

Ritual camera: exploring domestic technology to remember everyday life

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Ritual Camera: Exploring Domestic Technology to Remember Everyday Life

Can media technology help users treasure everyday life experiences? The authors take a research-through-design perspective and present Ritual Camera, a domestic camera for everyday life. Focusing on family dinners, they illustrate that mnemonic technologies could benefit from selective automated media creation.

People often value the memories of everyday life events long passed, such as walking to school through the fields, or sharing the newspaper over breakfast. During special events, such as holidays, we actively collect or create memorabilia—increasingly using pervasive technologies such as smartphones or wearable cameras—to help us later remember these experiences. However, despite the omnipresence of these technologies, people rarely capture everyday life for future remembering. People

underestimate the value of their ordinary experiences in the moment,¹ but these same experiences are often highly valued as memories.² In some cases, the repetition of an event is the main reason for value—it was simply always like that. But in most cases, more specific reasons evolve over time. A memory might be connected to present activities, iconic of someone's character, or remembered through an exception, or it might form a contrast with other people or the present.²

How could media technology support us in treasuring the everyday life experiences that we value for future remembering? Here, we take a research-through-design perspective³ to address this challenge. We discuss the design and evaluation of Ritual Camera, a domestic camera for everyday life. We developed Ritual Camera as a design research prototype to gain insight in representing our everyday life experiences. As such, Ritual Camera follows the approach of John Zimmerman, Jodi Forlizzi, and Shelley Evenson in that it functions as “an artefact [that serves as a] vehicle for embodying what ‘ought to be.’”³ In the context of domestic everyday life, we see design research as the preferred approach because it lets us deploy our ideas in a real-life context and learn about the topic by doing, which leads to new insights and ideas.⁴

Here, we present the design and evaluation of Ritual Camera as a case study of design research for embedded domestic technology in everyday life. The insights from our design process, field study, and reflections can inform the design of media technology for everyday life remembering.

Media for Everyday Life

Our everyday life seems to be a straightforward thing; however, through its omnipresence, it can be difficult to define. As Rita Felski

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Technologies for Remembering

Technologies for memory augmentation (also called mnemonic technologies) have been explored in many different contexts, including learning, healthcare, psychology, and law. Most projects serve as functional memory support, but some mnemonic technologies support more affective processes, such as bonding (see for example, Cueb,¹ a design of interactive photo cubes that facilitate sharing memories between parent and child). Both functional and affective reasons are seen in the use of cameras and smartphones.^{2,3} Several projects have designed variances of photography with mobile devices: Audiophotography⁴ explores the addition of audio, Behind the Camera⁵ uses dual-sided cameras, and Context Photography⁶ explores sensors to manipulate images. These concepts explore ways to capture contextual elements that are normally not grasped in a photo.

Smartphones show the increasing mobility and omnipresence of recording technologies, which is further explored in lifelogging. Lifelogging is considered to be the indiscriminating collection of information concerning one's life and behavior,⁷ often done with wearable cameras such as SenseCam.⁸ With our focus on everyday life, lifelogging is interesting for including media of mundane activities. However, although lifelogging has been shown beneficial—for example, as a memory aid for people with dementia⁹ and to stimulate reflection¹⁰—it has also been criticized. Many lifelogging systems lack a specific description of their foreseen added value. Distinguishing between the potential for different goals (reminiscing, reflection, or remembering intentions) would be beneficial.¹¹ Without specific goals, lifelogging concepts create an abundance of data that is difficult (if not impossible) to manage.

The examples presented in the Media for Everyday Life section in the main text represent effortful, selective capture. As Abigail Sellen and Steve Whittaker argued,¹¹ this is a large contrast with lifelogging, seen as an effortless and all-encompassing capturing strategy. However, this distinction isn't binary. For example, the concept of Other Brother¹² (a prototype of a stationary domestic camera with different sensors) explores partial autonomous capture in the home context. It consists of a stationary rotating camera that responds to audio and direct interaction to capture social events in the home. The results show how participants selected the focus of the camera by locating it in specific areas and made explicit sounds in an attempt to trigger the camera. These interesting insights in the combination of intention, effort, and automation motivate further research in the combination of

personal selection and autonomous creation, to which we strive to contribute with this work.

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put it, "After all, everyday life simply is, indisputably: the essential taken-for-granted continuum of mundane activities."⁵ Consequently, the value for remembering ordinary experiences is often underestimated.¹ Experiences

seen as ordinary at the time are seen as less ordinary several months later, and people are more curious and interested in remembering them than expected.¹

Everyday life and "the ordinary" are important themes in relation to

ubiquitous computing and HCI.⁶ As we aim to design for remembering our everyday life, we ground our work in autobiographical memory theory, in line with our earlier work,⁷ as well as work by Abigail Sellen and Steve Whittaker.⁸ (For

a discussion of related work in memory augmentation, see the “Technologies for Remembering” sidebar.) From a memory-theory perspective, the everyday life memories we’re interested in are part of *general event memories*.⁹ We focus specifically on a subset of general event memories: repeated similar events. In our previous research, 46 percent of the collected memories of everyday life referred to repeated events, with repetition being daily, weekly, or “often but irregular.”² These repeated event memories are similar to what Betty Johnston refers to as *layered memories*: “in the sense that many occasions merge into one in the telling of the story.”¹⁰

Despite the value of memories of repeated events, people rarely own any media of these experiences and often still don’t create media of similar experiences in the present.² Little research has been done focused on media from repeated events. Collections, built up over time, can become representations of repeated events. Daniela Petrelli, Steve Whittaker, and Jens Brockmeier, for example, describe a collection of shells that together represented “the family holidays.”¹¹ However, such representations of everyday life experiences are rare. Even when explicitly creating memory cues on a daily basis, important parts of a person’s life—such as his or her profession, interests, and hobbies—can easily be underrepresented.¹²

Based on these aspects, we formulated two main requirements for media for everyday life. First, because of the nature of everyday life, capture should be unobtrusive and require little effort. Second, media should support remembering multiple events. Current media doesn’t suit general event memories. In photo-triggered remembering, people can be prompted to focus on what can be seen in the photo rather than including events before, after, or “out of frame.”¹³ We argue that this makes photos less suitable for remembering general events, because one photo only represents a single occurrence. We thus see opportunity in media representing

a multiplicity of occasions in more combined or abstract visuals.

Designing Ritual Camera

Based on our review of psychology theory and related design work, our hypothesis is that, similar to our memories of repeated events, media could be created over time by combining, abstracting, and collaging individual instances. Our interest is twofold. First, how can repeated events be represented in media in a meaningful way? This question initiated the design of Ritual Camera for creating abstract media. The design process led to our second question: What is the potential value of a stationary camera within the home context?

The camera was developed as a design research prototype.³ Its main purpose was to let people experience the potential use of a domestic camera for abstract media. Rather than being intended as a technology to be commercially available or for prolonged use, it was developed to be used in a specific way, tailored to the study set-up. The artifact was developed as an embodiment of a possible future¹⁴ and as a way of embodying our developing implicit theories¹⁵ on the values of abstract media creation.

Developing the Concept

Our primary proposition during the development of Ritual Camera was that repeated events could be meaningfully represented by capturing individual instances and combining them into abstract visualizations. We made specific design choices in two areas to enable this: we optimized the prototype to recognize a repeated event through simple parameters, and we developed a diverse set of procedures for creating abstract media.

Because representing repeated events in visual media is a new direction, we decided to create a diverse set of visualizations for each participant. Similar to photographs, the intention of our visualizations was to support remembering. We were inspired by Johnston’s descriptions of layered memories as “many

occasions merged into one in the telling of the story”¹⁰ to create more abstract media. Current media types capture reality in a direct representation, such as in photos or videos. Symbolic memory media, such as souvenirs of which the meaning is known only by the owner, could be considered to be on the other end of a media spectrum. In creating abstract media, we’re interested in the middle ground between symbolic memory media and direct representations. Consequently, we consider abstract media to be indirect representations of reality.

Being able to create these abstract media of repeated events was the main reason to create a stationary camera for the home context. This sparked the question what other values this could have. We wanted to know if this direction fulfilled the requirement of capturing unobtrusively and with little effort. In addition, with the field study we aimed to collect insights on how using a stationary camera might stimulate reflection on and appreciation of everyday life experiences.

Together, the design decisions to answer these two main questions led to the concept for Ritual Camera (see Figure 1)—a camera that would create abstract visualizations based on personal parameters by collecting media over time.

Selecting a Case: Family Dinner

Rather than exploring different everyday life events, we focused on a single case in this study to compare participants’ experiences without any undue influence from the type of captured event. We chose to capture the family dinner, which, in most Dutch households, is an event repeated daily that is often considered a valuable memory.

Previous research suggests that food preparation and consumption provide an interesting context for reminiscing as well as provide valuable experiences to be remembered.¹⁶ For example, dinner as a context for remembering is explored through the concept of 4Photos.¹⁷ Instead, our concept explores dinner as “content” to be remembered. To broaden the insights, after their experience with media

of family dinners, participants were asked to speculate as to what other repeated events they might want to capture.

Developing Abstract Media

To explore abstract media as indirect representations of reality, we drew inspiration from theories of general event memories,⁹ from values of everyday life memories,² and from different visual styles. The visuals were designed iteratively. First, we explored making visuals based on photos taken at one of our homes (Ine Mols), and then we improved visual representation after an internal review.

This initial exploration focused on combining images in layers and collages. These visual representations were then improved upon to represent our source of inspiration, to be more diverse, and to be aesthetically pleasing. This led to a selection of nine visual categories used in the study. Three visual categories were based on characteristics of general event memories: emphasizing the *average* situation, *repetition*, and *habits* (see Figure 2). Based on our previous research² into the value of everyday life memories, we also included visual categories emphasizing *people*, *actions*, and *exceptions* (see Figure 3). Inspired by different visual art styles, we introduced three more abstract visual categories: *strips*, *pixel*, and *blended* (see Figure 4). All visuals were designed by one of us (Ine Mols). To ensure the visuals were created similarly for all participants, we defined structured photo editing procedures.

Developing the Camera Prototype

To collect the required visual material, we developed a camera prototype. A stationary camera, capturing the same perspective every day, was needed for many of the visual categories and fulfilled the requirement of unobtrusive creation. A specific prototype let us develop the desired freedom in parameters that existing stationary cameras couldn't provide.

The prototype consisted of a camera and motion sensor connected to a Raspberry Pi—a low-cost, credit card-sized

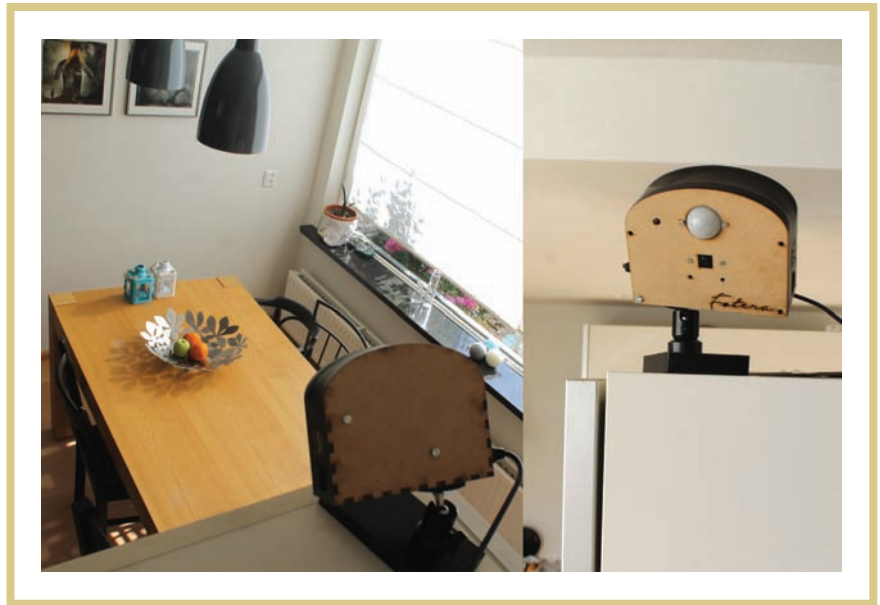


Figure 1. Ritual Camera positioned in a home context to capture the dinner setting. The camera took up to six pictures within a specific timeframe; we later selected one of them.

computer often used for prototypes—combined in a casing. A versatile base let us aim the camera at the dinner table (see Figure 1). The goal was to have one picture of dinner every day. However, with a single capture the risk to miss actual dinner activity was too high, so we set the camera to take up to six pictures within a specific timeframe. We later selected one of the six.

When implementing the prototype for our concept, we made several design choices, one of which was to make Ritual Camera look more like a work in progress than a finished product. In our experience, this leads to a more honest response from participants, although the prototype needs a certain level of realism to stimulate imagined use. We chose a shape and colors that would be unobtrusive and wouldn't stand out in the home environment.

Deployment

Ritual Camera was deployed in several households to gather qualitative insights. The goal of this study was to gain insight into our two main interests: learning how to visualize repeated events in a meaningful way and understanding the potential value of a

stationary domestic camera. The procedure was as follows:

1. Hold briefing: Gather participant consent, interview participants about their dinner experience, and install the prototype.
2. Capture photos: Employ the prototype to capture photos for approximately 14 days, without any participant-researcher interaction.
3. Pick up prototype: Remove the prototype and review photos for consent (as part of the ethical procedure).
4. Create visuals: Select one photo from each day and create nine visuals for each participating household.
5. Conduct final interview: One or two weeks after pickup, interview participants about the experience, the different visuals, and the concept's potential. During these interviews, include a ranking task to discuss the potential value of the visuals.
6. Conduct an analysis: Coding was done based on a conventional content analysis approach.¹⁸ In addition, we compared responses between the different ranking tasks and between the different visual categories.




Category	AVERAGE: Emphasize what is always the same by overlaying all pictures on top of each other with low opacity	REPETITION: Emphasize weekly repetition by presenting all images in a calendar-like grid	HABITS: Emphasize habits by collaging the most common objects with their frequency of occurrence
Image			
General response	Too vague [8 of 9]: <i>This one is very unclear; I can't really see anything in it.</i> (P3a)	Positive about the "natural" representation [6 of 9]: <i>On all these pictures you can simply see every day.</i> (P3a)	Triggers specific memories [7 of 9]: <i>That is a returning habit, the baby bibs and the discussions on their pacifiers.</i> (P2a)
Unique response	Recognition [1 of 9]: <i>You clearly see it is me, or at least, I see it. And a plate, very specific things. To remember dinner time you need to see a plate.</i> (P1)	Too boring [3 of 9]: <i>This is just the normal way of doing, it is so mundane.</i> (P5a)	Too much coincidence [1 of 9]: <i>This vase is too much of a coincidence, I received it as a gift and it stood there for a few days (but it is not normally there).</i> (P4a)

Figure 2. Categories of created visuals, as used in the study. This group of three was inspired by the structure of general event memories. Each category has a name and description, an example image, and a general and unique response with corresponding prevalence across participants (such as [1 of 9]).


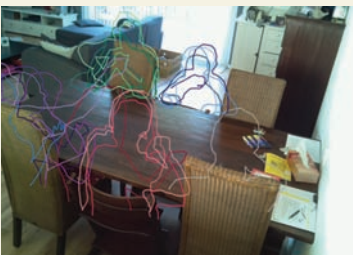

Category	PEOPLE: Emphasize people by collaging all people from one week in one visual	ACTIONS: Emphasize postures and actions by drawing outlines of all people during one week	EXCEPTIONS: Emphasize exceptions by collaging fragments of images that show exceptions
Image			
General response	Valued for showing all people & diversity [6 of 9]: <i>I like how you see all of us in different postures and actions. [...] it really shows the diversity of dinner moments.</i> (P2b)	Beauty & personal recognition [4 of 9]: <i>I find this one really beautiful, you don't actually see people, but still for yourself, you know who they are, that is really beautiful.</i> (P5a)	Surprise or insight after explanation [6 of 9]: <i>Now that you've explained it, it is funny to see. I thought the phone was a habit, but apparently it is an exception, luckily.</i> (P5b)
Unique response	Focus on posture [1 of 9]: <i>This is quite confronting, to see how I always sit at the table, that much bended forward.</i> (P4a)	Unable to recognize [2 of 9]: <i>This shows too little, you can see those are people, but you can't recognize who they are.</i> (P2a)	Non-surprising [3 of 9]: <i>This is simply very recognizable for me.</i> (P4a)

Figure 3. Categories of created visuals, as used in the study. This group of three inspired by values of everyday life memories. Each category has a name and description, an example image, and a general and unique response with corresponding prevalence across participants (such as [1 of 9]).

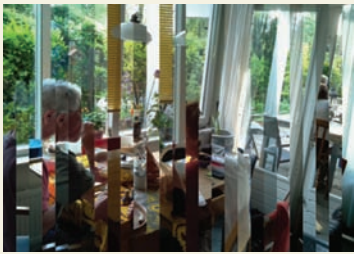
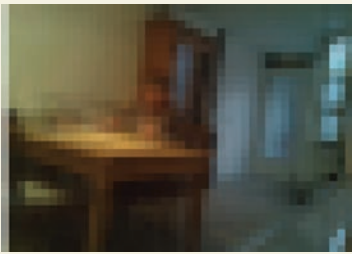
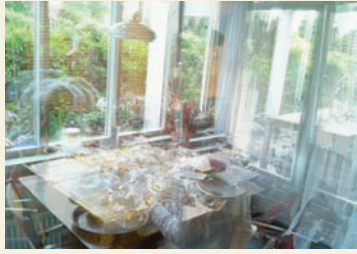
Category	STRIPS: Summarize the weeks by combining strips from each photo in one visual	PIXEL: Represent the dinner in an abstract manner by pixelating the overlay visual	BLENDED: Emphasize what changes by blending all pictures based on the lightest fragment
Image			
General response	Difficult but some recognition [7 of 9]: <i>Those are all small strips, [it makes it] difficult to see a total image. (P3b)</i>	Too vague [7 of 9]: <i>This is the least clear one, it could be anyone. [P1]</i>	Vague but some recognition [5 of 9]: <i>This one is mixed, but you clearly see some typical dinner things, the plates, the bottles. [P5a]</i>
Unique response	Focus on atmosphere [2 of 9]: <i>It is very unclear, but still you see some kind of summary. And the unclarity also shows how unclear it can be here sometimes with dinner and all the diversity in our schedule. (P3a)</i>	Focus on colors [1 of 9]: <i>It has a beautiful structure and nice colors. It feels very familiar, despite the abstraction. (P4a)</i>	Focus on artistic value [1 of 9]: <i>I see a palette of colors, more of an impressionistic painting, but it doesn't relate to us or our dinner. [P4b]</i>

Figure 4. Categories of created visuals, as used in the study. This group of three was inspired by artistic visual work. Each category has a name and description, an example image, and a general and unique response with corresponding prevalence across participants (such as [1 of 9]).

The concept was evaluated with nine individuals across five Dutch households, recruited through word-of-mouth within the researchers' social network. We selected a diverse set of household situations in terms of age and number of family members. The participating families were as follows:

- Single household: P1 (62 year-old female) is an active collector of souvenirs and keepsakes and a photographer during travel.
- Family with two children (ages 2 and 4), P2a (male, 38) and P2b (female, 32): The parents take photos with their mobiles, especially of the children, and collect physical keepsakes of the children.
- Family with two children (ages 1 and 3), P3a (female, 29) and P3b (male 34): The parents take mobile and digital photos and occasionally create videos.

- Couple, P4a (female, 67) and P4b (male, 68): The couple rarely create media but used to make a lot of analog photos. Now, they mainly collect souvenirs from their travels.
- Family with two children (ages 12 and 14), P5a (female, 46) and P5b (male, 51): This family is rarely engaged in media creation.

The final interviews were conducted individually with each adult family member to collect each person's individual opinion, with nine participants included in the results.

Findings

An overview of the responses for all of visual categories is given in Figures 2–4. The figures show an example of each kind of visual and provides both a general and unique response (spread across participants between square brackets—for example, [3 of 9] indicates that three

out of nine participants had a similar response). In considering our two main interests, our evaluation resulted in five main findings—three related to abstract media, and two related to the use of a domestic camera.

Abstract Media

Participants were asked to rank the visuals according to different labels: first, concerning their general perceived value; second, for the potential to support remembering in the future; and finally, for their reflective potential. Table 1 shows the combined overall rankings. The pixel-visual and average-visual categories were consistently rated having little value. Those visuals were often considered to be too difficult to recognize. Generally, we gained three insights: the value of visualizations depended on the envisioned use; people valued showing diversity over visualizing the average; and people recognized

TABLE 1

Average rankings of the visual categories for different uses. The rankings range from 1 (most suitable for this goal) to 9 (least suitable for this goal). The top three for each use have a bold outline. Technical details of selected development tools (last updated 9 Feb. 2015).

	General value	Support remembering	Reflective potential
People	1	2	1
Actions	2	6	7
Habits	3	7	2
Blended	4	4*	4
Repetition	5	1	5
Strips	6	3	6
Exceptions	7	4*	3
Average	8	8	8
Pixel	9	9	9

* Tied for fourth place

abstract or “invisible” notions of their lives in the visuals, such as ambiance and behaviors.

Understanding the influence of media use. The three different rankings show that the different visual categories held different values. For example, to be valuable for remembering, visuals had to be easily recognizable and contain as much information as possible, which is why the repetition-visual category was highly valued for this purpose. Visuals that involved more interpretation in the editing process (for example, the habits and exceptions visuals) were valued differently before and after explaining this process. After the explanation, they were considered to have high value for “reflection.” The exceptions and habits visuals were strongly appreciated [6/9 and 7/9 participants, respectively] once the process was explained:

Luckily [seeing] us taking out our phones is apparently an exception. [P5b]

[It is] weird to see that our daughter J is an exception. [P3a]

The object visual triggered explicit reflection during the interview in three cases. For example,

This is my bag from work, it's not even supposed to be there.... Maybe I should put stuff away more often. [P3b]

When ranking the visuals according to their general value, some people considered the use of media for decoration in the home or as a gift to others, for which the aesthetics of the image play an important role. Overall, the different rankings show that the requirements for abstract visuals depend on their envisioned use.

Visualizing diversity. When discussing possible visuals, most participants explained that showing what is always the same isn't as interesting as showing what's different. Diversity was often seen as an important value when ranking the visuals. This was appreciated for general value but especially for remembering. The repetition visual was most often appreciated for showing its diversity, but diversity was seen in other visuals as well:

[The repetition visual] shows that not one day is the same. [P2b]

[The people visual] is a series; you see different things, different ways we interact with each other. [P5b]

In contrast to our hypothesis that an average representation of a typical family dinner would be represented in the visuals, participants especially emphasized the diversity of typical family dinners, represented in a single visual.

Recognizing ambiance. On the first encounter with these unfamiliar visuals, people looked for points of recognition in the clothes they were wearing, the objects they were using, or how they were doing things. Using these points, people also recognized the atmosphere they valued:

This in a sense shows the ambiance at home, it doesn't need to be tidy all the time. [P3b on the habits visual]

The atmosphere of their everyday life was also recognized in the visual style of some images, in a more abstract matter:

The visual is a bit chaotic, which it can be at our table, chaotic and restless. [P2a on the blended visual]

Recognizing the ambiance in a photo is an example of successfully creating indirect representations of reality. The ambiance can't be directly represented, but can be remembered from indirect representations. Several participants reflected on the personal perspective that determines this recognition, especially in more indirect representations (such as the strips visual or actions visual):

If you show it to someone else, they wouldn't know, but we know what it is, that makes it interesting. [It is] very familiar and well-known despite the abstraction. [P5a on the pixel visual]

I have the impression that if you've been in situations, you can get all sorts of things from this [visual]. [P3a on the blended visual]

These quotes show how each person emphasizes different aspects of a photo. Small parts of photos can provide sufficient information if participants can still remember the situation that surrounded or led to what's shown in the photo.

A Domestic Camera

It is uncommon to have a stationary camera within the home for personal remembering, so we discuss the perceived value and concerns. Reflections on a home camera showed many other potential activities to capture and only very limited issues with privacy.

Capturing everyday life. In the interview, people mentioned different everyday events that might be interesting to capture. The nighttime ritual (of young children) was most often mentioned. Other suggestions were location- rather than activity-based, such as capturing the children's play corner or the living room couch as a location of diverse activity. One participant suggested recording front-door activity to include a wide variety of aspects of everyday life: family members leaving or returning from work and school, people getting in and out with equipment for hobbies, the arrival of (regular) visitors, and so on. In discussing capturing dinner and other everyday life events, audio was often mentioned as potentially valuable. These repeated events often focus on social contact, and recordings of voices and conversations would be appreciated.

Blending into everyday life. Most participants mentioned that they quickly forgot about the presence of the camera. Its out-of-site position contributed to this. Only one participant found the presence of the camera disturbing; others were more positive about the presence:

If I see [the camera], I have the tendency to pull a funny face or make a joke about it. But it hasn't been annoyingly present. [P3b]

Some participants expressed feelings of "being watched," because the camera and images were primarily perceived to be for the researchers rather than for private use. These privacy issues would be greatly reduced if people were more in control of the created media.

Discussion

The explorative study with Ritual Camera gave rich insights into the potential of abstract media and a domestic stationary camera. However, there were limitations in terms of the study size and duration.

Study Limitations

The study's timeframe posed several challenges in relation to the subject of everyday life. It was uncertain whether two weeks would be sufficient to capture "everyday life." Responses showed that this period included both diverse and recurring situations, which for us was sufficient to capture everyday life for this exploration. It remained a challenge to study how the capturing technology was embedded in everyday life in this time span. That would require multiple interactions with the device over a longer period of time. Still, the two-week period allowed us to get an impression of how an unobtrusive device could blend into everyday life habits, given that there were periods when the devices remained unnoticed.

The period between capturing and reviewing the media during the final interview was only a few weeks. Because everyday life experiences are most often valued in retrospect,² this timeframe is less suitable for judging this value. We therefore approached the appreciation of our visual media similar to how people judge photos—shortly after capture. A study on the long-term value of these abstract media as memory media would be of interest, ideally looking back several years.

The involved number of participants was limited in size. The sample size was chosen because this was a first explorative study into the value of abstract

media creation. We were interested in individual differences and chose a small sample size to allow for in-depth interviews. Furthermore, all adult family members in each household were interviewed separately, resulting in nine unique interviews. The number of individuals and different family situations involved were sufficient to collect a variety of responses and allowed for in-depth analysis of the collected qualitative data.

Insights from Design Research

The process of developing Ritual Camera sparked interesting reflection regarding design characteristics, technology interaction, and media parameters.

By developing the stationary camera iteratively, first-hand use¹⁹ sparked reflections on the influence of specific design characteristics. For example, the perspective of the photos triggered associations with images from security cameras, caused by the view from a top corner of the room. These and other insights led us to further consider specific design elements, such as the camera's angle, the resulting perspective, and the flexibility and stability of the stand. Such insights will be useful for future prototype developments, while the qualitative interview data provided more high-level insights that should help with broader future developments.

Direct interaction with Ritual Camera is limited to the moments of installation and removal. The concept doesn't allow for interaction after the process of capturing is initiated, which challenges our common notions of control over our interactive devices. In addition, because the concept doesn't provide any feedback on its progress or results, it includes an element of surprise for the users rarely seen in digital media creation. These novel directions embedded in the design are seen as design research contributions in and of themselves.

The design process was an exploration of parameters. During the iterative process of developing the visuals, the

researchers developed a certain level of skill—such as selecting a camera location that created interesting visuals. A similar skill was developed concerning the media parameters. For example, some visuals were more successful when including one week of material rather than two, to prevent cluttering the image. Together, the development of skills on media selection, media perspective, and filtering parameters led to questions on how these degrees of freedom should be integrated into interactive devices in which users have the freedom to create abstract media.

Contributions to Design Research

With Ritual Camera as a design-research prototype, we were able to make a potential future scenario experiential for the participants. Here, we discuss the process of Ritual Camera as a case study of research-through-design³ on embedding domestic technology in everyday life.

With this case study, we illustrate the value of prototypes to explore unfamiliar practices and potential future values. Using Ritual Camera and reviewing the resulting visuals allowed participants to experience one potential way to capture everyday life. The current setup didn't let participants experience the diverse potential of the concept in terms of personal selection, given that they didn't get to choose the parameters, position the camera, or make adjustments. Insights into this potential were gathered by supplementing the experience with a discussion of potential experiences during the interview. These discussions stimulated participants to reflect on the potential of capturing everyday life in a broader scope, rather than only through this specific embodiment.

This shows how the development of Ritual Camera as a concept and prototype allowed for insights to be gathered in multiple ways—by reflecting on the design and development process and through multiple moments of interaction with participants

over time. Information was gathered during the introduction interview, informally during prototype removal, and during the final in-depth interviews. Together, the participants' experiences with the concept, their reflections on this experience, and their discussions of potential uses and values resulted in diverse insights that were enabled through the prototype. This illustrates how Ritual Camera can be seen as a case study on how to conduct design research through prototypes that embody potential futures,¹⁶ helping researchers gather user insights while opening up a novel area of design.

Selective Media Creation

Overall, we see the design and prototype of Ritual Camera as an embodiment of the notion of combining automated capture with personal selection to demonstrate a potential future direction for media creation. The process helped us provide more details and identify requirements for our hypothesis that repeated events can be represented in abstract media.

Selective Automated Capture

One of our interests was the potential value of a stationary domestic camera. This value was mainly found in the unobtrusiveness and low effort required while creating rich and surprising representations. Rather than dealing with the amount of media after capture, we propose selecting, up front, which elements to include in automated capture (in line with Sellen and Whittaker's work⁸). With Ritual Camera, this is done by adjusting parameters such as position and timeframe. Selecting these camera settings and the related abstraction parameters becomes part of the creative process.

Similar to the researcher during the process, users could develop a level of skill in this creative process, even though the result would remain a surprise to some extent. The element of surprise, in combination with the

deliberate choice to capture, can contribute to the potential “double value” of abstract media creation in everyday life: appreciating aspects of everyday life in the now and remembering them in the future. As mentioned before, capturing everyday life is possible with current technologies but is rarely done. Selective automated capture could bridge this adoption gap, because the surprising effects of abstraction can give instant satisfaction, motivating current use while creating additional value in the future.

Abstract Media as Cues

With our abstract media, we aimed to represent repeated events in a meaningful way. Rather than approaching media as a direct recording of reality, we see media as *cues for remembering*. Cues can be seen as “a piece of information, a piece of mind or an experience, which facilitates memory recall.”²⁰ Cues depend on contextual and personal factors: participants' recognition of aspects that would only be clear to them show the highly personal nature of media as cues.

Approaching media technologies as a process of “designing effective retrieval cues”⁸ rather than direct capture opens up the design space to allow for more creative or abstract representations. A process of cue creation includes reducing the complexity of a complete situation to a limited visualization that provides sufficient support, a challenging and highly personal balance. Our findings show that for meaningful representation, media should represent the diversity of a repeated event. Furthermore, the representations must be personally adjusted and suitable for the envisioned use. Therefore, the control should partially remain with the user.

It will be challenging to determine how far the complexity can be reduced while still containing successful cues. This can be challenging, because seemingly unique cues can later become uninformative.¹² Further

research is required to determine how to determine the appropriate levels of specificity and abstraction for each individual and situation.

Future Scenarios

We end our discussion by translating these general directions into three different future scenarios for selective automated capture and abstract media that we believe to have value for people. These scenarios show the versatile potential uses of a situated camera in the home as an example of selective automated capture.

Visualize different aspects of life. Similar to our case study, a domestic camera could be regularly used for a few weeks to easily capture, appreciate, and remember the diversity of everyday practices. This could be done at different locations throughout the year, such as in the garden in the summer or in the living room during winter.

Capture slow change. Creating media over time has the potential to capture slow change, such as children's growth or a changing bedtime ritual. For such an approach, it would be interesting to lower the frequency of capture and create media over longer periods of time.

Create unique views of special occasions. Rather than focusing on everyday life, abstract media could be used to capture special occasions in a unique way. This would be especially interesting for events that last several days, such as the first days after the birth of a child, as one participant suggested. Combined media could represent the period as a whole and contain many smaller cues for specific events.

We envision a future in which combining personal selection, contextual sensing, and automated capture leads to meaningful cues for remembering our experiences.



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Such a capturing process is suitable to create indirect representation of reality in abstract visual media. These media are more suitable to serve as cues for remembering, as a large part of the remembering is left to the interpretation of the observer. With the design and deployment of Ritual Camera, we hope to have illustrated the potential value of both abstract media and selective automated capture in everyday life. ■

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