Kidkit Guides Children into Alarming Atmospheres: designing for embodied habituation in hospital wards

Sofie Kinch  
Aarhus School of Architecture / Alexandra Institute Ltd.  
Nørreport 20, DK-8000 Aarhus C  
sofie.kinch@alexandra.dk  
+45 89360000

Marie Koldkjær Højlund  
Dept. of Aesthetics and Communication, University of Aarhus, Helsingforsgade 14,  
DK-8200 Aarhus N  
musmkh@hum.au.dk

ABSTRACT
This paper presents the concept of Embodied Habituation as an architectural approach to designing contextualized technologies. It does so by identifying Middle Ground Experiences acknowledging how spaces are inhabited with ambiguous qualities that affect people emotionally. The research is based on the development and evaluation of Kidkit, which is interactive furniture designed for young children who are going to visit a hospitalized relative with fatal injuries for the first time. Kidkit empowers the child to engage and be present by shaping Middle Ground Experiences in the hospital ward environment that is full of intimidating medical equipment and alarms. The evaluation results indicate collective rewards gained when children succeed in Embodied Habituation. Finally, the paper discusses how Middle Ground Experiences inevitably establish grounds for how we design for spatial experiences within the interaction design community.

Author Keywords
Embodied Habituation; Middle Ground Experience; Atmosphere; Hospital; Interactive furniture; Sound.

General Terms
Human Factors; Design.

INTRODUCTION
“I feel that there are two different ways of experiencing this place, because when I have been off for a longer period, the place affects me in a different way than in everyday work life. After a holiday I can often have this… my gosh, do I really have to go in there?” [Sabroe, interview]. The quote explicates how an experienced nurse encounters the atmosphere of her work environment as a double-take experience. The ward, in which she is working, is a neuro-intensive care unit and by all means an extreme environment as patients are admitted with emergency and hovering between life and death. On one hand, the nurse habituates the stimuli in the ward due to her profession; on the other hand, she recognizes how the unit is inhabited with a certain, almost paralyzing, atmosphere, when she has been off for a longer period of time. This experience points towards habituation i.e. how the emotional impact of a contextual space changes over time [4]. Habituation is a natural process responding to how the emotional impact of our experience with contextualized technology calls for further investigation.

In philosophy, embodied experiences of space is examined by Bachelard [3] and in his book ‘The Poetics of Space’ he points to the fact that poetics is a way to probe the impact of human habituation on geometrical form. In this manner poetics refer to the ‘impurity’ of experience that goes beyond an objective description [24]. Poetic experiences of space is in this paper referred to as atmospheres and following philosopher Böhme [5], atmospheres are not reserved pleasurable experiences as space can be inhabited with all sorts of them including those of e.g. terrifying and oppressive character [ibid]. To design for ‘the flux of lived experience’ we emphasize that atmospheres exists as dynamic entities in-between space and body and we refer to Lefebvre’s rhythmanalyses [21] as well as Abraham’s notion on ‘rhythmizing consciousness’ [1] as ways to deal with how spatial entities affects us over time.

In this paper we propose the concept of Embodied Habituation (in the following EH) as an architectural approach to designing contextualized technologies. EH recognizes how we are affected by the environmental setting over time as repetitive embodied stimulation gradually reduces the strength of a response. To exemplify our point we refer to flight training equipment for astronauts. In order to preparing themselves for the flight, they use simulators to embody the feeling of being inside a spaceship. In this environment the astronauts are learning to resolve all such problems that might occur during their stay in space. The flight simulator becomes a tool for EH as
it repeatedly exposes the astronauts to stimulus, e.g., weightlessness, in order to shift these stimuli into background awareness. An interesting point is that the artificially created set-up does not diminish the usefulness of the EH approach. So how do we design for EH, when it is not physical factors such as weightlessness, but instead experiential factors as intrusive atmospheres of ward environments that we have to learn to embody? The paper is outlined as follows; first, we are positioning Middle Ground Experiences within the field of interaction design to set the ground for designing for EH. Then, the explanatory scope of EH is illustrated through the design case Kidkit. Finally, the method of EH is discussed and this is followed and concluded by a description of Middle Ground Experiences as new architectural perspective on interaction design.

**RELATED WORK**

Within the last decade an architectural perspective on pervasive computing has been of increasing interest to interaction designers, emphasizing that a basic premise of designing digital artifacts is that they shall be experienced on the scale of the body among co-present, collocated people [11, 20]. In this paper we shed light upon the experiential aspect of the context with particular interest in bodily awareness in space. We stand upon the shoulders of the tradition of Tangible User Interfaces, which has been occupied by an interest of designing for the sensing body [9] and also investigated the difference in designing for foreground attention and background awareness [17]. Initially, Ishii et al. [17] present peripheral interaction as a way to integrate technology in space and through the design case AmbientRoom they investigate how to design for background awareness through “a personal interface environment designed to provide information for background processing” [14, p.173]. Hence, referring to space as personal, three-dimensional structure, neglecting the value of the room, as a social and atmospheric space.

To stage our position we first present ‘artifact oriented experiences’ referring to Embodied Interaction [9] and Co-experience [3]. Then, ‘experience oriented environments’, referring to Affective Engagement [12] and Spatial Sharing [9]. However, these approaches do not appropriately cover our intentions of embracing the atmospheric qualities of space whereas we introduce Middle Ground Experiences to advance a better understanding of bodily awareness in space and serving as resource when designing for EH.

**Artifact oriented experiences**

In the following we refer to the concepts of Embodied Interaction and Co-experience coined by Dourish [9] and Battarbee [3] respectively. Both paradigms advocate for how tangible and social computing take advantage of the user’s embodiment in the real world when interacting with the system. To follow the aim of the present paper, we analyze these paradigms in the light of how they respond to the contextual setting of the experience.

Dourish’s emphasizes that the quality of embodied interaction is found in the relation between the tangible artifact and the physical and social experience it entails [9]. He points to the fact that designers increasingly need to understand that interaction is intimately connected to the setting in which the interaction occurs. However, the idea of setting is vaguely explored by Dourish e.g. “the physical environment are arranged so as to make certain kinds of activities easier (or more difficult) and in turn, those activities are tailored to the details of the environment in which they take place” [9]. Dourish refers to physical environment as a functional space, a frame in which the embodied experience occurs.

Let’s then consider the definition of Co-experience by Battarbee [3], which describes experiences with computational products in terms of how the meanings of individual experiences emerge and changes, as they become part of social interaction. The investigations of the concept remain in case examples among people situated in physically distant locations using e.g. mobile phones [ibid]. Thus Co-experience shed light upon relevant social aspect of user experience design but does not fully consider the role of other participants, their bodily relations and the environment in which the experience emerges [3, 11].

**Experience oriented environments**

To go further into the poetic qualities of space as introduced in the beginning of the paper we are dealing with processes in space [2] as well as how these affect our consciousness [1]. We follow these entangled processes firstly presenting the notion of Affective Engagement [12] referring to relational processes that can be transmitted in between people and environment. This is then followed by a recent DPPI contribution on Spatial Sharing [11] that inevitably points towards the collective gains of approaching user experience design from an architectural perspective.

Building upon Massumi, Fritsch offers Affect Engagement as possible resource when designing interactive environments [12]. This is a new perspective on affect to HCI contributing to moving away from previous understanding of affect as something, which can be transferred from an object (or a system) to a user [ibid]. However, due to the autonomy of affect, Fritsch argues that it does not make sense to talk about affect as part of either a person or a system. Instead, affective engagement is unformed and unstructured relational accounts that can be transmitted in between bodies [ibid]. The idea of affective engagement provides an understanding of how we orient ourselves in the world from a range of complex experiential dimensions, including nonconscious levels of experience such as passion and visceral reactions [ibid]. Thus affective engagement provides us a vocabulary for talking about how we experience interactive technologies in the world. However, we stress that from an operational design perspective it is difficult to grasp the complexity of Affective Experiences.
Another approach, which is highly relevant in this paper, is the paradigm of Spatial Sharing introduced by Fogtman et al. [11], which deals more extensively with the social aspect. With point of departure in architectural theory as well as interface design paradigms, Spatial Sharing emphasizes the potential of designing computational interfaces as architecture—as physical space offers us to look at the space in-between artifact and users [ibid]. Thus, we acknowledge that it is not the artifact that is in focus when we interact with it; as the physicality of the artifact, slides into background to give room for the interaction accruing between people thus accentuating the created space between the participants via the computer [ibid]. The paradigm argues for approaching computation as architecture in the sense that people share it; “It is not my space but our space and we find ways to negotiate the sharing based on our common cognitive background” [11]. Spatial sharing emphasizes physical interaction among collocated people and we build upon this going further into how affective relations among people collectively affect the interaction vice versa.

**Middle Ground Experience**

Initially, the field of interaction design has been occupied with an interest of designing technologies for foreground of attention, later expanded to encompass background awareness [17]. In the following section we raise our concerns on how the in-between is left unarticulated [18] and refer to the Middle Ground Experience (MGE) drawing upon architectural [24, 26] as well as philosophical notions on atmosphere [5, 6]. To begin with a clarification is needed on our understanding of space.

Following Harrison and Dourish’s distinction between space and place to the interaction design community, where ‘space’ refers to 3-dimensional structures of the world and ‘place’ refers to the experienced meaningful reality [10] we emphasize that MGE is not a relational account of mathematical ‘spaces’. Rather, we approach the in-between as the way poetic qualities of space affects our being in it. We refer to Böhme’s notion of ‘the space of bodily presence’ being the space within which we each experience our bodily existence [6]. “It is ‘being here’, a place articulated absolutely within the indeterminate expanse of space” [5 p4].

It can be difficult to point towards which elements constitutes the MGE as it is a complex fusion of countless factors which are immediately and synthetically grasped as overall atmosphere, ambiance, mood [24]. Acknowledging a spatial timbre created in-between subjects and object helps us to articulate how we do not perceive the MGE, but rather perceive on the basis of it [25]. Thus objects as well as other people being present in a certain space are all contributors of the MGE. The MGE is multisensory, and although it is experienced deeply subjective, it is common to all subjects and Böhme refer to atmosphere of a space as an ‘quasi-objective’ experience as it is in-between us and in us at the same time [5]. Thus the MGE is not a personal feeling of a place, but rather ‘an affective tonality’ to use Massumi’s words [14]. The MGE is never static, and to highlight the dynamic of it how we build upon Thibaud [25], who emphasizes how the temporal dimension give life to environments. We do not passively sense the MGE, as it sets the tone of a situation but resonates with the sensing bodies in a constantly shifting consonant and dissonant relationship [ibid]. This approach can help us to rethink how we over time get accustomed to a given contextual setting. To sum up, the value of MGE to the interaction design community is acknowledging how physical space collectively affects our bodily being in it and how the shared experience evolves due to physical factors thus it can be manipulated through technologies and people.

**RESEARCH PROBLEM**

The presented approach of MGE points towards an unleashed potential of approaching user experience design with respect to how our interaction with technology as well as with each other is affected by the contextual space. This concern points towards gains of approaching user experiences from a philosophic perspective emphasizing the notion of atmospheres. As pointed out by Dalsgaard et al. [7] remarkably few have been occupied with this interest within the field of interaction design. Therefore an expanded notion of the Böhman atmosphere related to HCI practice is suggested, by supplementing the notion of atmospheres to encompass technological, social and temporal concerns [ibid]. Concerning temporality they highlight that the atmosphere should be constructed as a processual and not static phenomenon “implying that the dimension of time is essential to understanding atmosphere” [ibid]. However, the temporal aspect is not further articulated as it is sub ordered in more palpable concepts such as space and technology. We emphasize this to be a problem and highlight how the dynamic aspect is essential when designing interactive technologies for an atmospheric context [16]. In the following we are presenting a design case, where the context inhabits a thick atmosphere, which to a majority of people is immediately experienced as intrusive and stressful. Thus we are interested in how to ‘soften’ the experience of the atmosphere. A critical question to explore is “how can collating the Middle Ground Experience with the concept of Embodied Habitation deal with the contextual experience in the perspective of how user experiences unfolds over time.”

**DESIGN CASE: KIDKIT**

The methodological approach for designing for EH is in the following unfolded in an environment where the Middle Ground Experience seems extreme as it can bring first time visitors into state of alert. The design research has taken place within the context of long-term activities in a neuro-intensive care unit, (in the following referred to as NIA), Aarhus University Hospital in Denmark. To give a brief impression of NIA; patients are admitted in emergency e.g. traffic casualties, and they have a heart condition, see
Figure 1. The sterile ward environments host three beds each; thus each ward is filled with alarming sounds and staff in determined action. The Middle Ground Experience is extremely tense in the wards giving the severe circumstances of the patients and following their relatives as pointed out in [13].

The design case has evolved through iterative design processes and user studies and interviews to set the ground for the design choices responding to high ethical standards. Initially we were informed by ethnographic observations in the ward and interviews with the staff regarding what problems they are facing in everyday life. During the design process, we discussed our concrete design suggestions with users, namely nurses and young children.

**Design problem**

In the design case we are concerned with the dilemma of bringing young children to meet a relative with fatal injuries in the alarming ward environment. On one hand parents do not think NIA is an appropriate place for children as a nurse explains: “Many parents are, certainly, fearful to bring their children here, and they are not pleased to do it, and that is, of course, understandable. They want to protect their children” [Sabroe, Interview]. On the other hand visiting the hospitalized relatives helps children to demystify their imaginations and diminish traumas in later life [15]. Staff at NIA follows recommendations [ibid] that children from three years onwards shall be informed and involved in the process of illness of a relative since young children often imagine a situation much worse than reality. Nevertheless, nurses most often need to encourage relatives to bring their young ones to NIA and it can be complicated as it requires mental energy to handle children between three and seven years, when a near relative has fatal injuries. The reason is, that children at this age do not comprehend the absolute concept of ‘never again’ and as such the fact that a dead relative is not coming back [ibid]. This is often confused with the fact that young children are not mourning; they do, they just do it in another way; in a different pace [ibid]. Nevertheless children who are going into NIA need to be meticulously prepared. Because is not unusual that young first time visitor’s respond to the environment by panicking [Stylsvig, former psychologist at NIA, interview].

In the ward, children are meeting a hospitalized relative eclipsed in medical apparatus and monitors and “because the hospitalized look alienated to the children, it is important that they meet the equipment as a friend” [Stylsvig, Interview]. Today, nurses emphasize to create a sense of connectedness with the children immediately after they have arrived. They use their intuition and humor, if appropriate [Sabroe, Interview]. But there are no specific procedures accompanying the visit situation. One tells that she tends to make drawings to explain the equipment to the child before entering the ward [Stylsvig, interview]. Another brings a draining tube, to show some of the equipment before entering [Moeslund, Interview].

What appears as a design problem is, that tools are lacking for preparing the children on entering the ward as well as assisting the children during the visit in the ward. Potentially, we emphasize that an initiative that accommodates the visit can have contagious effect on parent’s willingness to bring their children to visit the hospitalized.

**Designing for embodied habituating in NIA**

When children enter NIA to meet a hospitalized parent or sibling, for the first time, they embody a lot of conflicting feelings and expectations, like fear, curiosity, excitement, love, anger and hate [Stylsvig, Interview]. They are entering a situation that is difficult to understand and at the same time confronted by life and death in an environment that by all means evokes bodily state of alertness. In order to accommodate the best possible visit situation and make the children feel comfortable we use EH as method. This allows us to articulate the MGE and how it affects children’s shifting awareness in the ward.

In order to investigate how children gradually can become familiarized to the ward environment, a prototype initially helped us to clarify our design intentions and discuss these with potential users (two nurses and two four-year-old girls). The prototype is ‘a magic cube’, see Figure 2, which continuously unfolds thus exposing ten relevant pictures for discussing the circumstances of being visitor in NIA, e.g. an ambulance, holding hands, ward interior. Through this prototype we gained insight on, at least two important aspects of, how to approach EH in NIA.

In order to prepare the children the nurses have to demystify the environment before entering. In the cube-prototype we use visual representation, however, through discussion with the four-year old users, we realize, that this way of demystifying leave only little space for imagination; the children passively receive information instead of being constructors of it. As consequence, we choose another material: instead of visual representations, we emphasize how the sounds of the hospital equipment are more appropriate for preparing young children on the ward environment. According to the staff [interviews] and relatives [13] these are the primary stress factor, as the alarming sounds exist in constant cacophony. We present
the sounds by letting the children tune into the alarming sounds, as we refer to the concept of ‘peepholes’ [8] that allows children to access only a small part of a complex situation, and thereby stimulate curiosity, imagination and exploration. Thus, by comprehending small bits of information at a time, the children are gradually synchronized to the new environment.

Another insight from ‘the magic cube’ is the sense of belonging in the ward, through ‘the magical cube’, we realized that a small interface potentially exclude others from participating in the conversation in the waiting room. Furthermore, the cube does not assist children into the ward in a meaningful manner, neither it assists the meeting with the hospitalized. Thus we emphasize the importance of designing a digital artifact, which not only introduce the ward environment before entering, but also engage children in an embodied and meaningful way.

Ethical concerns on the design problem

The design problem can be approached from at least two perspectives, pointing to either technical or moral answers [11]. If we approach the alarming sounds as a technical problem, the answer would be to eliminating the alarming sounds. If we approach the alarming sounds from a moral perspective we dissolve the problem, as we instead recognize the alarming sounds and use these as material [ibid]. Pointing towards a moral design approach, Kidkit raises questions on how to design a digital artifact that in a respectfully manner facilitate the meeting between the patient and the child.

In the design process we are discussing whether the artifact shall appear as ‘a friend’ e.g. a cute, animated figure exemplified by ‘a snail’ that with its reactable feelers guide children towards the of bed the hospitalized. However, approaching the design as ‘a friend’ raises a number of concerns e.g. target group, symbolism and trust. Further, ‘the snail’ is designed for focal attention when entering the ward and when discussing this with a nurse, she proclaims “This isn’t going to happen. We show the child where the hospitalized is.” Thus to accommodate the sensitive visit situation we argue that the artifact has to appear as ‘a tool’ assisting the nurse as well as children when entering the alarming atmosphere environment.

Form and interaction technologies

Kidkit is an interactive, mobile and transformable piece of furniture, which is designed for children to habituate the ward environment by making them familiarized with the alarming sounds while being in the silent waiting room. Children can wheel Kidkit into the ward and through transforming actions it can be unfolded into a stairway, in the ward helping children to approach the hospitalized in their own pace. To get a complete impression of Kidkit, we recommend to see our video scenario on

Kidkit has the shape of five upholstered blocks, each having the dimensions of 42 x 42 x 18 cm stacked in two piles, whereas the upper block in each pile is flexible. On the upper, green block of Kidkit a touch interface is sewn into the surface, see Figure 3. The interface is consisting of eight sound triggers, made from touch sensors and a Phidgets board. Through a computer, the sounds are played through a loudspeaker. The sounds have been recorded in the ward and are categorized in three groups; yellow represent three different alarms, red being two suction from a respirator and blue are three ‘metallic’ sounds e.g. closing the lid on the bin. The interaction refers to a well-known practice, where a push triggers an audio event as feedback, known from e.g. an audio sampler where sounds differ in rhythm, which makes the sequence more fun to play with.

The material of Kidkit is hard foam in order to accommodate comfortable seating, secure standing and lightweight transforming actions, see Figure 4. The upholstery is tarpaulin that comes in four colors; red, green, blue and yellow. Tarpaulin allows for cleaning with alcohol, which is required in hospital environments. Yellow nylon straps on the vertical side of the blocks indicate the affordance of flexibility. Wheels are revealed through a handle on the side of Kidkit, making it possible to lift and lower the furniture when wheeling it from one space to another.

Kidkit is interactive furniture, and not a handheld device, because furniture physically relates equally to body and space thus emphasizing collective qualities. Figure 3, 4, 5, illustrate how Kidkit facilitates different positions both according to the relatives bringing the child, the child and the hospitalized and also for the nurse, assisting the visit. In the ground-position, Kidkit appears as seating for two, allowing the child to be physically close and at eye level with an adult because intimacy is of utmost importance during the visit in NIA, see right hand side of Figure 5.

**Embodied habituation through Kidkit**

Figure 6 illustrates how Kidkit is a tool for making the entrance into NIA less dramatic, firstly by listening to the alarming sounds by pushing the triggers. This action brings background phenomena of the ward into focal attention in the waiting room. By allowing children to control the alarming sounds, they are familiarized with these before entering. Furthermore, Kidkit allows children to transform the furniture into a stairway configuration.

Bringing the artifact into the ward creates a secure background space for the child. Kidkit is designed both for foreground attention and background awareness, and these different state of minds are underlined by the colors of the furniture, thus it both appear in strong colors in the waiting room; see Figure 3, and in gray scale, when unfolded in the ward, see Figure 4.

**Methodological approach for evaluating Kidkit**

Conducting research in real world environments is put to the extreme when evaluating Embodied Habituation through Kidkit. The Middle Ground Experience is very unique in NIA and we analyze the use of Kidkit in real visit situations. As such, we are not only dealing with evaluating our design artifact in the field [19], we are also dealing with users who are in a very sensitive situation. Kidkit has been tested in NIA for eleven months when the evaluation ends by December 2012. During this period Kidkit has been assisting nurses to accompanying children between three and seven years to meet a hospitalized sibling or parent. The evaluations indications build upon qualitative reflections written by the nurses and followed up by interviews, when possible. One time, we attended a visit situation ourselves.

All evaluation indications we gained through having Kidkit in NIA for 11 months are relevant to us. In the beginning of our evaluation we were facing a problem that nurses did not turn the furniture on meaning that they did not introduce the sounds to the children as intended. Most likely this was caused by lack of communication which we have taken note of. Another aspect is that Kidkit was ‘unknown’ and to some nurses it seemed complicated to integrate in everyday work practice [Moeslund, interview]. Initially we were invited to join all user test, however in everyday practice we were told that it was “confusing” [Loth, Interview] to invite us, not pointing towards our presence in the ward, but rather the procedures of making the phone call knowing that this would possibly be connected to a lot waiting time. We have emphasized that this was “no problem at all”. However, to exemplify the concerns the nurse refers to, we have experienced that a test of Kidkit was cancelled, simply because the hospitalized died before the young visitors arrived.

The evaluation of Kidkit has been complex, first of all because evaluating children in a visit situation in ward environment is a highly sensitive situation as the young users (and their family) are in crises. People find it
However, after the visit, we ask him, if he recognized any holding his the alarming sounds. He feels calm, he is telling stories and more likely to accept the existence of it. The conversation demystifies the sounds and the patient is in pain" The conversation points towards how the sound is not dangerous, we are knowing that a sound is not dangerous, we are familiar and not interesting, the children have the ability to put them into background of awareness because they are expected and predictable in the context. This example is underlined by similar visit situations pointing towards a difference in children’s ability to socialize when they have been introduced to the sounds of the ward beforehand.

A majority of the responses we receive from our interviews point to the fact that Kidkit is a favorable instrument for nurses to establish contact with the children. One nurse points to the fact that Kidkit highlight a shared focus on the child when being in the waiting room; “There is no doubt that the conversation was between the child and nurse and not between the adults - It was nice, for me, to have a tangible starting point for the conversation”. And in line with this, another nurse emphasizes; “The children are involved in the visit. It matters that we meet them on a children’s level.“ To give a few examples on the play practices Kidkit entails one child enters the ward sitting on Kidkit ‘driving a train’. Another example is given when a son and daughter are going to visit their father who is hospitalized. They are around two and five years old. When the son is wheeling Kidkit into the ward, the nurse emphasizes that the situation is ‘well-known’. The son tells his mother “I know this one”. The fact that he takes ownership shows that he is confident and not scared on entering the ward and he becomes ‘more’ than a visitor because he is in charge of the situation himself.

This being said, we also see examples where the nurses are split between handling adults in crises and the children. To give an example; two brothers are going to visit their hospitalized mother. The Middle Ground Experience in the waiting room is extremely tense as the farther is in crisis and “the boys are not in focus, they are just there”. When the nurse turns Kidkit on and presses a button “they are immediately there, both of them, and they actually thought it was funny and smiled when it said something…” The fact that the boys are smiling indicates that they are hearing the sounds as rhythms and not as alarms they should be afraid of. “Both boys are very interested in one particular sound, it was always this ‘dododododo’ they were searching for. They were sitting on each block of Kidkit while investigating the sounds ” the nurse explains. Thus Kidkit has become object for shared exploration, and it frames a gameplay among the brothers in a confusing situation where their father is in crises and not in a state of preparing his sons on meeting their critically ill mother.
Another insight is the quality of establishing a space, where the children belongs, either being in the waiting room, moving into the ward, or next to the hospitalized. Nurses independently refer to Kidkit as a ‘comfort zone’ for the children, which is remarkable in this environment. Three examples are in the following given on Kidkit as a comfort zone; In one example, Kidkit facilitates a safe ground for two girls, a daughter and a niece, both seven years old. The nurse explains: “They say no, when I ask if they want to wheel Kidkit, so then I do it, but both of the girls are walking on each side of it when we enter the ward”. In this situation we see that the nurse is guiding the children into the ward through wheeling Kidkit. In another example is a six-year-old girl visiting her little sister. When she places Kidkit next to the hospitalized, she unfolds Kidkit and spontaneously she steps up. Curiously, she looks at her sister and places a present on the bed. Then, she steps down again and talks to the nurse about her sister’s situation. Later, the girl steps up on Kidkit, she looks at her hospitalized sister and claims; “Her face is not in a very good condition” Thus Kidkit allows the sister to approach the hospitalized in her own pace. Third example is illustrated in Figure 7, where aforementioned 7-year-old brother is sitting on Kidkit next to the nurse and his hospitalized sister. After the photo is taken, the mother tells that her son is lying up side down playing mobile apps next to the bed. “It did not look comfortable, but he insisted to be on Kidkit” she tells. Thus Kidkit appears to be a comfort zone even when the environment is demystified and he is entertained by playing a game.

**Embodied Habitation as method**

In everyday life, the change of attitude via habituation usually happens almost passively in environments where we spend a lot of time, through a gradual and slow adaptation [4]. EH follows the phenomena of ‘habitual contexts’, which is introduced by McCullough in his book; Digital Grounds [19]. McCullough stresses the importance of how background processes in architectural space continuously influence the way we interact with technology [ibid]. EH points towards how interaction designers shall not approach the contextual setting of their designed artifact as fixed ground but instead as flows constantly evolving in-between user’s foreground attention and background awareness. Referring to the example of the astronauts preparing themselves for flight in the introduction of the paper EH happens through repetitive stimulations of the body. We cannot learn to be affected through intellectual exercises and according to aforementioned example; reading about being in a spaceship would not be sufficient training for the astronauts. EH is a dynamic process of getting accustomed to a particular context, thus we need to expose ourselves to the stimuli through repetitions. To coin the term; Embodied Habituation exists as dynamic negotiations between bodies and space and repetitive stimulation will gradually help us to leave certain environmental stimuli into background awareness. Other people as well as digital artifacts can obstruct as well as accentuate the natural process of Embodied Habituation.

In the Kidkit design case, we are occupied by an interest of designing for children to accelerate their process of EH and as such habituate faster than normal in NIA. This is needed because children enter a confusing and stressful Middle Ground Experience where various stimuli content for their focal attention. If we do not help children to leave sensuous stimuli into background awareness, the environment will inevitable take away attention from the aim of the visit, that being to communicate with the sick relative. Kidkit illustrates how to use EH as method, however it is produced through a local understanding in NIA and we acknowledge how the Kidkit design approach cannot be applied uncritically to other design contexts. Thus designing for EH in other contexts, hosting other types of Middle Ground Experience, calls for other design concerns than presented in the Kidkit case.

**DISCUSSION**

Our design case has demonstrated the concept of designing for Middle Ground Experiences underlying EH as method. Further we have argued that Middle Ground Experiences represent an architectural approach to designing for contexts by acknowledging the atmospheric qualities of place. By focusing on how a shared ground affects the way we interact with technology vice versa we align ourselves with recently developed paradigms of Embodied Interaction [9], Co-experience [3] and even more specifically with Affective Engagement [12] and Spatial Sharing [11]. On the face of that we will now discuss further how our approach differs from those proposed by Dourish, Batterbee, Fritsch and Fogtman et al.

Kidkit is interactive furniture; a tangible, movable artifact designed for all the senses. Following Dourish’ argumentation on Embodied Interaction [9] Kidkit may seem as a good example of a Tangible User Interface. However it goes beyond the intentions of both Dourish by actively incorporating the contextual space in the design.
process and how such qualities can infuse our relations with tangible devices. Following Battarbee’s argumentation on Co-experience [3], we argue that the aim of Kidkit is to establish a better experience among people; being the child’s relation to the nurse as well as to the hospitalized. The question is then, whether Co-experience covers the social experience Kidkit entails? Following Battarbee’s argumentation Co-experience is created over physically distant locations e.g. telepresence environments. Therefore we emphasize that our concept of Middle Ground Experience is shared experience in situ and cannot be experienced from elsewhere.

Our approach shares prominent theoretical beliefs with Fritsch [12] as well as Fogtman et al. [11] regarding our awareness on how subconscious processes affect the way we interact in interactive environments. Fritsch points towards concerns on making Affective Engagement operational [12] and we will argue that approaching Affective Engagement as flows in the Middle Ground helps us to contextualize these phenomena and approach those through multisensory means. Thus, Middle Ground Experiences articulate how Affective Engagement is a shared ground, and also how this can be manipulated through physical as well as social effects. Following Fogtman et al.’s argumentation on Spatial Sharing [12] we point towards computation that can be experienced as architecture as it establishes a social space among people; a space where the interaction and not the artifact is in focus. We go further, as the shared space is not only accentuated by the physicality of the artifact but through all means, digital as well as analog; participating users as well as other people and how all these entities together affect an overall timbre of a common Middle Ground Experience. We acknowledge how the Middle Ground affects our shared experience and how this ‘in-between’ evolves over time thus affecting our interaction with the digital artifact vice versa. A starting point for designing for Middle Ground experiences is therefore acknowledging its complexity [25].

The Middle Ground Experience refers to the intertwining between people and the world, and when Merleau-Ponty [23] refers to the “halfway” we see another way of approaching the grey area between people and things. Merleau-Ponty explains; “People negotiate their way through this halfway with their eyes, ears, hands, and body, as well as their sense of space and movement and many kinds of things they are barely aware of. Although everyone lives in the halfway every second, there are only few words to describe it” [19, 23]. The quote points towards the difficulty of handing Middle Ground Experiences; however as pointed out by [19] designers trained in the arts shall keep in mind that they are trained to capturing fleeting moment. It can be a challenge turning the ephemeral Middle Ground structures into words and conduct research results within the ambiguous phenomena for several reasons[20], as exemplified in the case. To grasp one part of the complex whole, we introduce Embodied Habitation as a holistic perspective on the digital artifact. Designing a technical solution “solving the problem” has not in itself been the aim of the case rather we seek to approach the research problem with the aim of designing meaningful technology. Kidkit is a balanced way of articulating the design where there is no differential treatment of interactive vs. non-interactive elements, instead we emphasize that it is about the whole and one where the genuine orientation to the Embodied Habitation motivates all design choices.

LIMITATIONS AND FUTURE WORK
In order to qualify our claims, and to reflect on the results, we now discuss possible limitations of the study, which include the size of design examples as well as the number of user evaluations. One possible limitation of this work is that we present one designed artifact and its evaluation, instead of exploring variations of artifacts. While it would also be beneficial to test multiple options with the users, the value of bringing the artifacts into the wild and gathering thick descriptions of the experience was much more valuable. We could imagine building upon the current results and bringing those findings into future design cases, yet evaluating one prototype does not diminish the findings in the present paper.

Another limitation of our work is the number of evaluations, and during the evaluation process we extended our deadline twice, because of lack in proper results. During the evaluation we realized that in order to get proper results in a sensitive environment like NIA, we would need to be present in the ward. Thus showing up in the morning was not sufficient, as the nurses did not manage to call us, when young visitors arrived. As consequence we made ourselves present in the waiting room in NIA to make sure that we would attend the visits. This is very time consuming as nurses reckon that children approximately are coming to NIA once a week, however, we emphasize that this is actually acquired in order to gain proper user evaluation results on Kidkit in its environmental setting.

CONCLUSION
In this paper we have identified and presented the concept of Middle Ground Experience to articulating how atmospheric qualities of space has been neglected within the field of interaction design so far. We draw upon relevant paradigms of embodied and spatial interaction and to scan the missing in-between of foreground of attention and background awareness and establish our contribution in architectural as well as philosophical notions of atmosphere. In order to design for middle ground we present Embodied Habitation as a methodological approach and provided an example case to illustrate.

The example case Kidkit investigated how to design for empowering children to enter a burdensome Middle
Ground Experience - in this case, visiting a relative in a neuro-intensive care environment. We point towards the collective gains when children succeed in Embodied habituation thus emphasizing how the Middle Ground Experience can be manipulated through technologies to affects the behavior of collocated people.

ACKNOWLEDGMENTS
We thank the Neuro-intensive care unit; Aarhus university Hospital in Denmark, most prominently nurse Lone MoeSLund and nurse Helene Bugge for kindly letting us into the ward and participating in this research, giving us access to conducting interviews with their colleagues, recording sounds, filming video scenario, and interviewing relatives to the hospitalized. Thanks to all colleagues Niels Albertsen, Kaj Gronbaek and Helle Karoff for discussing this topic, and Morten Breinbjerg, Thomas Markussen and Tim Merritt for giving valuable feedback in the process of writing this paper. Finally we thank the Alexandra Institute A/S for sponsoring the materials for Kidkit and as such making this research possible.

REFERENCES