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ORIGINAL RESEARCH

How nursing home residents with dementia respond to the interactive art installation 'VENSTER': a pilot study

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ABSTRACT

The goal of this study was (1) to determine whether and how nursing home residents with dementia respond to the interactive art installation in general and (2) to identify whether responses change when the content type and, therefore, the nature of the interaction with the artwork changes. The interactive art installation 'VENSTER' evokes responses in nursing home residents with dementia, illustrating the potential of interactive artworks in the nursing home environment. Frequently observed responses were naming, recognizing or asking questions about depicted content and how the installation worked, physically gesturing towards or tapping on the screen and tapping or singing along to the music. It seemed content matters a lot. When VENSTER is to be used in routine care, the choice of a type of content is critical to the intended experience/usage in practice. In this study, recognition seemed to trigger memory and (in most cases) a verbal reaction, while indistinctness led to asking for more information. When (initially) coached by a care provider, residents actively engaged physically with the screen. Responses differed between content types, which makes it important to further explore different types of content and content as an interface to provide meaningful experiences for nursing home residents.

➤ **IMPLICATIONS FOR REHABILITATION**
- VENSTER can facilitate different types of responses ranging from verbal reactions to active physical engagement. The choice of a type of content is critical to the intended experience/usage in practice.
- Activating content seems suitable for use as a meaningful experience during the spare time in between existing activities or therapy.
- Sessions with interactive content are short (avg. 30 mins) and intense and can therefore potentially be used as an activating therapy, activity or exercise.
- In order to actively engage residents with dementia, the role of the care provider seems very important.

Introduction

The central philosophy in nursing homes today is emotion-oriented care, tailored to the residents' individual needs and possibilities [1]. This philosophy is put into practice in various forms, for instance in multi-sensory, musical or creative therapy. Although evidence for non-pharmacological approaches is accumulating [2], they are restricted to a set timeframe and require a skilled professional to be present. This makes it worthwhile to explore if it is possible to provide nursing home residents with an experience they can enjoy on their own or with family and friends (informal caregivers), using interactive art as a medium.

Interactive art differs in its essence from non-interactive art. Recipients can only enjoy, watch and interpret a non-interactive artwork from a distance. Art historian Katja Kwastek states that "*Interactive art places the action of the recipient at the heart of its aesthetics. It is the recipient's activity that gives form and presence to the interactive artwork, the recipient's activity is also the primary source of his aesthetic experience*" [3]. An example of an interactive art installation is Anthonin Fourneau's "Water Light Graffiti" [4]. Without recipients' actions, it is just a black wall. But when they spray and splash water, the artwork comes to life. The experience and enjoyment lies in the interaction between the recipient and the interactive artwork. Research shows that interactive art has an effect on human behaviour. It can provide a rich experience in which play, exploration, cooperation and social interaction are encouraged [5–7]. In view of the intuitive and playful characteristics of interactive artworks, they are more accessible for people who find it hard to communicate with other people and/or have problems understanding the world around them. This makes interactive art potentially interesting for people with dementia [8,9].

The study reported in this paper assessed how nursing home residents with dementia responded to an interactive art installation called 'VENSTER', which was specifically designed for this study, and whether their responses differed when the nature of the interaction with the artwork changed.

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The interactive artwork 'VENSTER'

VENSTER (Figure 1), which translates as "WINDOW" in English, is an interactive art installation which could facilitate nursing home residents in connecting or reconnecting with the outside world. Not by augmenting existing activities or therapy, but by providing a meaningful experience.

The concept of VENSTER was devised by designers and implemented in co-creation with residents and their informal and professional caregivers (care providers) in a Dutch nursing home.

The installation can show pre-recorded calming (Figure 2(A)) or activating (Figure 2(B)) content, and is also able to present interactive content (Figure 2(C)), which can be manipulated in real time using touch screen technology. Each of the content types comprises several different scenes. When the installation detects the presence of a person, music starts playing.

Physically, VENSTER consists of two large (touch) screens, vertically mounted in a fake wall, plus a computer, a Kinect™ sensor and a roller blind with a string. The Kinect™ sensor tracks the user's position, and the computer adapts the perspective of the screens accordingly. The string attached to the roller blind serves as a switch to change the scene.

The goal of the present study was (1) to determine whether and how nursing home residents with dementia respond to the interactive art installation in general and (2) to identify whether their responses change when the content type and, therefore, the nature of the interaction with the artwork changes. This study is a first step in assessing the potential of interactive art installations as an experience-oriented care technology in a nursing home setting.

Methods

The research protocol was set up as an observational explorative study. The study took place at a nursing home facility in the south of the Netherlands. Participants who took part lived at a closed facility for people suffering from psychogeriatric disorders.

Study population

During the observations, 35 residents were living in the participating ward. All of them suffered from dementia to such a degree that they were unable to live independently. The selection of actual participants from the closed ward was made by the professional caregivers, based on availability. They were invited to spend some time in an indoor public space. Residents from an open ward could freely walk in and out of this semi-public square during the observations and participate spontaneously if they wanted to do so.

Ethical considerations

The research protocol was approved by the local ethics board (METC Atrium, Orbis, Zuyd; 14-N-100). No actual consent form was completed and this was given an exempt status. The ethical board approved the way participants were selected and included to enable the exploration of spontaneous responses of the residents in a "real-life" setting. Two weeks prior to the observations all residents, their legal representatives and the professional caregivers were informed about the upcoming study by means of an information letter. They were invited to try out the installation (which had already been placed on site) for themselves and contact the researchers for additional information, and they could refuse study participation up to the start of the observations.

Design

Six to eight residents of the ward and 1–2 care providers were invited to attend a session with VENSTER lasting a maximum of 2 h, in a public space of the nursing home (Figure 3). The residents were initially seated at a table, providing them with a clear view of the VENSTER installation. A public hallway, where other people could walk by, was located next to the seating area. The researchers were seated out of view and able to follow the session through a remote screen. Two video cameras (front and back) captured the participants' responses, which allowed repeated display of the observed responses.

During each session, one of three above-mentioned types of content (calming, activating and interactive, Figure 2) was presented. The calming content displayed for instance a nearby park and fishing pond (Figure 2(A)). Activating content showed videos that were designed to trigger (re)actions (e.g., a little girl placing her hand on the window and waving, Figure 2(B)). For the interactive content, the computer generated semi-abstract scenery (e.g., falling snow), which could be manipulated by touching the screen (Figure 2(C)).

When the majority of residents started to lose interest and focus, the care provider could signal the researchers to end the session sooner than the maximum duration of 2 h.

Data collection

The gender of the participants and the ward in which they were staying (open/closed ward) were recorded. Two researchers (TL and GJ) were present during all the observations. The observers kept their involvement to a minimum, interfering only when there was a malfunction of the installation. Where needed, field notes were taken to complement the recordings. A short, open exit-interview about the care providers' impressions took place after each of the 8 sessions.

Data analysis

The data was analyzed by two researchers (TL and GJ). All visible and audible interactions recorded on video were transcribed and coded. In case of disagreement, the researchers consulted two other researchers (SB and SvH) to reach consensus. The framework of codes was based on the results of a prior literature review on "Participant Responses to Physical, Open-ended Interactive Digital Artworks" [10]. The framework distinguishes between human–human and human–artwork responses, each divided into verbal, physical and emotional/mental responses. This global division was further subdivided into 11 categories (see see categories Figure 4(B)). To provide a comprehensive structure, all coded responses were organized in mind maps, using MindJet MindManager © (MindJet, Pleasanton, CA).

Coding of responses

Responses were coded as "human–artwork" when there was only one person involved and his/her response was directed towards the art installation. Responses were coded as "human–human" when 2 or more people were involved and their responses were directed towards each other. When multiple people directed a response towards VENSTER and each other, the response was coded as both human–human and human–artwork. When a response was individual, the coded name of the person was added; when two or more people were involved, all coded names were added, the initiator appearing first. If a resident

Figure 1. VENSTER: interactive art installation bringing the outside world into the nursing home.

Figure 2. Examples of calming (A), activating (B), interactive and (C) content.

simultaneously displayed two or more types of response, the response was recorded in all corresponding categories.

The following categories were used:

- All comprehensible verbal feedback with regard to the installation, either directed towards the installation or to another person, was coded as "*verbal responses*".

- All distinguishable physical actions of any duration with regard to the installation, either directed towards the installation or to another person were coded as "*physical responses*".

- When participants looked away from the installation or other people, staring into the distance for more than 3 s, the response was coded as "*lost focus*".
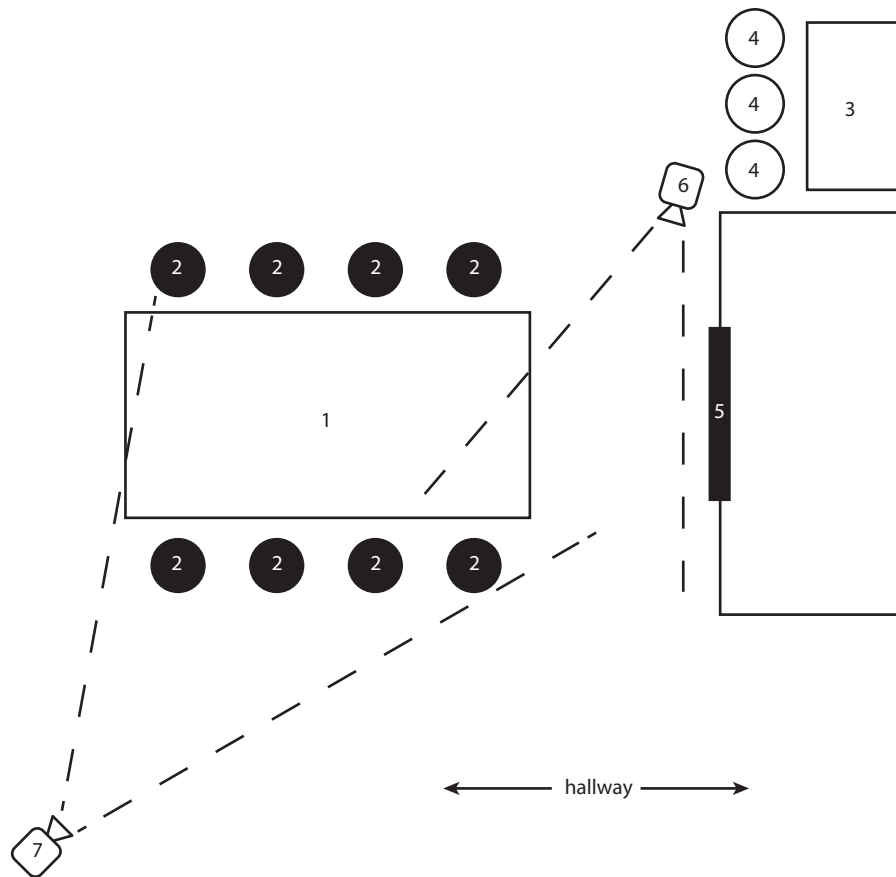
Figure 3. Overview of the position of VENSTER, the cameras and surroundings. Legend: 1: table, 2: chairs for participants, 3: table where researchers were seated, 4: plants, 5: VENSTER, 6: front camera, 7: back camera.

- All actions unrelated to the installation were coded as *"not important"* and disregarded (e.g., conversation about pouring coffee).
- Interactions that could not be interpreted by the researchers because of poor articulation or sound quality were coded as *"unclear interactions"*.

The data are presented in tables, showing both the absolute numbers of responses and percentages. All results are relative to the first column of the table. Because session lengths differed, results were averaged to a number of responses per hour. For example, all sessions with activating content added up to 3:36 h of video, eliciting 790 coded interactions. This was averaged to 226 interactions an hour, by dividing all numbers by 3.5. Clustering of similar responses resulted in subcategories (Figure 4(B)). For instance, *pulling the string* and *waving to person in scene* emerged as subcategories of *Respond according to affordance*.

Results

None of the recipients of the information letter refused to participate in the study. Eight sessions took place, with a maximum duration of 1 h 32 min. A total of 8 h and 43 min of video was recorded.

Ten clients (eight females) of the closed ward participated in the study. During the first session, one female resident of the open ward walked in and stayed, only for this session. Four professional caregivers, two activity supervisors and two volunteers, all of them female, guided the sessions (Table 1).

During eight sessions, a total of 1417 responses were identified (100%). More than half of them ($n = 737$, 52.8%) were human–human responses. One-third ($n = 481$, 36.6%) were human–artwork responses. The remaining responses consisted of *losing focus* ($n = 138$, 7.7%) and *unclear interactions* ($n = 61$, 2.9%). The average durations of calming and activating sessions were comparable (91 and 83.5 min, respectively). The sessions with interactive content were noticeably shorter (avg. 32.5 min). Figure 4(A) gives an overview of the initial framework.

Recognition seemed to play a major role in perceiving a personal connection and having an immersive experience for the nursing home residents: they commented on what they saw, asked for confirmation or reminisced about past memories when they saw something they could relate to. When the depicted content triggered memories or recognition, it initiated a conversation. If the memory or recognition was incomplete, it triggered the residents to ask others, mostly care providers, for more information or confirmation. Participants were also activated by content that was specifically designed to trigger a counter-reaction. Examples included a child waving and placing her hand on the window, and children skipping rope. Familiar music was recognized and the residents sang or tapped along by themselves or together with someone else. The attention shifted to music mostly when there was a less interesting moment in the visual content. When semi-abstract content was shown, nursing home residents were hesitant to interact. They searched for instructions and confirmation from a care provider or someone else present (Tables 2–4).

Human–human responses

Human–human responses accounted for 52.8% of the total responses recorded. A detailed overview of the human–human
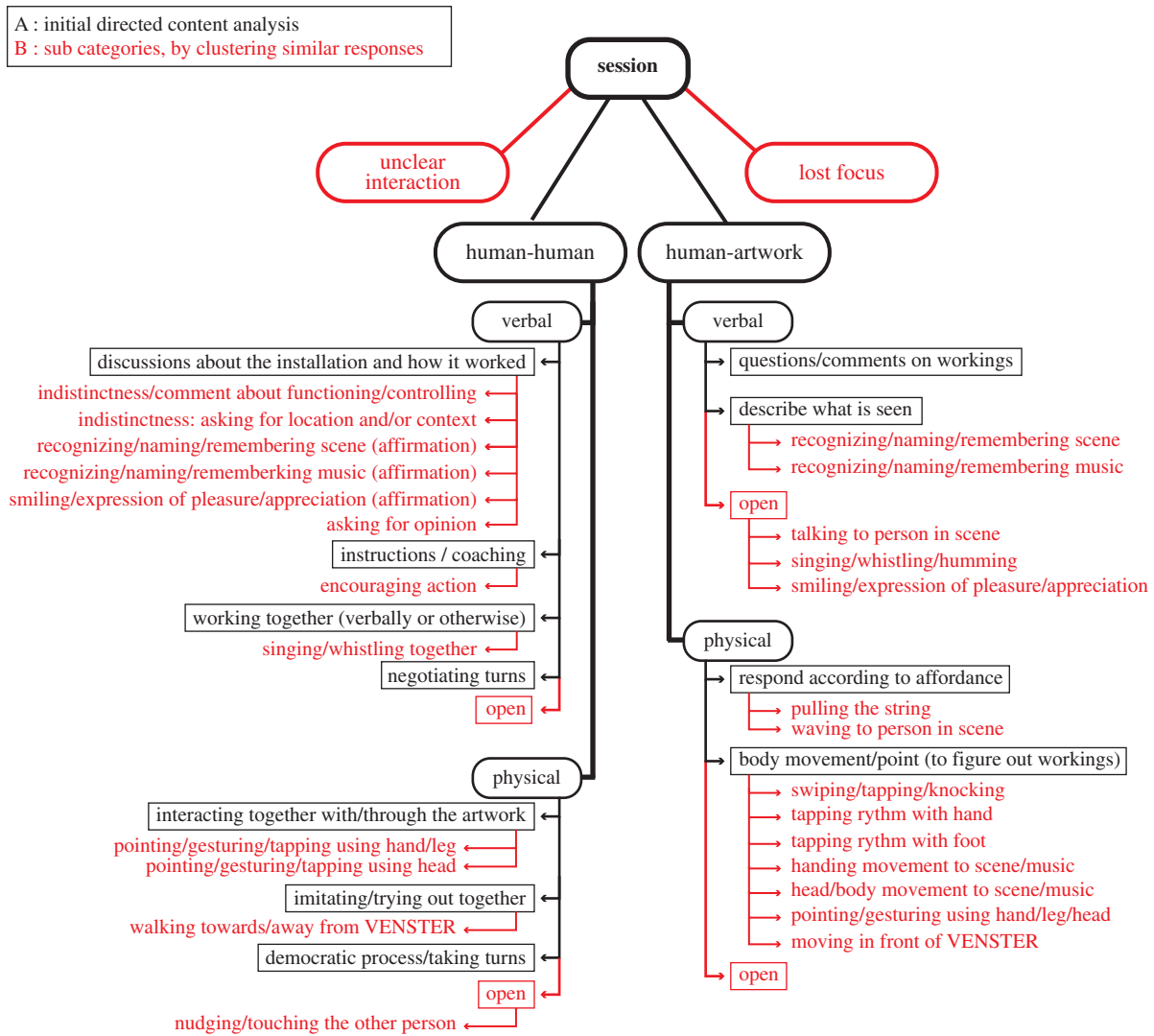
Figure 4. (A) Overview of the initial framework. (B) Subcategories created by clustering similar responses.

Table 1. Overview of the eight sessions, with detailed information about the time of day, type of content, duration of the session, gender of the residents and profession of the caregivers.

Session	Time of day	Type of content	Duration	Gender residents	Care providers	
					Gender	Role/profession
1	Evening	Calming	1 h 32 min	2 male, 4 female[a]	F	Informal caregiver
2	Midday	Activating	1 h 18 min	2 male, 3 female	F	Professional caregiver
3	Midday	Activating	1 h 29 min	2 male, 2 female	F	Professional caregiver
4	Morning	Calming	1 h 30 min	2 male, 3 female	F	Informal caregiver
					F	Activity supervisor (in training)
5	Midday	Interactive	44 min	1 male, 3 female	F	Professional caregiver
6	Midday	Activating	28 min	1 male, 3 female	F	Professional caregiver
7	Midday	Interactive	21 min	1 male, 3 female	F	Activity supervisor
8	Midday	Activating	28 min	1 male, 3 female	F	Activity supervisor

h: hour; m, minutes; F, female; M, male.
[a]Resident from the open residence (other participants were residents of the "Maretak" closed ward).

responses is presented in Table 2. The percentages reflect the relative occurrence of a response in relation to the total number of human–artwork responses (100%). Nearly all human–human communication happened between clients and care providers, mostly initiated by the care provider (Table 2).

Human–human: verbal responses
The category of *Discussions about the installation and how it worked* was the most frequently recorded human–human

response overall (66.1% of all human–human responses) It contained six subcategories, of which *Recognizing/naming/remembering scene* had the largest number of responses (26.8% of all human–human responses). When residents or care providers recognized the content presented or when a memory was triggered, they shared this with a care provider, initiating conversation. Children playing, animals and familiar places particularly triggered verbal reactions.

The *subcategory Indistinctness/commenting about functioning/ controlling* had the second largest number of responses. When

Table 2. Human–human responses.

	Type	Category		Sub-category
Human–human responses, 100% ($n = 345$)	Verbal, 79% ($n = 273$)	Discussions about the installation and how it worked, 66.1% ($n = 229$)	26.8% ($n = 93$)	Recognizing/naming/remembering scene
			15.3% ($n = 53$)	Indistinctness/comment about functioning/controlling
			8.1% ($n = 28$)	Indistinctness: ask for location and/or context
			7.9% ($n = 27$)	Smiling/expression of pleasure/appreciation
			6.6% ($n = 23$)	Asking for opinion
			1.4% ($n = 5$)	Recognizing/naming/remembering music
		Instructions/coaching 9.9% ($n = 34$)	9.9% ($n = 34$)	Encouraging action
		Working together (verbally or otherwise) 3% ($n = 10$)	3% ($n = 10$)	Singing/whistling together
		Negotiate turns 0%		
		Open 0%		
	Physical, 21% ($n = 72$)	Interacting together with/through the artwork, 15% ($n = 52$)	15% ($n = 52$)	Pointing/gesturing/tapping using hand/leg/head
		Imitating/trying out together, 4.8% ($n = 16$)	4.8% ($n = 16$)	Walking towards/away from VENSTER
		Open, ($n = 4$)	1.2% ($n = 4$)	Nudging/touching person
		Democratic process/take turns 0%		

Table 3. Human–artwork responses.

	Type	Category		Sub-category
Human–artwork responses, 100% ($n = 240$)	Physical, 69% ($n = 166$)	Body movement/pointing (to figure out workings), 50.8% ($n = 122$)	24.2% ($n = 58$)	Swiping/tapping/knocking
			9.3% ($n = 22$)	Tapping rhythm with hand/foot
			6.6% ($n = 16$)	Pointing/gesturing using hand/leg/head
			5.9% ($n = 14$)	Hand/head/body movement to scene/music
			4.8% ($n = 12$)	Moving in front of VENSTER
		Respond according to affordance, 18.2% ($n = 44$)	13.7% ($n = 33$)	Pulling the string
			4.5% ($n = 11$)	Waving to person in scene
		Open 0%		
	Verbal, 31% ($n = 74$)	Describe what is seen, 11.1% ($n = 27$)	10.4% ($n = 25$)	Recognizing/naming /remembering scene
			0.7% ($n = 2$)	Recognizing/naming /remembering music
		Open, 19.9% ($n = 47$)	14.4% ($n = 34$)	Singing/whistling/humming
			4.1% ($n = 10$)	Smiling/expression of pleasure/appreciation
			1.4% ($n = 3$)	Talking to person in scene
		Questions/comments on workings 0%		

interactive content was shown, residents struggled to understand that the screen was touch-sensitive and the content reacted to their input. This then generated a lot of verbal responses by the clients asking for instructions. Care providers coached them verbally, provided instructions about the controls and figured out possible interactions or encouraged the residents to interact or keep interacting (subcategory *encouraging action*, 9.9% of all human–human responses).

Although participants tapped their hands or feet and sang along to music, there were hardly any verbal comments in the subcategory *recognizing/naming/remembering music*. Finally, no responses were found for verbally negotiating turns to interact with the installation.

Human–human: physical responses

Physical human–human responses accounted for less than a fourth of all human–human responses. By far, the largest number of responses occurred in the category of *interacting together with/ through the artwork*, in the form of *pointing, gesturing or tapping*, for example when recognizing a scene and pointing this out (physically) to someone. These responses were initiated by both care providers and residents.

When the response *walking towards/away from VENSTER* occurred, this was mostly initiated by the care provider, who physically guided the resident to take a closer look.

Human–artwork responses

All human–artwork responses accounted for 36.6% of the total responses recorded. Table 3 shows the human–artwork responses in detail.

Human–artwork: physical responses

Body movement and/or pointing (to figure out how it worked) accounted for half of all human–artwork responses overall. This mostly occurred in combination with encouragement by the care provider and was linked to recognition of the content (pointing something out) or using (or trying to use) the interface.

Music triggered the residents to *tapping rhythm with hand/foot* and *head/body movement to scene/music*.

As regard, responses that were linked to the interface or content affordance, pulling the physical string attached to the roller blind was by far the most frequent response (13% of all human–artwork responses). It was mostly the care providers and some residents who pulled the string to skip the current scene and advance to the next. *Waving to person in scene* occurred mostly during scenes specifically designed to trigger this behaviour, for instance showing a young girl interrupting her rope skipping, walking towards the camera, putting her hand on the window and then waving. Almost everyone, including care providers and passersby, waved back.

Full body movements were carried out mostly by care providers in front of VENSTER to adapt the perspective in order to see more of a particular scene or to figure out how the adjustable perspective worked.

Human–artwork: verbal responses

When residents recognized the lyrics, rhythm or melody of a song, they sang, whistled or hummed along (14.4% of all human–artwork responses). Responses in the category *describing what is seen* (11.1% of all human-artwork responses) were almost all related to the content. Residents responded verbally when a memory linked to the depicted content was triggered. In

Table 4. General overview of all participant responses.

			Calming (%)	Activating (%)	Interactive (%)
All responses, 100% ($n = 655$)	Human–human, 52.8% ($n = 345$)	Verbal, 41.7% ($n = 273$)	6.1	14	21.6
		Physical, 11.1% ($n = 72$)	1.8	3.5	5.8
	Human–artwork, 36.6% ($n = 240$)	Physical, 25.3% ($n = 166$)	1.9	8	15.4
		Verbal, 11.3% ($n = 74$)	1.7	3.9	5.7
	Lost focus, 7.7% ($n = 51$)		2.1	3.6	2
	Unclear interactions, 2.9% ($n = 19$)		1.5	1.4	0

most cases, they recognized a place or context from their past. Responses in the subcategory *smiling or expressing pleasure/appreciation* included residents smiling, laughing or verbally stating that they were enjoying themselves.

Very few responses in the category *Talking to person in scene* were recorded. Residents would sometimes talk to a (real or imagined) person in the video, say hello or coach a child that was skipping rope for example. No *questions or comments about the way the installation worked* were expressed by the participants directly to the artwork.

Responses per content type

Table 4 shows an overview of responses for the three different types of content.

All sessions with calming content together account for 3:02 h of video. A total of 3:36 h of video was recorded during sessions with activating content, and one hour of video in total during sessions with interactive content. Overall, human–human responses were more common than human–artwork responses. Sessions with calming scenes generated the lowest number of responses, while those with activating scenes had more and those with interactive scenes the highest number. Human–human responses were mostly verbal, while human–artwork responses were largely physical.

Discussion

The main aim of this pilot study was to assess whether the interactive art installation 'VENSTER' was able to evoke responses in nursing home residents with dementia. Both human–human and human–artwork responses were noted, each including verbal and physical responses, with individual differences between participants in the type and frequency of responses.

In general, frequently observed responses were naming or recognizing the depicted content, asking questions about the content and how the installation worked, physically gesturing towards or tapping on the screen and tapping or singing along to the music.

The nursing home residents we observed almost never communicated directly with each other. They rarely asked for instructions or additional information from each other, nor did they negotiate taking turns, either verbally or physically.

Our secondary aim was to identify possible differences in responses to each of the content types presented in "VENSTER" (calming, activating and interactive). Although sessions with *calming content* lasted up to 1.5 h, the observed interactions were brief and limited. Some residents lost focus for minutes on end, even falling asleep for the bigger part of the session.

When presented with *activating content*, participants were generally calm and focused for up to 1 h, in contrast to the normal situation (verbal information from nursing staff), where a minimum of two care providers needed to be permanently present and the atmosphere was generally agitated. Responses were recorded steadily throughout the whole session, mostly linked to what was seen and/or recognized on the screen of the installation.

Sessions with *interactive content* were short (avg. 30 min) but rich in responses. The reason for the short timespan could be that there were only four different interactive scenes available at the time of the study, or perhaps the participants grew tired more quickly because of the intensity of the interactions.

Study limitations

No cognitive/emotional responses were recorded, because of the observation method used (video observation), and the inability of the residents to reflect on their own behaviour.

The duration of interactions was not measured, which might have distorted some results. Loss of focus can serve as an example: although not directly reflected in the results, episodes of loss of focus lasted much longer in sessions with calming content, compared to sessions with activating and interactive content. This tendency was less distinct for other recorded responses, but some nuances were probably lost.

If a resident carried out two or more types of response simultaneously, these responses were coded in all corresponding categories. This influenced the total number of responses recorded, possibly overrecording some responses.

Group composition differed in most sessions, so results were influenced by the characteristics of the participants present. One example is that almost all responses in the subcategory of *singing/whistling/humming* in a particular session with activating content came from the same person.

Nursing home residents with dementia often lack initiative, because of existing medical conditions, so the role of care providers as facilitators for interaction is important. Although the type of content presented and the group composition differed across sessions, we are convinced that the involvement and dedication of the care providers present is of great importance.

Implications for practice

When VENSTER is to be used in routine care there are several aspects that need to be taken into account to make the experience as rich as possible for the residents. The choice of a type of content, for instance, is critical to the intended experience/usage in practice:

The sessions with *calming content* seem suitable when the installation is not being used actively. It keeps the illusion of a real window alive and can draw attention because the scenery is different from the real windows. During the sessions with calming content, however, participants were not able to keep their focus on the installation, which needs to be considered when implementing it for other target populations.

Activating content seems suitable for use as a meaningful experience during the spare time in between existing activities or therapy. Participants can be generally calm and focused for up to 1 h. This creates time for a care provider to initiate one-on-one conversations and actively encourage the residents to interact with the installation. The installation can serve as a catalyst for

conversation and action, providing something new to do or to talk about. Recognition triggers memory, indistinctness leads to asking for more information. After being initially coached by a care provider, residents actively engage with the screen through pointing, gesturing and/or tapping.

Sessions with *interactive content* seem less suitable as a pass-time in between activities, but could potentially be used as an activating therapy, activity or exercise. They are short (avg. 30 min) and intense. The role of the care provider seems very important, however. The semi-abstract, interactive content is not always understood by the residents on their own, so care providers have to be the facilitators who invite them to interact, help them operate the installation where needed and coach them to keep the interaction going. Scenes with interactive content are specifically designed to induce residents to physically interact with the installation, mostly in combination with encouragement by the care provider. Some residents may search for context by asking, and when nudged by the care provider they may interact and explore.

Implications for research

Our findings suggest that recognition plays a major role for nursing home residents in terms of perceiving a personal connection and having an immersive experience with "VENSTER". This raises questions about the potential of abstract interactive art for nursing home residents. What is needed to help nursing home residents overcome their initial hesitance when there is no recognition or link to an existing mental model? Does a link to a mental model need to be present in order to succeed? And if so, to what extent?

Eventually, VENSTER will not only show pre-recorded content, but will be able to establish a live connection with the outside world and vice versa. Examples could include a direct live feed with a fun fair, primary school or musical performance. A short, promising pilot project was conducted using a Skype connection with low quality sound and image, connecting the elderly care home directly with a primary school. Without instructions, both parties overcame the technical obstacles and conversed with each other for over an hour. Further research is needed to explore this potential.

Conclusion

"VENSTER" evokes responses in nursing home residents with dementia, which illustrates the potential of interactive artwork in the nursing home environment.

It seemed that content matters a lot. In this study, recognition seemed to trigger the memory and (in most cases) a verbal reaction, while indistinctness led to asking for more information. When (initially) coached by a care provider, residents actively engaged physically with the screen by pointing, gesturing and/or tapping. Responses differed between content types, which makes it important to further explore different types of content and content as an interface in order to provide meaningful experiences for nursing home residents.

In addition to the target population examined in this pilot study, "VENSTER" could also be interesting for other groups of people. More research into the potential of interactive art in health care is warranted, as all people who permanently or temporarily reside in a place that feels disconnected from the outside world might benefit from interactive art installations like "VENSTER".

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