Conceptual Designing of a Virtual Receptionist: Remote Desktop Walkthrough and Bodystorming in VR

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Early user involvement in the design of intelligent virtual agents (IVAs) is fundamental for usability and otherwise good user experience. In this paper, we present a combination of methods used in the remote conceptual design of a virtual receptionist for a university department. The study builds on two workshops with potential users. The first was a bodystorming workshop in virtual reality (VR) with four researchers at the department, and the second was a desktop walkthrough workshop on an online whiteboard with five students at the department. Proposed solutions from the workshops were deconstructed using a morphological chart into a pentad of parameters: agent, act, scene, agency, and purpose. New design concepts were then composed by combining solutions. Sketching was used to further detail and present the generated concepts. Our analysis of the workshops indicates that the bodystorming workshop had an aesthetic perspective on embodied interaction while the desktop walkthrough workshop had a more instrumental perspective on usability. The combination of embodied but remote ideation methods with morphological chart structured by the pentad is novel to not only the IVA field, but also to interaction design in general. Finally, the conceptual design of a novel cross-platform IVA is proposed.

CCS Concepts: • **Human-centered computing → User centered design**; **Participatory design**.

Additional Key Words and Phrases: Intelligent virtual agents, design, user involvement, bodystorming, desktop walkthrough, morphological chart, virtual reality, remote design, conceptual design, concept sketching

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1 INTRODUCTION

This paper focuses on remote user involvement in the conceptual stage of intelligent virtual agent (IVA) design. The design of IVAs is multidisciplinary and it focuses on different user-centred aspects such as dialogue, emotion, appearance, presence and behaviour. Yet, as Isbister et al.[16] state, design choices regarding these aspects are often based on the "introspective examination of personal preferences" rather than any accurate reflection of the design goals or the qualities valued by the users.

In relation to conceptual design, Parush [21] highlights the importance of human performance, usability, and user experience. Human performance refers to the perception, cognition, emotion, and behaviour of the user. Usability and user experience refers to the learnability, effectiveness, efficiency, and subjective experience of users interacting with a system to accomplish goals with a certain degree of satisfaction. Parush argues that user requirements form a basis for the conceptual design [21]. Usability has been a longstanding concern for the field of human-computer interaction (HCI) [3, 11, 15] and early user involvement has been a cornerstone of design for usability and user experience. User involvement brings attention to practical functionality and how the system fits to the context of use, and it can include users either as active designers or as information providers [19]. In this paper, we focus on users taking an active role in a design process, but doing so remotely over distance.

Remote user involvement, or distributed participatory design (DPD), aims to create a virtual or online shared space that is suitable for cooperative design whilst preserving the geographic situation of each participant [20]. Social networking applications and web content creation platforms provide some tools and practices for DPD [14]. Platforms such as [1]Zoom, [2]Miro and [3] Mozilla hubs are examples of applications that can facilitate remote cooperative design for geographically distributed participants.

The purpose of this study is to explore approaches to the remote conceptual design of an intelligent virtual receptionist at a university department. The work builds on DPD with users mediated by multiple social technologies to develop concept design ideas for the virtual receptionist. The research question is: *How might we do remote conceptual design of a virtual receptionist for a university department?*

The research approach can be characterised as a combination of Research-through-Design (RtD) and case study research. RtD builds on design methods, design practices, and design processes for the purpose of generating new knowledge [40]. It draws on a reflective practice that continuously reinterprets and re-frames "a problematic situation through a process of making and critiquing artifacts that function as proposed solutions" [40]. Case studies are carried out not only for an encompassing understanding of the individual case, but also for generating findings about a phenomenon across cases, and the development of general theoretical statements on observed regularities [12]. A case study is an "empirical inquiry about a contemporary phenomenon (e.g., a "case"), set within its real-worldcontext—especially when the boundaries between phenomenon and context are not clearly evident" [37].

[1]Zoom
[2]Miro
[3]Mozilla hubs

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1.1 Conceptual Design Methods

Conceptual design can be conceived as a phase in the design process where it is decided what it is that should be designed and why. This phase is sometimes referred to as the fuzzy front-end of design and innovation and it is characterised by searching for both information and inspiration [24, 28]. Conceptual design can also be conceived as an innovation approach that involves iterative framing and re-framing for reaching existing goals in radically new ways or pursuing completely new purposes [38, 39]. A design concept is an anticipatory, well-founded, focused, and understandable description of a product or service [18]. It minimally consists of a name, a purpose, and design principles [38], but it can also be structured according to Burke's Pentad [9]: agent/who, act/what, scene/when–where, agency/how, and purpose/why [4, 5]. The constituents of the pentad can also be used for analysis of the design problem as described in the WWWWWH method [31].

Wertsch [33] relates Burke's Pentad of human actions and motives to his own framework of thinking as mediated action. He states that the pentad involves focusing on agents and their cultural tools or mediational means. Mediated action can be defined as a way of "researching how people use different types of objects and tools both physical and psychological to structure their interactions, communicate with each other, and think" [23].

Conceptual design methods typically include methods for concept generation, selection, and testing [30]. In this paper, we focus on concept generation and in particular the methods of bodystorming, desktop walkthrough, morphological chart, and concept sketching.

1.2 Bodystorming

Bodystorming is a method that emphasises the physical situation of use. It is an embodied method, which means that it takes advantage of embodied cognition and interaction, (i.e., the bodily actions involved in the development of thoughts, ideas and actions [1]). Embodied design methods enable the use of all of a person's senses in an emergent design space [34]. Bodystorming is a form of brainstorming using participants' bodily presence in the context of use to gain insight into the user experience [22, 29].

1.3 Desktop Walkthrough

Desktop walkthrough is a method that allows for a quick simulation of a service experience using simple small figurines such as LEGO pieces to represent people or other elements of service [7, 29]. It facilitates visualisation, externalisation, and prototyping of potential service scenarios with an emphasis on temporal aspects, physical movement, and playful collaborative exploration of alternatives [8].

1.4 Morphological Chart

Morphological chart is an analytical and structured engineering design method. It is based on deconstruction of the overall design into parameters or sub-functions that can have multiple components or solutions. [27, 31]. A morphological chart consists of a table with one row for each parameter/sub-functions (e.g., stop vehicle or put vehicle in motion) and possible solutions/components for them (e.g., disk breaks, rim breaks, tire breaks, feet, parachute, and anchor to stop vehicle) [31]. The solutions are then combined to generate new design solutions. Morphological charts encourage divergent thinking and prevent against overlooking novel solutions to design problems [17]. A limitation is that it is difficult to apply when the goals are not clear and there is not yet a decided main function [31].

1.5 Concept Sketching

Sketching is traditionally used during the conceptual design phase to seek design solutions. Sketching is important at this stage in that it provide subjective interpretations where opportunities for solution ideas and direction of change are most crucial [25]. Sketching allows for dialogue between specialists, recognition of conflicts and possibilities, and re-interpretations [36]. It is useful in the revision and refinement of ideas, generation of concepts and facilitating problem solving [6]. In concept sketching, it is important to represent what *crux* the concept addresses, and what the principle behind, or the *thing* is, with it [5, 38].

1.6 PMI Chart

One way of evaluating concept ideas is by using a PMI (plus, minus, interesting) chart. The PMI chart is a decision making and critical thinking tool originally proposed by Edward De Bono [26]. It is used to encourage the evaluation of ideas, concepts and experience from different perspectives [26].

The following section describes how the methods of bodystorming, desktop walkthrough, morphological chart, sketching, and PMI chart were carried out in this study to answer the question of how we might do remote conceptual design of a virtual receptionist for a university department?

2 METHOD

RtD aims to produce original and relevant knowledge by means of well-documented and reflective design practice. This knowledge can include for example novel design methods and specific design artifacts [40]. RtD can contribute by re-framing the design situation, identifying of new opportunities, and creating artifacts that embody theories and technical opportunities [41]. In our case, the knowledge are in the form of generated concept ideas and re-framing of the design situation and the practice of designing virtual intelligent agents by co-designing with users who imagine how an IVA can fit the purpose of a particular space and how it would be experienced.

This is a study of how we might do remote conceptual design of a virtual receptionist for a university department. This is approached by exploring potential purposes for agents in this context and generating design concepts together with users by representing the intended physical context of use in a three-dimensional virtual reality (VR) environment and on a two-dimensional online platform. Two workshops, one with Bodystorming and one with Desktop Walkthrough, were conducted. Both workshops were conducted in 3 parts: design activity (i.e., bodystorming or desktop walkthrough), brainstorming, and a final discussion.

The bodystorming workshop was carried out in a virtual reality environment. A 3D model of the office building built using Tvori[4] and deployed in Mozilla hubs. The desktop walkthrough was carried out using Miro and a combination of LEGO and other figurine

[4]Tvori

representations, to achieve a look and feel that would be similar to an ordinary face-to-face desktop walkthrough.

2.1 Remote Bodystorming

The bodystorming workshop had four regular participants, a facilitator and an observer. One of the regular participants was female and the others were male. All participants were researchers who were familiar with the office building where the interactive virtual agent would be used. Informed consent was given by the participants.

The workshop was carried out in a web-based VR platform (Mozilla hubs) that allowed for access with a web browser, without any prior installations or VR equipment. A 3D-model representing the office floor of the intended university building was designed (using Tvori) and implemented into Mozilla hubs. The physical presence of the participants was represented using avatars as shown in Figure 1.

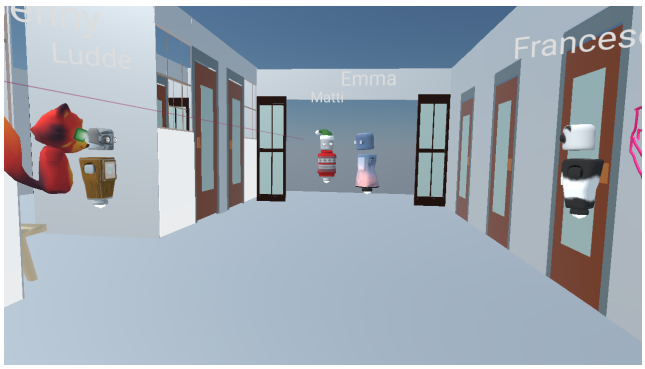

Fig. 1. Bodystorming session in VR: participants' avatars in the corridor station

The workshop had three phases: bodystorming, brainstorming and a discussion. The bodystorming phase involved three stations: the entrance, coffee area and the corridor. The participants first explored the office space, then came to the first meetup station for the bodystorming phase. The bodystorming moved to the next station when the participants felt they had exhausted all their ideas of the current station.

The brainstorming phase was carried out using the online whiteboard platform Miro. All participants wrote down all ideas that had been generated during the bodystorming session. The ideas where then categorised into two main groups Places and Designs. Places had the three bodystorming stations as sub-categories. The design category had the following sub-categories: Platforms and Modalities; Abilities; and Concepts. The final phase of the workshop was a discussion with participants about their experiences of the workshop as a whole, including its limitations and benefits.

Procedural issues faced during the bodystorming workshop were technical in nature—participants could not hear each other during the initial connection to Mozilla. This was resolved by changing browsers and reconnecting. One participant could not resolve the issue due to security restrictions and therefore was not included in the workshop. The other issue was that audio was not recorded for the bodystorming session. This was covered by the notes taken during the session.

2.2 Remote Desktop Walkthrough

The desktop walkthrough workshop had five regular participants, a facilitator and an observer. Of the regular participants, 2 were female and 3 male. All participants were master students and one of them (a Design student) had never been to the building while the other four (Cognitive Science students) were familiar with the office building. Informed consent was given by the participants.

The workshop was carried out in Miro. The layout of the online whiteboard consisted of a blueprint of the office floor, 2D images, sticky notes and other default tools that come with the Miro platform (such, frames and shapes). This is shown in figure 2. The images on the floor plan represented the participants and intelligent agents (physical and virtual).

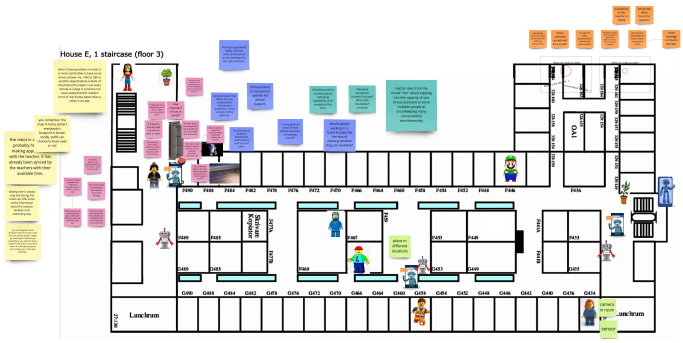

Fig. 2. Desktop walkthrough on an online whiteboard

The desktop walkthrough workshop was divided into three phases: the walkthrough, brainstorming, and a discussion. The participants were first introduced to the platform, then provided with two scenarios (see A). Three participants were intended to first role play and enact the scenarios to encouraging idea generation. The 3 participants were assigned roles, which were to be swapped between the scenarios. The roles were: a student, an intelligent agent (represented by a robot image), and an overseer (acting as a voice of reason). The overseer was to assist the other roles in generating ideas by asking questions and making suggestions if the actors of the two roles seem stuck. The student and the intelligent agent roles could communicate with the overseer as well. The actual enactment lasted a few minutes before all the participants started discussing ideas and solutions instead.

The brainstorming session consisted of all participants writing down generated ideas on the sticky notes and then reorganising them into categories based on how the ideas were related. The workshop was concluded by a group discussion about how the participants had experienced the workshop, including its limitations and benefits.

The desktop walkthrough session was planned to last about 50 minutes with 20 minutes of defining and refining the generated ideas. However, the session was disrupted after 25 minutes by a 20-minutes power-outage for some of the participants. When the workshop was resumed, the participants moved on to the defining and refining phase to prevent loss of generated ideas. One participant missed the

discussion session due to the changed time plan. The participant and the facilitator had the discussion session a few days later instead.

2.3 Data Collection and Analysis

Data was collected by video recording of the sessions and by note-taking by the authors, one in the role of facilitator and other in the role of observer. The analysis was iterative and notes and recordings were put in relation to Burke's Pentad [9] (see Appendix A). The morphological chart method, used as described in the introduction, was employed to generate potential design concepts from the collected data as illustrated in Figure 3. Sketches were made for selected concepts and PMI was used to evaluate them.

3 RESULTS

The concept design is of a virtual receptionist for the offices of a university department that houses staff offices, meeting rooms, and labs used by both members of staff and students. The offices also include common areas such as a couple of lunch rooms and a coffee area.

The ideas generated in the bodystorming were concerned two main categories: Places and Design. The places category consists of the bodystorming discussion areas: entrance, coffee room, and the corridors and what functionalities that a virtual receptionist could have at those places. Examples include recognition of members of staff at the entrance, stating interesting facts in the coffee room, and the agent appearing on screens outside each door of the corridor. The design category consists of platform and modalities, abilities, and concepts.

The ideas from the desktop walkthrough were grouped into the categories Platform (e.g., robot or screen), Abilities (e.g., can contact staff, can show the location of people), and Trust versus Speed (e.g., inspired by the movie *Her*, one virtual receptionist could serve several people simultaneously).

3.1 Morphological Chart

The generated ideas were then structured using Burke's Pentad as shown in figure 3. The chart has the elements of the Pentad in the left column: Act, Agent (with one row for the human and one for the IVA), Agency (with one for the platform and one for modalities and abilities), Scene, and Purpose. Some ideas were unique to the bodystorming (marked yellow in the figure), some were unique to the desktop walkthrough (marked green in the figure), and some ideas surfaced in both workshops (marked red in the figure).

3.1.1 Act. In both workshops, imagined acts included that the receptionist agent would providing information and directions. Acts from the bodystorming included that the agent would invite users to interact verbally and make the user aware of its presence. Acts from the desktop walkthrough were that the user would request information, make video calls, and view or book slots in staff members' schedules.

3.1.2 Agent. Human agents imagined in both workshops included visitors and students, while the interactive virtual agent was imagined on screens by each door that the agent could move between. Human agents in the bodystorming also included members of staff. Interactive agents from the bodystorming included ideas about a personal receptionist, a ghost, a herald, a research platform, a division assistant, and a coffee machine. Ideas from the desktop walkthrough also included cameras and sensors in offices.

3.1.3 Agency. It was in both workshops imagined that the platform and modality of interaction could be a physical robot, a screen-based agent, or a sound guide that the user could interact with on the mobile phone, or using voice. It was also imagined that the agent would need to be able to interpret the behaviour of the human user in some way. The participants in the bodystorming also imagined a guide that showed the way using light, text, QR-codes, projections, bulletin boards, and customisable avatars. They thought that the agent could have a human-like personality, perhaps nursing, that would adapt to the person it was interacting with. This would require the ability to recognise people. They also thought it could be a teachable agent. The participants in the desktop walkthrough also imagined touchscreens, that students could swipe their student identification cards, that there could be whiteboards, digital maps, and arrows that would appear and show directions. They also had ideas about interactive virtual agents that could move between different media and platforms, conduct several conversations at the same time, and schedule appointments with staff members.

3.1.4 Scene. The participants in both workshops considered situations of use at the entrance to the building, that agents could move between places, and the coffee area in the middle of the building. The bodystorming participants also considered the corridor, and the desktop walkthrough considered the stairs.

3.1.5 Purpose. In both workshops, the imagined purpose would be to get information, but also socialise, and enhance conversations between people. The bodystorming also had ideas about providing assistance and giving reminders as potential purposes.

3.2 Design Concepts

Three concepts (one main and two alternative) were created from the morphological chart using the following criteria:

- feasibility—is it feasible to design and implement?
- desirability—is it desirable from a user's point of view?
- novelty—is it interesting and original?

The main concept is a cross-platform virtual receptionist that provides information to all human agents (visitors, members of staff, and students) through different media in a user journey across the user's mobile device, a large screen, and a physical robot. The virtual receptionist is knowledgeable (omniscient) and is accessible in the main scenes: the entrance, the corridor, and the coffee area. This is illustrated in the sketch in figure 4.

The second concept is a mystical virtual receptionist that provides details on the availability of members of staff to students (human agent) and allows students to book time slots on the members of staff's schedules. The receptionist is available in specified locations and can be accessed using a student card. The receptionist can interact in the form of a ghost or through screens placed on each door and can move between screens. The purpose of the receptionist is to provide assistance to students. This concept is illustrated in figure 5.

Act	Agent invites users	Verbal conversation	Provide information-sound, remind, inform, direction	Agent makes aware of presence	View or book meeting rooms	User request information	User makes video call	View or book slot in staff schedule	
Human-agents	Visitor	Member of staff	Student						
Agency - Platform and modalities	Physical robot	Screen-based agent	Sound guide	Light guide	On the mobile device	Voice/speech	Text	QR-code	Projector
	Bulletin board	Avatars	Touchpoints on the screen	Student card	Whiteboard	Digital map	Virtual arrows appear to show direction		
Scene	Entrance	Media in use location	Coffee area	Corridor	Stationed in different specified	Stairs			
Agency - Abilities	Evaluate human behaviours	Humanlike, personality, naturing, adapting	Customizable appearance and voice	Recognize people	Knowledgeable (all knowing)	Teachable	Move between media (physical and virtual)	Can conduct multiple conversation simultaneously	Schedule staff availability
Interactive agents	Personal receptionist	Ghosts	The Herald-the shouter	A research platform	Division assistant	Coffee machine	Screens on each door	Camera and sensors in offices	Agent that can move between screens
	Augmented reality – signs showing direction	Light button on doors to show availability	Button at entrance to get robot to come to the entrance	Digital map/floor plan showing location					
Purpose	Obtain information	Provide information	socializing	Provide assistance	Give reminder	Enhance conversations			

Fig. 3. Morphological chart based on Burke's Pentad

The elements of the Pentad are displayed in the left most column. Each row displays results corresponding to each element. The results of the Bodystorming session are marked in yellow, the results of the desktop walkthrough session are marked in green and the results that overlap both workshops are marked in red

Entrance: Virtual receptionist providing information on monitor.

Corridor: Virtual receptionist providing information through a mobile device.

Coffee area: Discussion with physical robot.

Fig. 4. Sketch of cross-platform virtual receptionist

The third concept (schedule custodian) is a virtual receptionist that makes its presence known to members of staff (the human agent), provides reminders, and allows staff members to view and book meeting rooms. The agent provides schedule information and can be used to enhance conversation in scenes such as the coffee area. The interactive modalities of the virtual receptionist is voice and it is screen based. The receptionist's purpose is to provide assistance and reminders. The schedule custodian is illustrated in figure 6.

The concepts were subsequently evaluated using a PMI (plus, minus, interesting) chart. We used the PMI to identify the strength and weaknesses of the generated concepts as shown in table 1. The PMI chart will assist in identifying the most suitable concept

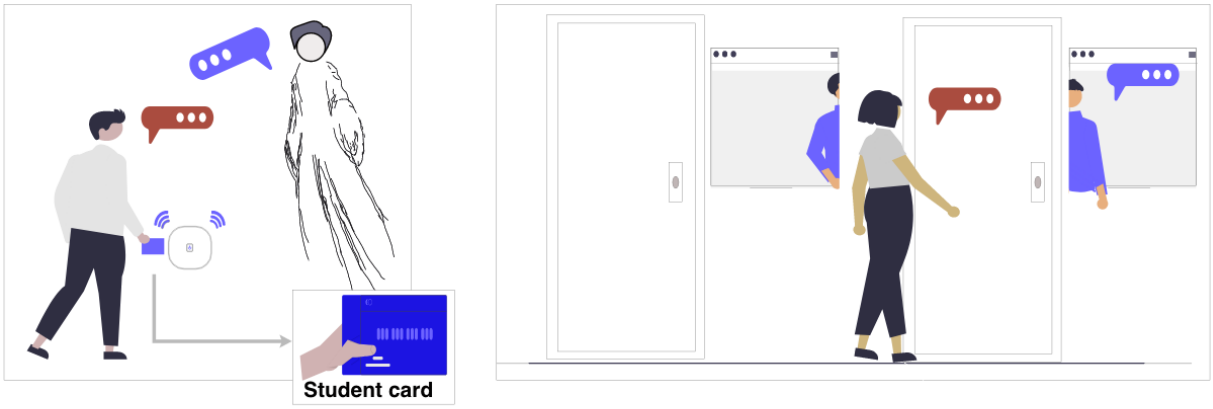

Fig. 5. Sketch of mystical virtual receptionist

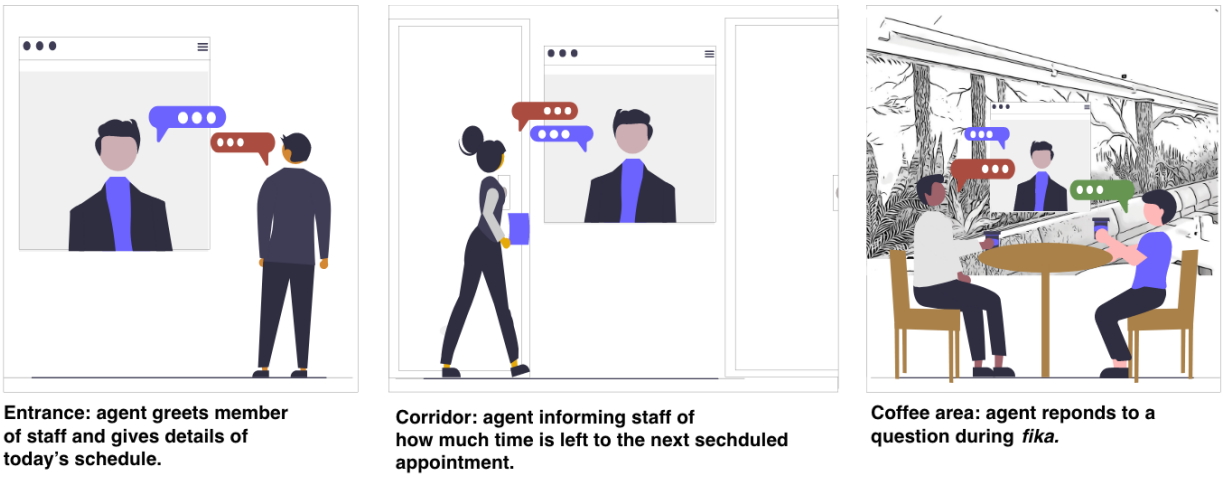

Fig. 6. Sketch of schedule custodian virtual receptionist

for the next phase of the development (prototyping of the virtual receptionist).

3.3 Remote Concept Design Methods

The participants in the bodystorming and the desktop walkthrough were asked to reflect on the methods used in the workshop they participated in, and they were also asked to make comparisons to face-to-face workshops.

In the bodystorming, the participants thought that there were contextual cues from the physical environment that were missing, which could have triggered additional ideas. The 3D-model of the offices were by necessity simplified. For instance, the presence of other people in the building, the real lighting, and the exact layout of the space could have given rise to other ideas. The absence of real constraints of interaction in VR can also give rise to unrealistic ideas (e.g., flying). The participants thought that a benefit of doing the bodystorming in VR was that the lack of contextual cues also could give rise to ideas since they already were familiar with the physical space. Another perceived benefit was there were no people in the same space that could interrupt the workshop. Also, being able to fly meant that you could take a bird's eye view of the offices.

In the desktop walkthrough, the participants found it difficult to imagine the real physical space in the role playing. They thought that tangible physical things make it easier to role play. The physical tangible objects, such as Lego, afford playing in a way that digital objects on the screen do not even though the provided props in the form of images and figures did trigger ideas. The participants also thought that turn-taking was difficult at times. Using the online whiteboard (i.e., Miro) facilitated uninterrupted work. There was one participant who had not been in the building, and for her the props meant that she did not have to imagine the structure of building, and she felt that she could instead focus on generating ideas based on the provided scenario.

Concept Name	Plus	Minus	Interesting
Cross-platform	- Provides support to all identified users (human agents). - Technically feasible. - Accessible from different media. - Wider range of services.	- Accesses to personal devices. - Wide range of services may require a wide range of data sources.	- Include other features such as a digital map for visitor. - Extended to other buildings and areas of the campus.
Mystical (Hogwarts inspired)	- Secure - accessible by student card. - Novel concept. - Desired by participants of both workshops.	- Complex - May be difficult to implement. - Limited to a specific group of users. - Acceptance by users of the building.	- ghosts can move between rooms and screens. - have visitors guided through the building by ghost agent.
Schedule custodian	- Accessible in common areas - Technically feasible. - Allows for future improvements (is teachable).	- Limited to a specific group of users. - Limited type of service: staff schedules.	- Teacher staff can use the platform for student projects (as it is teachable). - Include the options to allow access to personalized information.

Table 1. Plus, Minus, and Interesting chart of the generated concepts

There were qualitative differences between the ideas from each method. The acts from the bodystorming focused on what the intelligent agent would do, while the acts from the desktop walkthrough focused on what the user would do. The agency imagined in the bodystorming focused on the embodiment of the intelligent agent (e.g., robotic vs. screen-based vs. projector) and the aesthetics of the manner of behaviour it would have (e.g. nurturing). The agency imagined in the desktop walkthrough was more instrumental and focused on the mediational means provided to the user (e.g., scheduling staff availability). Another difference, concerning the scene, was that the bodystorming focused more on places, while the desktop focused on the user's trajectory or task.

4 DISCUSSION

The aim of the paper was to explore approaches to the remote conceptual design of an intelligent virtual receptionist at a university department. The process involved bodystorming in VR and desktop walkthrough on an online whiteboard with prospective users. A number of ideas were generated, some unique to each workshop and others overlapping. The ideas were then processed using a morphological chart structured by Burke's pentad to generate the three concepts. The concepts refer both to the acts of the IVA and those of a user in different scenes of the department building.

The conceptual design phase focuses on decisions of what should be designed and why [5, 38]. The users' experiences and needs form the basis of the conceptual design [21]. In the design of the IVA, we have had users as remote participants in a distributed design process. We used VR and an online whiteboard to bridge distance and create a virtual shared space for collaboration to mitigate challenges that are common in distributed participatory design [20]. Social networking applications and web content creation platforms, in our case Zoom, Mozilla Hubs, and Miro, can as earlier research also has indicated [14], eliminate challenges related to prior knowledge of a given collaboration platform.

The conceptual design phase is crucial when generating completely new designs and exploring what the purpose of the design effort is. Information is fuzzy and incomplete in concept design projects, and it's challenging to capture user's intention [32]. We use a combination of embodied design methods (bodystorming and desktop walkthrough) to overcome these challenges. The morphological chart was used to combine solutions to obtain a number of concept variants-"feasible alternative concepts" from a large number of solutions[32]. A novel approach was to structure the morphological chart by Burke's pentad. The combination of interaction and service design methods (bodystorming and desktop walkthrough) with remote collaboration tools (VR and online whiteboard), and the morphological chart structured by Burke's pentad has not been documented in design research before.

The design of IVAs focuses on different user-centred aspects such as dialogue, emotion, appearance, presence and behaviour, but design decisions do not always reflect the design goals or the qualities valued by the users [16]. Research on cross-platform (multi-modal) IVA design or development tends to refer to systems/platforms that combine aspects of an IVA (e.g,[10, 35]) or the integration of an IVA platform with another platform such as VR or augmented reality (e.g., [2, 13]). We have in this design study presented a somewhat novel and interesting concept of a cross-platform IVA where the agent is able to adapt to different embodiments, be it physical (robot) or virtual (on screen), and provide seamless interaction.

4.1 Limitations

There was a small number of participants in the study (4 in the bodystorming and 5 in the desktop walkthrough) and a larger number of participants might have made a difference to the study and the results.

The paper builds on a case study, and as such it cannot be replicated. It is from this study not possible to to say if the observed differences between ideas generated in the two workshops depended

on the participants (i.e., PhD students and lecturers in the bodystorming and master students in the desktop walkthrough) or if they depended on the methods.

As the study is of an IVA of a specific department building, it may be difficult to generalise to other contexts. Instead, the reader is advised to consider what aspects that make results transferable from this specific case to another. The generated concepts might be best applied to similar settings, whilst the applied method combination might be generalised further. The results remain tentative, and conclusions should be regarded as working hypotheses to be tested in further research and development.

4.2 Future Work

The next step is further development and evaluation of the generated concepts to validate them. This will include feasibility studies of some of the novel concepts. The future work is aimed at prototyping and construction of a cross-platform intelligent virtual agent.

It would be worthwhile conducting an experiment given that a qualitative study makes it difficult to be conclusive about cause and effect. The aim of an experiment would be to study if bodystorming and a desktop walkthrough yield different kinds of ideas. The working hypothesis from this study is that the desktop walkthrough gives more ideas focused on the users' interaction flow through an instrumental task while the bodystorming gives more ideas on the aesthetic embodiment and manners of behaviour of an interactive system. However, how to operationalise and choose dependent variable for such an experiment is still a validity and reliability concern.

4.3 Conclusions

This paper has presented the remote conceptual design of an intelligent virtual receptionist at a university department. The work consists of a combination of methods that are novel in the area of intelligent virtual agent design. The work combined embodied but remote methods (bodystorming in VR and desktop walkthrough on an online whiteboard) with morphological chart structured by Burke's pentad. A working hypothesis is that a bodystorming yields more aesthetically focused ideas about embodied interaction while the desktop walkthrough gives a more instrumental usability focus. The concept of a cross-platform IVA is interesting for further research.

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A DESKTOP WALKTHROUGH: SCENARIOS

Scenario 1: You are new to E-huset 3rd floor and have been asked to leave your assignment at Emma's office. You also plan to discussion changes to your upcoming project with Mattias while you are here. Emma is not in her office and Mattias is currently at a conference.
To remember: You are free to make a few changes to the scenario.

Scenario 2: After you get hold of Emma, she suggests you book a room for the discussion. You have to check her availability and that of the room meeting.

Act: invite people to interact with / recognize staff/read body language/greeting **Agent**: Virtual receptionist **Scene**: Entrance **Agency**: verbal/sound (not intrusive) **Purpose**: find out if assistance is required **Act**: Get the receptionists attention **Agent**: visitor/member of staff/student **Scene**: Entrance **Agency**: QR code, body language **Purpose**: get information **Act**: respond to requests/questions **Agent**: Virtual receptionist **Scene**: Entrance **Agency**: verbal/sound **Purpose**: provide information **Act**: respond to requests **Agent**: visitor/member of staff/student **Scene**: Entrance **Agency**: verbal **Purpose**: obtain information	**Act**: information update from news and social media/ fun facts/ student projects **Agent**: Receptionist **Scene**: coffee room **Agency**: text, verbal **Purpose**: socializing, add to occurring conversations **Act**: reminding if running late for an event **Agent**: Receptionist **Scene**: coffee room **Agency**: text, verbal **Purpose**: reminder on upcoming calendar event **Act**: providing room details such as room name. **Agent**: Receptionist **Scene**: corridor **Agency**: verbal/text **Purpose**: provide information

Fig. 7. Bodystorming Burke's Pentad

Act: Get location of room/schedule details of member of staff **Agent**: visitor/student **Scene**: Entrance/door of member of staff **Agency**: voice activation **Purpose**: get information **Act**: Make video call to member of staff **Agent**: visitor/student **Scene**: Entrance **Agency**: screen, robot **Purpose**: provide communication	**Act**: schedule office hours for teachers **Agent**: Receptionist **Scene**: anywhere within the building **Agency**: screen, robot **Purpose**: provide availability details to users **Act**: provide useful information about the campus facilities in interesting. **Agent**: Receptionist **Scene**: student waiting **Agency**: screen, robot **Purpose**: take out the boredom of waiting

Fig. 8. Desktop Walkthrough Pentad