by Jean-Honore Fragonard's paining *The Swing* (1767) which reportedly depicts an erotic scene involving three people: a woman riding the swing, a voyeur in the bushes watching the woman's exposed legs, and a bishop controlling the swing via a pull rope. This was mapped onto a ride structure in which each participant moved between three distinct roles: voyeur, rider, and controller.

On arrival, each participant joined a queue, to be fitted with a gas mask when they reached the front. They were then taken to a specific viewpoint where they became the voyeur, watching a floodlit rider swinging in front of them. Once the ride stopped, this rider dismounted and was taken to a seat next to the swing to become the controller. In turn, our voyeur was now led to the swing to become the new rider. At this point the floodlight was extinguished and the controller was now spot-lit from above while they initially controlled the swing, with the rider at their whim. After a while, control of the swing passed over to the rider, which would often involve a noticeably jerky moment of transition if their breathing was out of sync with its movements. After roughly two minutes, the ride stopped, the rider was moved to assume the role of the controller and our new voyeur became the next rider.

Breathless was deployed over the course of an evening in a large studio space to an invited audience, during which time 50 participants experienced the prototype ride.

Figure 1. Rider on the Swing and Controller behind

Ulrike and Eamon Compliant
Our second example focuses on enlightenment by engaging participants with a dark and challenging theme, while also involving an unusual and discomforting form of sociality. The performance *Ulrike and Eamon Compliant* created by the artists Blast Theory invites participants to follow the stories of either one of two terrorists, Ulrike Meinhof, who belonged to the Red Army Fraction that was active in Germany in the 1970s and committed suicide in prison in 1976, and Eamon Collins, an active member of the IRA in the 1970s and 1980s, who was murdered in the late 1990s [3]. The work was created for the 53rd Venice Biennale in 2009 and has subsequently toured to several other cities. In Venice, Participants began at Palazzo Zenobio. Following an induction, they were invited to walk along a narrow corridor where they could read the biographies of Meinhof and Collins. They then entered a plywood chamber through which tiny holes had been drilled to allow observers to see in from the outside. Here they found a plasma screen, a shelf holding a phone and a pair of sunglasses, and a set of instructions inviting them to call a phone number. Once contact had been made, they were asked to remain on the line, stand in the middle of the room, don the sunglasses and look at the screen. A person appeared on the screen, and they were asked whether they would like to be Eamon, 'a customs agent from Northern Ireland with four children', or Ulrike, 'a journalist and single mother based in Berlin'. Having made their choice, they were asked to leave the building, turn left, and wait for another call.
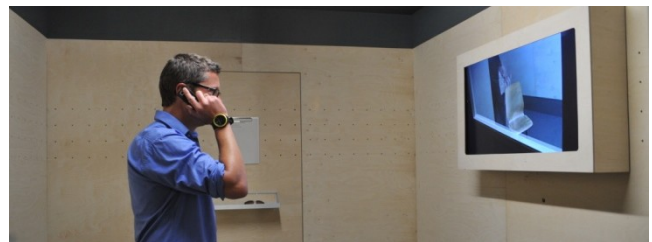
Figure 2. Making the initial phone call (Blast Theory)

Each participant was then guided on a walk through the city during which they received a series of further pre-recorded phone calls that narrated the life story of either Ulrike or Eamon (depending on their choice), detailing the events that led to their terrorist acts, their subsequent arrests and interrogations, and ultimately to their deaths. These were mixed with instructions as to where to go, but also how to behave. For example, one call asked participants to stand in the middle of a bridge, look for some church towers, and touch their heads if they could see them. Such instructions were designed to establish a sense of constant surveillance and increasing compliance. At another point, participants were asked to record a message, referring to themselves as Ulrike or Eamon, and at two further points were offered the option of withdrawing from the experience altogether.

Eventually, participants were guided to a deserted and dirty alleyway leading to a canal. Here, they were asked whether they could make one final commitment. If they chose to continue, they were guided to the abandoned Ludovico

Church where a performer was waiting for them. If they didn't, the experience would stop and a final call told them how disappointing it was that they had not taken responsibility for their actions. Those who went to the church were led to a replica of the room in which they had started, containing two chairs and with the screen replaced by a mirror. The performer then conducted an interview during which they explored the participant's view of terrorism leading to the question: "Could you imagine a situation in which your community was being attacked; people coming into your community and killing neighbors, friends, at random. Could you imaging a situation then where you might fight?" As they were led away from the interview, they were invited to wait behind the (one way) mirror to watch the next participant being interviewed.

Figure 3. The final interview (Blast Theory)

DESIGNING UNCOMFORTABLE INTERACTIONS

Our next step is to map out how uncomfortable interactions may be delivered in practice, drawing out from our various examples a range of design tactics. In order to lend a coherent structure to our discussion, we group these tactics under four principle forms of uncomfortable interactions: visceral discomfort, cultural discomfort, discomfort through control, and discomfort through intimacy, each of which can also be related to areas of more mainstream thinking within HCI. We recognize that these cannot be treated as strictly orthogonal or separable dimensions – there are complex relationships between the physical and cultural aspects of what we may find disgusting for example – rather our intention is to provide a tractable framework for approaching what turns out to be a multifaceted concept.

Visceral discomfort

HCI has become increasingly interested in the embodied and physical nature of interaction [9], and so the first form of discomfort we consider is visceral, which refers to those aspects that most directly relate to physical sensation, from the unpleasant feel of materials, to demanding stressful or strenuous movements, to causing pain. Previous projects suggest three tactics for creating visceral discomfort.

Design unpleasant wearables and tangibles – the first is to create devices that are uncomfortable to touch, hold and especially to wear, as the weight and sensation of technology on the body may be unusual and discomforting. The striking physicality of the gas mask used in *Breathless* provides a compelling example of this tactic. Gas masks are uncomfortable to wear, especially for the uninitiated, with a close physical fit and overpowering rubbery smell. They soon become hot and tend to fill with sweat, dripping down the face in a disturbing way. Highly restricted visibility can be disorientating, especially as the eye-holes have a tendency to fog. The claustrophobic nature of the mask may also create a fear in participants that the experience might cut off their breathing. The often lengthy process of donning wearable technologies can heighten anticipation as reported in [31] (and may require intimacy with strangers as we discuss later). Thus, in general, designers may wish to choose materials that are rough, tight, prickly, sweaty, or otherwise physically unpleasant. This extends to the design of graspable interfaces as illustrated by *The Meatbook*.

Encourage strenuous physicality – our second tactic is to relate interaction to unusually strenuous physical activity. Rollercoasters and other thrill rides routinely place unusual physical stress on the body through the experience of high G-forces and movements such as inversions, rolls, suspensions and drops. In a different vein, *I Seek the Nerves* encouraged participants to run to the limits of their physical ability and comfort; a tactic that reflects a growing interest in 'exertion games' within HCI [27], although the aim here was to use discomfort to create intensity rather than promote wellbeing through exercise.

Cause pain – a final obvious, but especially challenging, tactic for creating visceral discomfort is to cause pain. Our review covered several examples of this, from the extreme theatre of Marina Abramović and Stelarc, to game controllers that deliver electric shocks during everyday entertainment. The most effective tactic here is likely to involve delivering 'acute' (in the sense of transitory rather than especially strong) pain rather than 'chronic' (long term) pain, and to create pain without causing significant or lasting physical damage – thus low-level electric shocks to physical extremities may be an acceptable approach.

Cultural discomfort

HCI has also recently taken a turn to the cultural to help explain the nature of interactive experience, and here we can also seek out discomfort by creating interactions that invoke dark cultural associations.

Confront challenging themes and difficult decisions – one tactic here is to confront participants with difficult decisions involving culturally challenging issues. Thus, *Ulrike and Eamon Compliant* draws upon terrorism, while some other works we mentioned addressed warfare and surveillance. More generally, the cultural acceptability of material that is considered adult, difficult or vulgar provides a significant (and continually shifting) boundary for discomfort. While traditional media such as books and films have long dealt with such material, for example in horror and erotica, interactive works may raise the level of

discomfort by requiring users to directly take moral decisions and resolve dilemmas. Thus, *Ulrike and Eamon Compliant*, employs the tactic of pausing to explicitly ask the user whether they wish to keep going, suggesting that they are crossing a significant boundary, and also asks them whether they would ever engage in acts of terrorism.

Design culturally resonant devices – cultural associations extend beyond the content of the experience to the form of the interface itself, including to the design of devices. Thus, in addition to visceral discomfort, the gas masks may invoke chilling associations with, or even direct memories of, warfare, civil unrest for some, or perhaps alternatively of bondage and erotic play for others. Such resonances are very culturally specific and so require a nuanced appreciation of the experience of participants and the context of use. Very different cultural resonances will be invoked when gas masks are deployed in a horror maze, fetish-themed nightclub, or war museum.

Discomfort through control

A central concern of HCI is the nature of control of the interface, and here the general thinking has been that the locus of control should remain largely with the user [32]; in other words, it is generally good when people control the interface rather than the interface controls them. Thus, our third kind of discomfort, and one that is fundamental to interactive experiences, involves distorting this typical balance of control. We suggest that participants may become uncomfortable when giving up control, or indeed assuming an unusual degree of control.

Surrender control to the machine – part of the thrill of amusement rides such as *Breathless* lies in giving up control to the machine; being strapped in and unable to get off no matter what transpires. Interactive experiences open up new possibilities here through the tactic of giving the user partial control, or perhaps inexorably leading them to a crucial tipping point at which they lose control. Thus, the study of the breath-controlled bronco ride emphasized the powerful feeling of simultaneously battling to control both the ride and one's own body, and ultimately losing control of both [23]. Inspired by discussions of ambiguity in HCI, a possibility is to emphasise the frustration inherent in unpredictable control and surprising system responses, while the reverse approach of overly precise control may also create discomfort through extreme compliance.

Surrender control to other people – theatrical performances typically involve surrendering control to the performers, which may engender uncomfortable feelings of helplessness, disempowerment, or more neutrally a lack of responsibility. This is a familiar tactic from many everyday performances, for example where comedians single out members of the audience. *Ulrike and Eamon Compliant*, however, involved a far deeper surrendering of control, with participants complying with actor's detailed instructions and having to visibly acknowledge their own compliance with these. Similarly, part of the discomfort of *Breathless* arises from surrendering control to other participants as well as to the ride.

Require participants to take greater control – there is discomfort to be found in assuming greater control of others as this may invoke feelings of power, responsibility, capriciousness or mischief. Thus, *Breathless* requires participants to control others as well as being controlled, while *Uncle Roy All Around You* invited online participants to try and take control of those on the streets of a remote city [2]. In short, perturbing the usual balance of control in interaction by requiring participants to assume either greater or lesser control over the computer and/or others may be a major cause of discomfort.

Discomfort through intimacy

Another facet of interaction that is especially ripe for discomfort is intimacy. Various HCI papers have promoted the cause of intimate interactions and presented a wide variety of prototype interfaces, typically with a view to enabling emotional connectedness and relief from stress or anxiety [17] or sexual fulfilment and wellbeing [1]. However, intimacy is a tricky business, and offers plenty of scope for engineering discomfort by distorting the social norms around which it is negotiated.

Isolate people – our first tactic here is to deny the comfort of intimacy by isolating people from the social support of friends and family, leaving them alone in an unfamiliar environment. Not only is isolation disturbing, but it also naturally focuses participants inwardly on their own feelings (self-intimacy). *Ulrike and Eamon Compliant* demonstrates this tactic in its solo exploration of the city. The gas masks achieve a more localised isolation, cutting people off from awareness of their immediate environment, anonymising them, and reducing their ability to communicate with others (especially through facial expressions), focusing them instead on the sound and sensation of their own breathing.

Establish intimacy with strangers – at the other extreme, intimate encounters with strangers such as performers can be very uncomfortable. Thus, the final one-to-one interview in *Ulrike and Eamon Compliant* is an especially challenging moment in which participants are confronted with the unknown in a very direct and personal way; the anonymity of being in a large audience is suddenly stripped away and reactions are laid bare in a direct one-to-one encounter. Taking a step further, *Mediated Body* required participants to physically touch the performer's body, demand an unusually high level of intimacy with a stranger.

Employ surveillance and voyeurism – there has been a growing discussion in HCI about the role of the spectator in interactive experiences [30] and this too can be exploited as a source of discomfort. One approach is to emphasise the sense of vulnerability inherent in being surveilled, especially by unseen observers as implied by the instructions in *Ulrike and Eamon Complaint*. This tactic can also be seen in *Mediated Body* whose unusually intimate interactions were performed in front of a watching

audience. There is also discomfort to be found in watching others. The study of the ride telemetry system in [31] reported an incident in which the ride controllers had to watch a rider pleading for the ride to be stopped on behalf of another. This tactic might exploit the helplessness felt when watching loved ones enduring discomfort without being able to intervene or even comfort them (thereby distorting conventional intimacy by making it unidirectional). The reverse is the illicit thrill of voyeurism exploited by *Ulrike and Eamon Compliant* when participants are invited to look through the one-way mirror at the next participant being interviewed. This may become especially uncomfortable when they voyeur is aware they may also being watched.

EMBEDDING DISCOMFORT INTO EXPERIENCES

So far, we have identified various forms of discomfort that are relevant to HCI along with specific tactics for realising them. By relating these back to our various examples we have also shown that a single experience may employ several such tactics. *Ulrike and Eamon Compliant* confronts the challenging theme of terrorism, involves surrender of control through compliance with instructions, and moves between moments of isolation (exploring the city), intimacy (the interview) and voyeurism (looking back). *Breathless* exploits the visceral discomfort and cultural associations of gas masks while also playing with surrender of control to the ride and to others, and also employing isolation and voyeurism. In other words, our tactics are clearly used in combination.

But there is more to the matter than just this; the tactics are also only applied at particular moments during eachexperience. We need to remember that discomfort is not the overall goal, but rather a momentary point on a journey. Again, we can draw on long-established knowledge from the field of performance studies to help us understand this. The Renaissance saw the development of the classic five-act performance structure consisting of exposition, rising action, climax, falling action, and dénouement as visualised in Gustav Freytag's pyramid (Figure 4), which was based on Aristotle's earlier three act structure [13]. This structure provides us with an elegant way to approach embedding uncomfortable interactions into experiences.
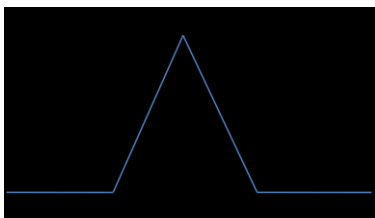
Figure 4: Freytag's pyramid

Exposition: first, is the importance of the initial framing of the experience (marketing, briefings and queuing) and how this sets up an uncomfortable anticipation from the very outset. In performances such as *Ulrike and Eamon Compliant* the exposition takes the form of an initial briefing, usually delivered in serious tones, that serves to build anticipation of what is to follow. Rides are thoroughly branded and marketed, including strong visual thematising, making tactics related to cultural discomfort especially relevant at this stage.

Rising Action: anticipation of discomfort increases as the experience proper begins and suspense gradually builds. In *Ulrike and Eamon Compliant* this occurs when stepping out of the building and waiting for the phone call. Instructions are then given gradually, so that the suspense is protracted for almost the entire duration of the piece. Rides often begin slowly, crawling through initial scenery that presents the 'backstory' to the ride, before slowly ascending a ramp towards the first drop. Tactics of intimacy may come to the fore here, for example with participants being able to tune into the experiences of those ahead of them.

Climax: this marks a climactic moment of a particular discomfort in which anticipation turns into actual experience, for example the initial drop during a ride or a face-to-face encounter with a performer. Two important principles guide the design of this climactic moment. First, it must be transitory, both in terms of being relatively brief compared to the duration of exposition and rising action, but also in that its effects soon pass. Thus, electric shock game controllers deliver short shocks after long periods of suspense, while the initial drop on a rollercoaster lasts a matter of seconds compared to maybe an hour of queuing. The feelings of nausea that sometimes arise on rides, and that may linger for a considerable time, demonstrate the importance of this principle – it seems unlikely that anyone would deliberately design a coaster to cause nausea.

Falling action: following the experience of discomfort naturally comes a moment of release or catharsis. This may be associated with feelings of intense pleasure, even euphoria. The experience may seek to extend this for a while, for example adding some gentle curves or smaller drops to the end of a ride.

Dénouement: finally, is the critical importance of reflection afterwards which provides opportunities to assimilate the experience of discomfort, share it with others through storytelling, further deepen any new insights, or simply to enjoy the bragging rights of having passed through a rite of passage. We argue that it is especially important (but often neglected) to design in explicit moments of reflection such as opportunities to meet other participants or acquire documentations such as souvenirs, photos and videos (e.g., [10]). This is especially true in experiences that make extensive use of isolation, as participants will have had little opportunity to discuss a possibly highly subjective experience with others. Tactics of control and intimacy may be especially applicable here as experienced participants will be in a position to control others and may be able to reflect through doing so.

We note that while discomfort may rise, peak and fall according to this dramatic structure, various forms of discomfort can be experienced throughout and indeed, as

we suggested, some tactics may be more relevant to particular 'acts' that others. Moreover, experiences will often involve multiple peaks in which participants experience successive discomforts, for example successive dilemmas, encounters, physical shocks and so forth.

THE ETHICS OF UNCOMFORTABLE INTERACTIONS

Deliberately introducing discomfort – in whatever form – into an interactive experience requires careful ethical consideration. Obvious reference points are Garfinkel's social breeching experiments [14] and Stanley Milgram's experiments to investigate the extent to which ordinary people might obey the orders of an authority figure to cause pain to a stranger by administering electric shocks [25]. Experiments such as these prompted debates about the ethics of deception and placing subjects in distressing situations and, along with the Stanford Prison Experiment [36], were instrumental in shaping the governance of research involving human subjects. In a US context, incidents such as the Tuskegee Syphilis Experiment [19] led to the establishment of Institutional Review Boards (IRBs) which, while initially focused on medical trials and experiments, now encompass much research involving human subjects. However, this expanding role has not been without debate, especially in the social sciences where researchers have expressed concerns about the models of ethics used and the restrictions imposed by IRBs [28].

At first glance, by arguing for discomfort as a principle of interaction design, we might appear to be flying in the face of professional practice. In response, we might argue that there are significant differences between the ethics of experimental HCI and what we are doing here. We might claim that our proposals draw on a quite different tradition from art and performance that cannot readily be shoehorned into current governance models based on experimental and medical ethics. However, to be credible, such arguments must also set out alternative ethical positions.

Justifying uncomfortable interactions

In the following we consider three broad justifications for uncomfortable interactions, two from the perspective of the experience designer, and a third from that of the researcher.

Most ethical systems would consider discomfort as something to be avoided or reduced where possible. This is particularly explicit in Epicurus, who identifies *aponia*, the absence of pain, as an intrinsically "good" thing and a goal of life. Jeremy Bentham in his utilitarian philosophy defined pleasure as intrinsically good and pain as intrinsically bad (and therefore to be avoided) [8]. While deontological ethical systems are based on an axiomatic definition of the *rightness* or *wrongness* of actions, independent of their consequences, our approach to uncomfortable interactions is instead more grounded in a consequentialist approach which assess the goodness of an action solely in terms of the goodness or otherwise of its consequences. Adopting this point of view, our first justification for a degree of short-term discomfort lies in longer-term benefits to participants of entertainment, enlightenment, and sociality. We might ask ourselves, in effect, will the participant be *happy* with hindsight with what occurred? Or perhaps more generally, given what they know afterwards would they have chosen to take part? Thus, an experience dealing with the topic of genocide might be quite traumatic and rather *unhappy*, but none-the-less considered ultimately valuable and "worth-while".

A second justification for uncomfortable interactions lies in an individual's right to choose. Contemporary western ethics and human rights follow Immanuel Kant among others in assigning a primary value to the individual, and in particular to their free choice and self-determination, which may include the right to *choose* discomfort for themselves if they wish (at least subject to limitations of its impact on others and assuming that they are in some sense competent to make this decision). This might be sufficient ethical justification for employing discomfort that was clearly chosen by the participant, for example by choosing to ride a rollercoaster (and assuming that they understand what it does, or at least could have found out if they wished to). More generally, this might justify a range of discomfort in art, performance and new media, where it can be argued that the viewer or participant can reasonably expect it given available knowledge of the genre, artist, or venue. However, the same principles of individual value and autonomy also *dis*allow the arbitrary imposition of discomfort on another, at least against their will. Moreover, as interaction designers, we might ourselves be uncomfortable with justifying discomfort solely on the basis of a participant's consent.

Of course, some of the examples of uncomfortable interactions that we presented in this paper have also served as HCI research projects, leading us to a third potential justification for discomfort in terms of contributing to the common good by increasing knowledge. This is not generally our focus in this paper, where we have argued for the benefits of uncomfortable interactions to the cultural experiences themselves. However, we recognise that in cases where art works are also part of research projects, the researchers involved, who may often also be developers of the work, must also apply appropriate principles of research ethics. Such works therefore operate within two overlapping ethical frames: one governing the participant's experience during the work, accountable to various cultural and public bodies and public taste; and the other governing how this experience is captured, analyzed and published as research, accountable to research institutions, funders and of course, the public. This radical difference between artistic/cultural goals and research goals, including the need to balance the two, means that, while similar underlying principles may apply, some specific ethical issues that are well known to HCI need to be revisited.

Informed consent

The idea of informed consent, which is a lynch-pin of experimental and medical ethics, can be difficult or impossible to achieve in a straight-forward way in the sorts

of experiences that we are considering. One legal perspective on informed consent is that is the transfer of risk – and to the extent possible, liability – from the experimenter to the subject. In the experiences that we are considering there may be discomfort, but there will not be the same level of risk that there may be in, for example, an experimental medical intervention. Consequently, the appropriate level and form of consent may be quite different, for example wrapped up in the initial choice to "go on a ride". This is not to say that participants don't consent in an informed way, but rather that this is achieved through the initial advertising, ticketing, content and framing of the work rather than through explicitly asking for consent. This framing may include the use of various rating scales to indicate appropriate age ranges for engaging with content or physical requirements such as minimum heights and health warnings for rides.

Beyond general warnings however, there are clearly cases where, at least in detail, the participant *cannot* know in advance what discomfort(s) they are signing up for, for example, with tactics that involve uncertainty or surprise. This is further complicated by often wanting to play up the anticipation of discomfort over and above its actual experience, in which case the participant believes themselves to be signing up for something worse than they will actually experience (although this would seem preferable to the reverse). The core question here is can one achieve an appropriate framing of the experience that in effect defines a common understanding or contract (but often unwritten) between designer and participant which is consistent with the discomfort experienced?

Another factor here is peer pressure. In recognizing the importance of social bonding, and especially of 'rites of passage', we need to be aware of the likelihood of considerable personal social pressure on participants to take part. Some members of groups may be more nervous than others and we may wish to be careful about designing experiences in which the leader determines the level of discomfort for a group.

The right to withdraw
The right to withdraw at any time is another cornerstone of experimental ethics. However, it may be impossible to withdraw from certain experiences once a key point has been passed. For example, it is typically impossible to withdraw from a roller coaster ride once the ride has begun, but such rides are typically short and also carefully regulated to be safe so as to minimize the risk to participants, even if they are in a state of panic. Consequently it may be acceptable and justifiable that opportunities for withdrawal may be more limited than would be the case in other contexts. While one might argue that experiences should be clear about any point of no return, we observe that explicit warnings about the right to withdraw are often a tactic to further increase suspense as we in *Ulrike and Eamon Compliant* and queues for rides

which advertise a 'last chance to turn back'. Consequently, such a principle may be problematic in some situations.

Privacy and anonymity
An individual's right to privacy is often taken to be an important ethical principle within HCI, especially with regard to preserving anonymity in relation to research data. However, some tactics to generate discomfort by distorting intimacy clearly impinge on this, most notably the deliberate use of voyeurism in which an unseen participant spies on the actions of another. An important principle to consider here is whether private actions become visible to those outside of the performance frame, for example to mass audiences who have not been properly inducted into the experience, including by recording actions for subsequent publication or broadcast. We would argue that breeches of privacy and anonymity should largely be restricted to those within the performance frame, at least without requiring more explicit consent.

Managing risk
Finally, if we are designing and deploying experiences that involve elements of discomfort then we have a clear responsibility to consider and manage risk. Given the breath of the tactics that we identified previously, there is a wide variety of risks to consider from physical danger and injury, to emotional trauma, to possibilities for social embarrassment. Dealing with such risks is also necessarily a practical matter, requiring assessment and management within a variety of professional codes and regulations. First, practitioners must anticipate potential risks with reference to established best practice including risk assessment, health and safety and legal liability guidelines. This is often standard practice for professionals working in the cultural sector within galleries, theatres to theme parks. Second, is the incorporation of contingencies into the experience or alternative "paths" through it. A specific issue for interactive experiences is the importance of orchestration – a set of procedures and supporting technologies that enable human controllers to monitor and intervene in an experience from behind the scenes. Orchestration has been widely studied in HCI and has even been proposed as the necessary counter-force to 'interactivity' [3] and we reemphasise its importance as a primary consideration.

CONCLUSION
Based on an analysis of various interactive cultural experiences, we have argued a case for deliberately designing uncomfortable interactions. The ultimate goal of such interactions is not to cause long term suffering or pain, but rather to underpin positive design values related to entertainment, enlightenment and sociality. It appears that, through a wide range of tactics, designers can promote various forms of discomfort – visceral, cultural, control and intimate. These may be used in combination, but also need to be carefully embedded into a wider experience which requires paying attention to dramatic structure of exposition, rising action, climax, falling action, and dénouement. Finally, we have considered the ethics of uncomfortable interactions, arguing that we need to situate

them within a distinct ethical framework, and revisiting issues of consent, withdrawal, privacy and risk.

We have deliberately restricted our discussion of discomfort to interaction as part of *cultural experiences* in areas such as live arts, performance, games, visiting, rides and new media. We recognise that there are other kinds of interactive experience and technology that might also raise the question of deliberately designing for discomfort. Potential candidates include the design of weapons (although these are often intended to cause discomfort to their targets rather than users) and other coercive technologies. Other areas for discussion include sports interfaces where temporary discomfort may lead to enhanced performance or fitness, persuasive technologies where it might lead to longer term benefit for an individual or society, and possibly human sexuality where there boundaries between pleasure and pain can become blurred. It will be both interesting and challenging to explore uncomfortable interactions within these domains too.

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