Autonomous Vehicles for Children with Mild Intellectual Disability

Perplexity, Curiosity, Surprise, and Confusion

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Figure 1: Children and safety driver on a self-driving bus.

ABSTRACT

Self-driving buses will be part of the public transportation system of the future, and they must therefore be accessible to all. The study reported in this paper examines the user experiences of 16 children with mild intellectual disability riding a self-driving bus. The qualitative analysis, performed by iterative affinity diagramming, of interviews, observations, and a co-design session with five of the children, suggests that familiar situations were characterized by contemplation and curiosity, while unfamiliar ones were characterized by surprise or confusion. The temporal structure of past, present, and future situations in the field of attention played a significant role in the children's experiences. This leads to design considerations for an explainable interior of self-driving buses.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in accessibility**; • **Applied computing** → *Transportation.*

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1 INTRODUCTION

In this study, we investigate the experiences of children with mild intellectual disability (ID) using autonomous buses (Fig. 1). We adopt from the American Association on Intellectual and Developmental Disabilities (AAIDD) a definition of ID, which includes limitations in cognitive functioning and adaptive behavior, negatively affecting social, conceptual, and practical skills. Technological advancements in transportation should cater to individuals with diverse needs and abilities [24]. Although several design approaches, such as universal design, inclusive design, accessibility, and design for all, have emerged to address inclusivity [15, 28], people with ID may still find their needs unmet, particularly in transportation [4, 13, 35].

Autonomous vehicles (AVs) have the potential to serve underserved populations, including children and people with disabilities.

However, concerns about safety, system reliability, and privacy persist [18, 19, 21, 22, 26, 34]. Autonomous buses can promote children's independent mobility, but understanding the vehicle's autonomous nature is crucial for their safety [5, 20, 25].

Adults with mild to moderate ID have show mixed attitudes to AVs, ranging from freedom to fear and curiosity [3]. Perceptions of such vehicles have in a focus group with this user group been positive and characterized by eagerness [8]. The trip was comfortable, smooth, and quiet, and participants enjoyed the large windows. They also thought that they would use the service to facilitate their independent mobility. Most did not feel any need for assistance on the bus, but some raised safety and accessibility concerns inside or outside the bus due to lack of familiarity with the technology. They thought that many such issues could be alleviated by remote assistance or an onboard attendant.

In a previous paper, we report initial results on the same data material as this paper builds on [anon. ref.]. We have noted that children with mild ID found the self-driving bus experience favorable but also experience confusion about certain aspects of the bus's behavior. The safety driver and support person played key roles in ensuring safety, establishing a positive social climate, and providing explanations.

A recent systematic review of research on AVs for people with disabilities argues that research, among other things, should include more participatory design with diverse disability groups and address the entire travel journey and not only vehicle features [7]. This qualitative study aims to understand the experience of autonomous bus rides for children with mild ID and develop insights for design work involving these children.

2 THEORETICAL FRAMEWORK

In this study, we take a pragmatist stance on user experience and interaction design [6]. A pragmatist principle is that conceptualizations, habits, and structures establish temporary stability in a given situation. A situation is a contextual whole of subject, physio-spatial surroundings, other people, artifacts, and social constructs. It can be determinate, which means that it is unreflected as habits and conceptualizations developed over time work in a predictable and controllable way. It can also be indeterminate, which means that there is a breakdown in which the situation appears problematic as the habits do not lead to the expected outcome. Indeterminate situations are approached in a mode of inquiry with the aim of changing the situation to a determinate one by transforming any components of the situation. Users are seen as resourceful actors who will use any resource (including designed technologies) to make sense of and transform their situation. Current experience is tied up to previous experience, and based on past experiences we form expectations of how situations will feel [36]. In this fashion, expectations bind the past, the current, and the future experiences together. Differences between the anticipated and what actually happens forms a gap that is filled with emotions, such as satisfaction, anger, disappointment, doubt, or curiosity.

Situations of use can be characterized by a pervasive felt quality that is the basis for any perceptual discrimination and conceptual definition that follows. A situation in an ambulance-control centre can for example have the pervasive quality of emergency [23]. The pervasive quality of a situation is a complex of different aspects, such as the practical, the aesthetic, the social, the ethical, and the technical, all at the same time [2]. An indeterminate situation can be characterized by the quality of surprise or the quality of confusion giving rise to conceptualization and inquiry [16]. Surprise is then experienced in situations where you wonder what happened, and confusion appears in situations where you wonder how to do something. The structure of the situation, i.e., what the situation consists of, can be expressed in terms of a field of attention consisting of theme (or figure/focus), thematic context, and margin [1, 14].

2.1 Research Questions

Two questions are posed: (a) How do children with mild intellectual disability experience riding the self-driving bus; and (b) what objects are focal for them and what objects are in the context and margin of their attention?

3 METHOD

We invited 16 children (age M=9.75, SD=1.61) with mild ID to ride the self-driving buses with a following interview and a co-design session. Parental written consent was followed by children's videotaped oral consent to participate. The Swedish Ethical Review Authority has approved the project.

To learn more about the participant's relation to technology in general, thirteen of the participants completed a 4-item version of the Technology Readiness Index (TRI) 2.0's [27]. The questions and answer scales were modified to work for children with mild ID and picture support was used. The mean score was 2.65 (max=4, min=1, SD=.44), indicating that they are cautiously ready for new technology. They generally expressed discomfort (M=1.85, SD=1.14) when others saw them struggling with technology, and insecurity (M=1.69, SD=.75) about the fact that people use technology so much. They also expressed optimism for new technology (M=3.54, SD=.88) and their own ability to use it (M=3.54, SD=.52). The digital short version of Raven's Progressive Matrices 2 (RPM 2) was also given to ten of the children [30] to learn more about them. They (age M=9.9, SD=1.91) were on par with children at the mean age of 6.03 years (SD=1.19).

3.1 Observation and Interview Sessions

The bus ride lasted about 20 minutes, with a safety driver, a researcher, the children, and potentially their needed support persons. Two cameras recorded the journey from different angles, including the bus interior and its immediate surroundings. A portable camera captured the embarkation and disembarkation. Participants were encouraged to express their sentiments and opinions before the trip. They were asked about how they felt at least once throughout each ride, even if nothing unusual occurred. They were also asked about how they felt if something happened, such as sudden braking, the safety driver taking charge of the bus, or the bus stopping for a while. They were also asked about how they felt if they appeared, through their words or actions, to be thinking about something special. Every time someone was asked how they were feeling, they were given questions on what had caused that sensation and, if it had been unfavorable, how they would improve the bus or its interior.

The subsequent video-recorded interview consisted of open-ended questions on how they felt about the bus and the bus ride, what they thought was good and bad about the bus and the bus ride, and what they would change if they could. Finally, they were asked if they would like to ride the bus again.

3.2 Co-design Session

A co-design workshop was done with 5 of the children with the purpose of exploring their own ideas about how self-driving buses could be used, and to play out a scenario of a bus ride that did not go without friction. Recommendations for conducting co-design workshops [29] were followed which means that we tailored the process to the emerging situation with the children; we catered for favourable conditions by having the facilitator (MF) meeting the children several times; we focused on what the children had the ability to do rather than disabilities, encouraging them to express their thoughts; and finally, we made use of a storytelling method. The workshop was conducted through a theatrical set-up where the children some weeks after their experiences with the self-driving buses were invited to ride with a magical (self-driving) bus in a room at their school. The bus and the scene were constructed with chairs, mats, cardboard-made props, and other props. The scenes were chosen to introduce a potentially problematic situation where participants were forced to interact with the bus. The purpose of that was to see how they would choose to act.

First, the bus was introduced as a bus that could be in any way the children wanted and that one of the authors (MF) would tell what happens and the children were invited to tell us or show us what they do on the bus. Another author (MA) acted as the bus, speaking in a cup to simulate a speaker, and making sound signals on a xylophone. The script for the scenario was as follows (translated from Swedish and slightly shortened):

(1) A hot summer day the children stand at a bus stop and are asked where they want to go.
(2) The bus arrives and the door opens. The children are asked what they do.
(3) A voice sound "Welcome onboard, where do you want to go?"
(4) The bus confirms the destination, and the doors closes while the bus says <beep> "The doors close" and the bus starts to drive.
(5) The bus suddenly brake <ping, ping>.
(6) A cycle lies in the way of the bus and the bus says "There is something in the way I cannot continue" <ping>. The children are asked what they do.
(7) After some time, the bus says: "Dear passengers. We have stopped for something on the driveway, can anyone of you remove the obstacle". The children are asked what they do.
(8) After the cycle has been removed the door closes <ping, ping> and the bus continues driving.
(9) The bus says, "Next stop is [destination]." The bus slows down and stops <ping, ping, ping>
(10) The bus says, "We are now at your destination [Destination], when do you want to be picked up?" The children are asked what they do.
(11) The bus says, "The bus picks you up at [time]" and then <pong, pong> and the button with the arrows next to the door lights up.
(12) Afterwards the children are told that they have a fantastic day before they travel back.

Afterwards, the children are asked the following questions:

- What did you think about the bus ride?
- What did you like with the bus ride?
- What did you dislike with the bus ride?
- Would you like to do this for real? Why/why not?
- Is there anything you would need assistance with?
- Would you have preferred to have something or someone with you on the bus? Why?
- Is there anything you would like to change if the bus ride would have been for real?

The two support persons who attended the session were also asked about their thoughts on the events of the workshop.

3.3 Qualitative Data Analysis

The qualitative analysis was made using iterative affinity diagramming [31], also known as the KJ-method [32], which has roots in Japanese ethnology and has become popular in design and management. It can be characterized as a combination of consensus-oriented brainstorming and abductive thematic analysis where people with different perspectives jointly do the analysis of qualitative data. The five researchers involved in the analysis had backgrounds in cognitive science, disability research, traffic psychology, informatics, and interaction design. Analysis was made in four iterations. The final iteration focused on the co-design session and was performed by two of the researchers. Each iteration had the following procedures: (1) each analyst watched the video recordings while noting observations and ideas on sticky notes; (2) all analysts read their notes out aloud and put them on a whiteboard; (3) notes were structured into "teams" (i.e., groups or categories) by identifying what observations and ideas the intuitively are similar or related and teams were ordered into overarching "families" (i.e., themes); (5) the analysts discussed what it was that bound the notes together, that is, their shared latent meaning; (6) teams and families were named; (7) relations between themes and families were indicated by drawing lines between them. All notes were transferred to an online whiteboard so that the analyst working at another site could integrate his analysis.

12 teams (e.g., explanations/anticipation building, nothing special, and surprises) and 4 families (e.g., curiosity and the expected and unexpected) were created. Each team was interpreted by each researcher individually considering the theoretical concepts and research questions described earlier in this article. These short interpretations were finally discussed and the results and discussion below are the results of this discussion.

3.4 Validation Strategies

Three kinds of triangulation were used in this study: triangulation of theories; investigator triangulation; and methodological triangulation [9].

Triangulation of theories was employed, not to seek consensus, but to disclose different aspects of the phenomenon. This article

reports a re-analysis of data (interviews and observations) also analysed in a previous paper [11]. The previous paper was based on a top-down analysis from self-determination theory where observations were interpreted through the concepts of the theory. The analysis in this paper was instead performed bottom-up, after which a pragmatist theoretical perspective was employed with the goal of understanding experiential situational qualities close to the experiences of the children.

Investigator triangulation was used, with two of the authors involved in interviews, observations, and co-design sessions. The other two authors and another research were involved in the analysis.

Methodological triangulation was used to allow the participants to express their experiences and thoughts in different ways: observations, interviews, and a co-design session.

4 RESULTS

The results are reported under the headings of experienced situational qualities and the structure of the field of attention, relating to each of the two questions.

4.1 Experienced Situational Qualities

Four situational qualities of riding the self-driving bus were identified for the children: Familiarity leading to contemplation with the two aspects of curiosity and perplexity, and unfamiliarity leading to surprise or confusion.

4.1.1 Familiarity. After the initial excitement, the situation was experienced as familiar, and habits from regular buses and cars worked without any particular challenges. Many children were quite independent in handling seat belts and exiting the bus (less so entering it). After about 10–20 minutes, the bus ride became habitual for most children and experienced as nothing special and without anxiety. Below is an illustrative excerpt of this from one of the children that display that other things are going on in his life from the start of the journey:

> The bus ride is trespassing on the children's snack time and just after embarkation participant 8 is searching for something in his pockets and pulls out a spoon which he holds for the rest of the ride

Contemplation: When the children didn't have any more surprises or confusions, and the current situation was characterized by familiarity and boredom, then some children would instead ponder the current situation and express curiosity.

Curiosity in the environs passing here and now (e.g., look at the dogs) would occasionally distract from the boredom of a slow habituated journey. The journey back to the school offered nothing new in the surroundings and could for that reason be experienced as more boring. The children would then become curious about the interior of the bus, such as buttons, controls, and screens but also the sound the bus makes:

> Participant 13: What is this sound, dut dut.
> Security driver: It is warning the truck that stands there

In this excerpt and several more situations, the children ask about the sound the bus makes to warn other vehicles. The children at the co-construction workshop also displayed curiosity and stopped doing what they did to listen to when the bus spoke. In the co-construction workshop the sounds the bus made seemed of little interest to the children but how it spoke was interesting and curious.

Perplexity would characterize situations where the children out of curiosity inquired into the workings of the bus without being able to completely understand it. Buttons and screens were for example not always easy to understand and sometimes explored as in the example of curiosity above. The bus's behavior was also a subject that led to perplexity. The support persons or the safety driver would then offer explanations.

> [After a sudden brake]
> Support person: Now the bus sensed that a car approached and then he had to brake
> Participant 4: Why?
> Support person: Otherwise we had crashed
> Participant 4: Does it crash?
> Support person: That was why it braked. The bus sensed that.
> Participant 4: How could it?
> Support person: He has those things in the front. Sensors it is called.
> Participant 4: What is that?
> Support person: They sense that a car approaches. Now it stops.
> Participant 4: How do you know that it is a boy?

Participant 4 expresses multiple perplexities about the bus's behavior and nature in this excerpt. First, why did it suddenly brake in this situation? Second, about what sensors are. Third, the gender of the bus. If the explanations given by the support person is enough for participant 4 data does not tell.

4.1.2 Unfamiliarity. There were also situations that were characterized by being unfamiliar to the children. In these situations, they could react with either surprise or confusion.

Surprise: When the bus suddenly braked or made some sounds, the children would be surprised, sometimes laugh, and then wonder why it behaved in that way. The safety driver or support person would then explain what the bus "saw" with its sensors. The actions performed by the bus could be unexpected and difficult to explain. Below are three examples of surprise from the video recordings:

> [Participant 1 shouts and laughs and participant 2 smiles when the bus suddenly brake]
> [Participant 4 frowns after sudden brake and moves her hands from the lap and grabs a bar underneath the seat and holds the bar for roughly a minute.]
> Participant 13: Aj [...] Aj aj aj [after a sudden brake]

In contrast to the sudden braking, the journey also felt slow and sometimes surprisingly boring for some of the children.

> Participant 13: I run faster than this
> Participant 11: No, this is not fast
> Support person: We are in an area where you can't drive faster
> [Support person discusses the speed with participant 16]

Security driver: Now we will go fast [participants argue against]
Participant 2: Better if it would go faster [...] Better with normal cars

Fast is a relative concept and we know that at least one child experienced the journey as occasionally fast. But the clearest conclusion from this is that most of the children have expectations to travel faster than the bus currently goes.

Confusion: Some parts of the bus were difficult to understand for the children would largely go unnoticed but sometimes cause confusion in what was expected from them. Instructions given by someone else were followed, and the children wanted to follow rules. However, it was sometimes difficult to know what rules applied to which confusion arose. Here is an illustration of such a confusing situation:

Participant 12: You need to have belts
Participant 13: [Turns to see if there are belts] We don't have belts
Researcher: It is not necessary here
Participant 11: Okey, then we need to sit without belts the whole way [...] this will not go fast, this will go slow and therefore you do not need belts
Researcher: It can brake hard, were you sit [points at side were participant 12 sit] you need to have belts but were we sit there is no risk

In this situation participant 12 have belts because she sits in the back of the bus facing forward. Seats facing forward have belts and seats facing backwards do not have belts which participants in several journeys are confused about. Later participant 13 dances in his seats when suddenly the bus brakes and he minorly hits his head on his seat. Therefore, there is a risk of sitting without belts facing backwards when you do not sit still with your back pan to the seat-back. The confusion is also therefore also about who is at risk when the bus brakes. Overall, although the children that participated in the co-construction workshop expressed familiarity, they foremost expressed confusion about what to do, specifically how to solve the problem that was presented for them and to use buttons.

4.2 Structure of the Field of Attention

Five structures of the field of attention were identified for the children with mild intellectual disability riding the self-driving bus. The structures are named based on the objects of attention (i.e., the theme): Surroundings, friends, bus behavior, own performance, and bus operation.

4.2.1 Surroundings. The children would often attend to the current environs and the things that the bus passed on its journey. The following is an example:

Participant 1: It was a bird there [...] I'm checking if there are any dogs

As some things in the environs became thematic during the journey, the surroundings would be the thematic context, and the self-driving bus and other people on board the bus were marginal.

4.2.2 Friends. Some people, such as friends or support persons currently present in the bus would also become themes in the field of attention. Having a chat and a laugh with someone is an example of this. Below are two examples of this:

Participant 9: Continuously does a thumbs up to friends and support persons
Participant 2: Towards train-station!
Security driver: Towards Alvik!
Participant 2: But we agreed upon to the train-station
Security driver: Ah just so.

Participant 2 and other children continuously had a chat with friends, support persons, and the security driver during the journey and participant 2 expressed disappointment when the bus turned around to return to the school. The upcoming end of this socially pleasing situation was a disappointment. Other people besides the one the participants were conversing with would then be in the thematic context. Things in the bus or the environment could enter as topics of conversation, but the self-driving bus and the environment outside the bus would largely be marginal.

4.2.3 Bus Behavior. As shown above, regarding the bus braking abruptly, the way the bus behaved would give rise to questions of why it did the things it did. This was also prominent in other situations. Below follows an example of the need for explanations when the bus has stopped at a crossing suddenly when it senses a bus at a nearby bus stop that stands still:

Participant 15: But if that bus stops, then this bus could go?
Support person: If they could stop? But now it is their turn?
Participant 15: Yes I know, but
Security driver: But now it seems that the bus don't want to go. We go first
[Security driver presses the manual go-button that the security driver can use to tell the bus to go into a crossing]
Participant 15: How does it know when to stop?
Security driver: It senses [?] this is how it sees [points at the screen, participant 15 leans forward]

This excerpt is interesting for several reasons. First, the child expresses perplexity about what can be understood as a perplexity (similar to the theme reported above) about why the bus stands still when other traffic is waiting for the bus to go. Second, later when the child asks about this the security driver explains how the bus sees the surroundings, not how the bus makes decisions. This can therefore also be understood as a perplexity of what the bus can and cannot do. As the event that happened and the reasons for it were thematic, then the current and future behavior in the bus would be contextual. Other people and the environment were marginal.

4.2.4 Own Performance. At times, the children would be hesitant and wonder about what to do and also what was expected from them. An example of this is the previously described excerpt that follows with that participant 13 dancing in his seat and hitting his head. Another example of this is where to sit on the bus:

Participant 15: Where should I sit?

> Researcher: There you have belts
> [Researcher points to the seats facing forward where participant 15 then takes a seat]
> [Participant 10 steps onto the bus and directly approaches a bar with buttons for the security driver that controls the bus. One support person leads her to the seat closest to the bar. A second support person asks if there are any belts there. It is not. She needs a belt and therefore she is led to a seat next to participant 15]

In this example, participant 10 is interested in a bar that is thematic for her when stepping onto the bus. Taking a seat is marginal therefore she needs assistance with taking a seat. Also, she needs a belt because she is short and does not reach the floor with her feet when sitting in a seat and furthermore struggles with body movements. A conclusion from the excerpt is that the bus and other people that could direct them would then form the thematic context so that surroundings and previous events could become marginal.

4.2.5 Bus Operation. The last theme was that of how the bus worked. It was more obvious in the perplexity section above that the participant was interested in the inner workings of how the bus worked in terms of sensors. Also, the previously described perplexity of what the bus can and cannot do can be understood as an inquiry into how the bus works even though it was not obvious in the conversation. The following is an excerpt from the recordings where the same participant expresses interest in the screen in the bus that displays what the bus "sees" are invited to watch the screen:

> Security driver: Here you see what it sees, and here someone stands
> Participants 15: Is it him [Participant turns from the screen and points at MF] can you move and go over there [points to another side of the bus and looks back and forth to the screen]

The participant is invited to watch the screen and takes the opportunity to explore how it works by commanding other people to move about the bus. Other participants also show interest in the screen, and one also proclaims that it is "a map of the whole world". The screen can be understood as a window into how the bus works, which is otherwise something abstract. Several children also notice that the control that the security driver uses to control the bus is a control of a well-known video game console which made some children joke that the bus was like a video game. The safety driver and the support persons that could offer explanations would be part of the thematic context, other things would be marginal.

5 DISCUSSION

The first research question was how children with mild intellectual disability experience riding the self-driving bus. In the present study, we have seen that it often was experienced as a familiar and contemplative situation that could be characterized by curiosity or perplexity. This is an example of what in pragmatism is referred to as a determinate situation where expectations are met and habits of action and thought work [6]. However, the bus ride was sometimes unfamiliar and surprising, and sometimes unfamiliar and confusing. This is referred to as indeterminate situations that are unexpected and habits of action and thought break down, at which the subject enters a process of inquiry to transform the indeterminate situation to a determinate one [6].

The second research question was about what objects are focal for the children and what objects are in the context and margin of their attention. The theme could vary between children and change for individuals between surrounding other passengers, and how the bus worked. The ones that were not the theme of attention, would be contextual. The attentional field could suddenly change when the bus did something unexpected, at which the behavior of the bus would become a theme. Other people that could offer an explanation would then be contextual. Arvidson [1] refers to this as restructuring of the field of attention. Similarly, when the children did not know what was expected from them and how they should do things, other people also became contextually relevant.

There are temporal aspects to the field of attention underlying our results. The children are making sense of the present situation in perplexity or curiosity, or the surprising past situation in which the bus did something unexpected, or the future situation in which what to do is confusing. Each of these themes offers opportunities for learning. Holmlid [16] made note of the two qualities surprise and confusion in relation to user experience in learning situations in the introduction of new computer applications in the workplace. In our observations, we could see that there were learning opportunities motivated by explorative curiosity, and sometimes perplexity in the present. There were also non-explorative or non-investigative experiences in certain circumstances, like passing time or being distracted. These experiences are quite similar to the ones reported by Feeley, et. al [8].

In summary, the children's user experience might be described as the contemplative curiosity and perplexity here and now, surprising about what the bus did, and confusing about what to do.

5.1 Design Considerations

The temporal aspects discussed above should also be reflected in the design of the self-driving bus for the children with mild intellectual disability. A design effort could be framed as the design of an *explainable interior* that can make use of e.g., screens, voices, and sounds. The interior should retrospectively explain the bus's sometimes surprising behavior, and prospectively explain what comes next and what performance is expected from children. This would contribute to the call from Charisi et al. [5] to the necessity for children to comprehend the autonomous nature of the vehicle for the sake of their safety. It is also in line with what has recently been proposed under the notion of "graspable AI" [12], i.e., explainable artificial intelligence (AI) physically manifested in AI-driven artifacts (for instance an autonomous bus). Further, it might also reduce the anxiety in relation to self-driving vehicles by people with intellectual disability reported by Bennet, et. al [3].

Bennet, et. al also noted that their participants were curious about the technology. This echoes our results, and an explainable interior could be designed for the current situation allowing for curiosity-driven exploration of how the bus works or of the surroundings. There is also an opportunity to design for social interaction between passengers, that is, co-experiences [10]. The goals

should be to make the situation familiar for the children so that they become accustomed to the behavior of the bus and construct realistic expectations that will help them feel guided and on the right path. This would allow the children to stay in the present and safely enjoy their journey without being surprised or confused.

We have invited children with mild intellectual disability people to ride autonomous shuttles and we have documented how they experienced the ride with the purpose of re-designing the shuttles for them. This is one way to design for the future in which children with mild intellectual disability and other children have more autonomy and independent mobility as noted by Larsson [20]. Providing people with intellectual disability with control and choice in transportation will continue to be a worthwhile effort [4, 35]. This will include guaranteeing that new technologies in public transportation are inclusive [24].

5.2 Future work

Our co-design session was only preliminary. It would be worthwhile to dedicate an entire study to such sessions. Co-design of explainable interiors with children, in the same spirit as the work in progress described by Severs et. al [33] where they explore the inclusive design of the interior of a self-driving bus. There is a need for a great variety of research to meet the variation in and between different special needs populations [17].

5.3 Conclusions

This study has shown that children with mild intellectual disability experienced riding with a self-driving bus as contemplative curiosity and perplexity here and now in familiar situations, and surprising with a focus on what the bus did or confusing about what to do in unfamiliar situations. What connects the qualities of the situation with the field of attention is a temporal structure: past, present, and future situations. The results lead to design considerations about how to design an *explainable interior* of a self-driving bus that takes retrospective, current, and prospective aspects into account.

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