

# Rain: A careful smart home that evolves into a toxic host

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## ABSTRACT

Smart home guru's, who are predominantly male, are facilitated through smart home devices to monitor and thus to psychologically abuse others in the household. In this study, a research artefact was developed to represent a protective smart home. It was deployed with two couples for seven days, to analyze the interaction and implications that this technology could have on their everyday life. Although Strengers et al. argue that smart home devices should be designed to limit opportunities for toxic masculinity, our study of taking away the masculine protective role of the smart home guru and applying it to the smart home instead, shows that a smart home with an evolving protective nature is perceived as invasive, and therefore toxic, when it has its own values and takes over control without permission from the householders..

## Authors Keywords

Smart home; toxic masculinity

## INTRODUCTION

Smart home devices are used for different reasons by different users [3, 7]. In a research study on Intel's ambient computing vision in smart homes conducted by Strengers et al. [9], three categories were defined for which smart home devices are used: protection, productivity, and pleasure. A closer look at the protection category reveals how that is mainly done through monitoring. Which ever protective reasons one might have, someone else's privacy can be infringed because of no given consent or knowledge that the monitoring is happening. To describe the protective nature of smart home usage, we take two examples from the case studies by Strengers et al. [9]. Example one is about a father who wants to know if his children are doing their homework, or checking how his dogs are doing when he is not home, both for the sake of protection and with no harmful intent. Yet he may not have had any negative intent, it does elicit ethical and privacy related questions. The second example reflects how this protective yet monitoring use of smart home devices can become abusive to the person who is being monitored. The study explains how the smart home brings gender stereotypes and dimensions along, much like many domestic products have been gendered for decades [1].

Current smart home technologies promise to replace tasks traditionally performed by wives or housekeepers [8]. This shows how a masculine technical user is prioritized to have more control and access over the technology. Through this advantage, the masculine technical user, also referred to as the smart home 'guru' of the house, can be facilitated to use to technology for psychological abuse and domestic violence to others in the household. This could, unintentionally, evolve into toxic masculinity and is a subset of masculinity that "involves the need to aggressively compete with others and dominate others" [5, p.278]. Strengers et al. raise specific concerns about women and their safety, highlighting the importance of "ensuring that women (and all smart home users) are aware and supportive of how smart devices can and are being used within their home, and are able to operate them safely and securely without exposing themselves or others to additional internal or external threats." [9, p.645] Note that this concerns psychological abuse.

As defined by Pierce [6], there is a creepy line in technology design, with useful, beneficial and beloved technologies on one side, and unacceptably scary, dangerous and problematic technologies on the other side. The aim of this research is to find the creepy line for a careful smart home.

Placing toxic masculinity as possible 'trend' towards the future, led to questioning how the smart home can take this role upon itself instead of being the facilitator for someone

else, becoming a toxic host. As described above, protectiveness can evolve into toxic masculinity by monitoring and taking control over the house and the householders. **What if your smart home becomes a toxic host? see figure (x).** The research questions answering this 'what if statement' is **What characteristics of a careful smart home are perceived and experienced as protective and which as invasive?**

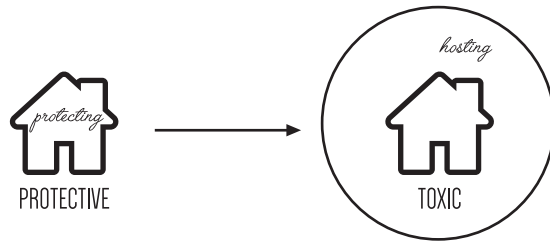


figure 1. evolving smart home

## DESIGN

### Casing

For this study, Rain, a research artefact representing a smart home device, was made. Its appearance needed to contain resemblances with other smart home devices like Google Home and Amazon's digital assistant 'Alexa' which have a minimalistic appearance that is calm and clean in a basic color (see figure 5). The casing design of Rain is inspired by a radio from the 50s and seamlessly blends in with every (smart) home environment. As Rain's purpose is to give voice messages, the speaker is the main focus. On top of the case are two luminous buttons that can be interacted with and represent the state of the Rain: 'I'm awake' and 'I'm home' or 'I'm away' and 'I'm sleeping'. Pressing the blue button turned on the device, representing the former state, pressing the white button turned it off, representing the latter state (see figure 2).



figure 2. Rain in context



figure 3. Visual style



figure 4. Packaging unboxing

## Name, voice and character

Rain is a gender neutral name of American origin and means 'Abundant Blessings From Above' [4]. The name was chosen since the device is meant to be gender neutral to separate this study from gender biases. Rain's voice was computer generated to mimic the slightly robotic and unnatural flow of speech of existing smart home devices and manually altered to be gender neutral in a vocal pitch program.

The weather related definition of 'rain' is resembled in the packaging of the device (figure 3). Phonetically, Rain sounds similar to 'reign'.

'To reign' represents the evolving character it has in going from protective to invasive and taking over control and rule the house. Rain takes over control to reign.

To give the participants a feeling of ownership over their new smart home device and to create a plausible narrative, an unboxing experience was added at the beginning of the study through the packaging of Rain (figure 4).

## Script

The duration of the deployment was seven days and the script was designed accordingly. Every day, four messages were delivered; one in the morning and three from the time the participants came home in the afternoon. The timing of the messages was daypart dependent. In the morning and afternoon an immediate message was given when pressing the blue 'I'm awake' button. The other two messages were scheduled evenly over the remaining time from the moment of coming home until 23:00 PM. Throughout the seven days, Rain's character evolved from protective to invasive in order to find the creepy line [Pierce, 2019] for each individual participant. The character evolved at a subtle pace and the messages were categorized in five themes:

1. Finances
2. Health
3. Maintenance
4. Monitoring
5. Security

The themes were easily relatable and applicable for most households and inspired by existing smart home usage [10], [11], [12]. Rain's script started with notifying the householders about new updates and observations related to the themes and gradually became more executive in decision making, excluding the householders in this loop. Eventually, Rain even referred to 'our' house and for example called for a maintenance company for which the householders received a physical invoice. In total, two physical letters (see figure 6 and 7) were sent to the participants, designed to look and feel like official letters and addressed to Rain instead of the household. The full script can be found in the appendix.



figure 5. Rain



Green Pure Klantenservice  
Antwoordnummer 674012  
1064 WS DEN HAAG

Juni 2019

Welkom bij Green Pure

Beste Rain

Welkom bij Green Pure! Wat fijn dat u naar ons bent overgestapt. Om u welkom te heten bieden we u de eerste 6 maanden van uw contract een korting aan van 25%. Uw contracttijd bedraagt een jaar, waarna u de mogelijkheid heeft om deze te verlengen.

Zoals besproken zal Rain ons informeren indien zich problemen voordoen in de levering van jullie nu groene energie. Voor elke vraag of elk probleem is het uiteraard mogelijk om een van onze medewerkers via klantenservice te spreken. Via onze website is het mogelijk om inzage te krijgen in te automatisch gegenereerde transcripties van de gesprekken tussen Green Pure en Rain.

Namens heel Green Pure wens ik jullie een heel groen jaar tegemoet.

Met vriendelijke groet,  
Johan Hoekstra  
Green Pure

figure 6. Letter fictional energy provider



Max' Montageservice  
Graaf Gradoffstraat 172  
5612 BZ Eindhoven

KvK nr: 8028 4198 1923  
BTW nr: NL 90 1230 5647 B01  
IBAN: NL41 RABO 0001 2356 90

Tel: 040-19903886  
E-mail: contact@maxmontage.nl  
Website: www.maxmontage.nl

Aan: Rain

**Datum:** 05-06-2019  
**Betreft:** Factuur repareren raamscharnier  
**Factuurnummer:** MM-2019060521

Geachte heer/mevrouw,

Gelieve het onderstaande totaalbedrag, onder vermelding van het factuurnummer, binnen twee weken over te maken op het rekeningnummer bovenaan de factuur onder vermelding van betalingskenmerk 9028 2019 0605 2101.

Hopende u hiermee voldoende geïnformeerd te hebben. Mochten er vragen of onduidelijkheden zijn, dan kunt u ons bereiken op het vermelde telefoonnummer.

Met vriendelijke groet,  
Max' Montageservice

Omschrijving	
Raam scharnier (3x)	€ 66,21
Montage (2 uur)	€ 64,00
<b>BTW (21%)</b>	<b>€ 27,34</b>
<b>Totaal</b>	<b>€ 157,55</b>

figure 7. Letter fictional mechanic

## METHOD

Rain was deployed in the homes of two young heterosexual couples in their twenties for the duration of seven days. The couples were selected to be familiar with smart home technology and were informed that they would receive a new smart home device. The couples were briefly interviewed prior to the deployment to understand the roles that they had within their smart home and how their smart home was set up. At the end of the deployment, we retrieved Rain and interviewed the couples in a semi-structured interview. To facilitate the interview, we presented the script that Rain had played over the course of the week to the participants and asked them to rate every message on a 5-point Likert scale [2] from protective to invasive. Due to the small sample size, no statistical analysis was done with the quantitative data. Their answers were then used to talk through the script, such that the participants could indicate the messages that stood out to them and explain why, and adjust their scale if needed. The interviews were transcribed in verbatim and annotated. We refer to the first couple as P1 (male) and P2 (female) and the second couple as P3 (male) and P4 (female).

## FINDINGS

In this section we describe findings on the annotated interviews. Findings are presented in common categories and supported by quantitative data from the Likert scale.

### Communication

Within the couples the amount of communication differed. One couple discussed all information that Rain shared, even by messaging each other about it when one of them was not at home. P1: "I wasn't there. You texted me about [this message]." The other couple failed to share the information at multiple occasions, which led to confusion and missing information.

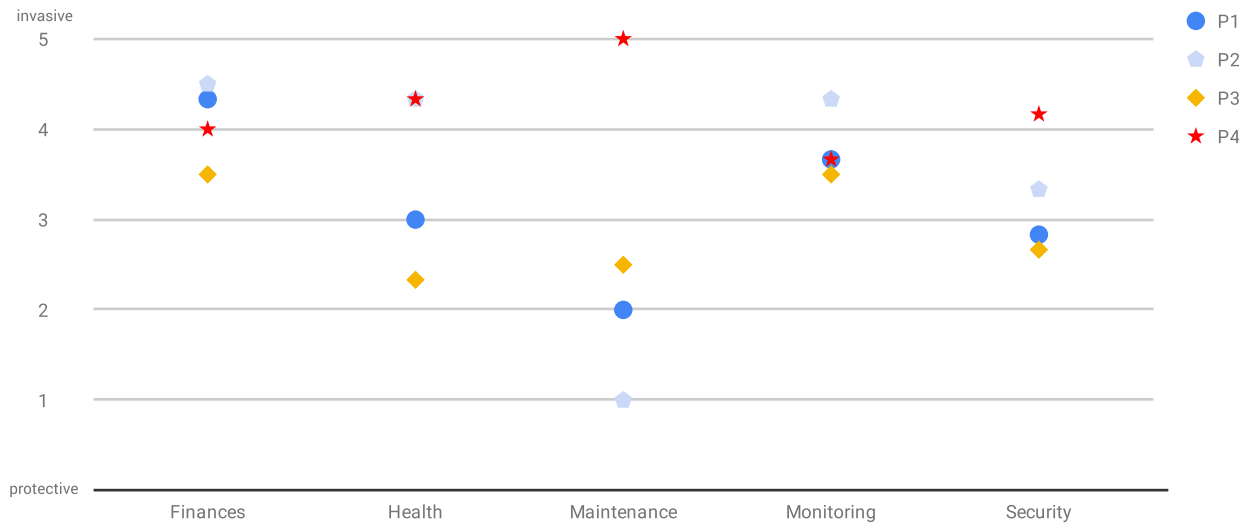
The participants liked seeing the letters and thought that it was a 'funny' part of the study, but did not change their opinions based on the content of the letters.

## Control

All participants indicated that they wanted to remain in control of their final decisions and that they felt omitted by the system that Rain was trying to be. P4 said that “These are things I like doing, then I ask myself: ‘what am I still doing here?’”. P1 added to that argument by stating that he would like “a stupid smart assistant that sees that the bread is not good anymore but that it doesn’t think that you need new bread.” Additionally, they indicated that this was influenced by the fact that they had not consciously brought the sensors that Rain was hypothetically using into their homes. They did not mind receiving information but they disliked when Rain acted upon the information, especially when they believed that Rain bypassed personal values. P4 indicated that she “was not ready to let go of control yet”.

## Boundary

What participants accepted and did not accept from Rain was influenced by whether it was applied to something that was personal for them. If it concerned something personal, they would rather do it themselves. However, the things that were indicated as personal differed per participant. For example, P2 did not like that Rain ordered clothes for her because she wanted to retain autonomy over her own style. P4 was okay with the ordered clothes as she could return them anyway. However, in comparison to the others, she did not like the idea of the maintenance features when Rain started calling a mechanic to repair the window, as her house was a very personal space: “Something that happens at your house is more personal and closer to me, one step too fast”. This is supported by the maintenance division as can be seen in graph 1. None of the participants liked the idea of Rain being in control of their finances as they considered their finances highly personal. P3: “Fine... but who pays? Rain? I would be like, the surprise is nice... but [I don’t like] that it also decides for me to spend my money.” The finances and monitoring themes were scored highest in the script (see graph 1).



graph 1. Scatter plot results Likert scale compared to the five themes

Another clear boundary, especially for P1 and P2, was when Rain started speaking in “we” instead of “you” and thus implied being a part of the household. They indicated that this felt like there was an intruder in the house which made them feel extremely uncomfortable. P1: “I thought that was really strange that Rain said ‘our refrigerator’. Now that I read that Rain sees itself as part of the house, I think that is just the limit.” On the other hand, P4 indicated that having been exposed to Rain for longer might have led to a more personal and accepting connection: “If you have a connection and the feeling like your house knows you, there would be a better acceptance” (P4).

## DISCUSSION

We conducted this research with the intention to provide insights into the roles that individuals take on in a smart home that limits possibilities for toxic masculinity. By deploying a protective smart home device that takes away a monitoring role of the tech guru in the home, we reached rich insights on the everyday experiences of couples living in a protective smart home.

Participants want their smart home to have a supportive role, not executive. This meant that the cases in which Rain acted based on data, participants would have liked to approve these actions or have done it themselves. While Rain tried to make the roles within the smart home more equal, in this case, an imbalance between the householders and Rain started to exist. In general, keeping track of matters in and around the house was considered helpful but participants did not want the system to move beyond these secretarial tasks. This finding in itself is interesting as Strengers and Nicholls [8] emphasized in their paper that current smart homes are designed to replace traditional forms of domestic labour that are predominantly performed by female members of the household. Our findings show that replacing the male, monitoring ‘guru’ role was not necessarily appreciated and created a mild aversion towards the careful smart home. The tipping point for this aversion was personal, which makes it difficult to describe a distinct ‘creepy line’ [6]. However, the findings clearly imply that the main reason for the aversion was that Rain had its own personal values and acted upon those.

Assembling a smart home is a conscious choice. The relationship between the participants and Rain could have therefore influenced the acceptance and interaction with Rain, as it was not personally purchased by the participants. This could be a reason why there was pushback and disinterest in having sensors by the windows and why the maintenance messages were not desired. There was no feeling of ownership over Rain despite the attempt through the unboxing experience. Possibly a deeper affection for Rain and home automation devices in general would improve the acceptance of the actions Rain took. It could have made Rain part of the household. The physical letters did not have any added value to the ownership over Rain, yet did contribute to the overall experience of the user test.

## Limitations

The interaction with Rain was key for the study to succeed. When the participant forgot to turn Rain on, the messages of that day were missed and the effect of the subtle changes disappeared. There was no feedforward for interacting with the device and thus there was a larger chance of forgetting about it. These design flaws could be improved in another design iteration. Another flaw concerning the perception of Rain by the participants was the character that was meant to be gender neutral yet still perceived as female. In addition, the delivery of the messages was sometimes abrupt and caused fright, or simply irrelevant to their everyday life at that moment.

At last, the individual participation was influenced by the home context. This refers to the relationship dynamics within the couples and their home environment, such as the size and setup of their home. This might have influenced how much of the messages they heard and how the content was perceived.

## CONCLUSION

Although Strengers et al. argue that smart home devices should be designed to limit opportunities for toxic masculinity, our study of taking away the masculine protective role of the smart home guru and applying it to the smart home instead, shows that a smart home with an evolving protec-

tive nature is perceived as invasive, and therefore toxic, when it has its own values and takes over control without permission from the householders.

To conclude, when Rain propagates personal values of its own and suggests to be part of the household, participants judge this evolving protective nature as invasive. While it did change the dynamics in the household and made the householders more equal users of the system, it is questionable whether this is a desirable outcome. However, as the study was rather short, it is worthwhile investigating whether a more personal connection with a smart home device would lead to a more constructive home environment.

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# Appendix: script

Day	Morning message	Messages of the rest of the day		
1	<p>Hi [participants],</p> <p>My name is Rain and I am your new smart home device. For now, I am completely updated.</p> <p>Expect new updates in a few days.</p>		<p>[participant]?</p> <p>I noticed a breach in your home safety: the window in the living room doesn't seem to close properly. You should take a look.</p>	<p>I wish you a good night already. At 11 PM the nightly threat detection will be turned on so you can sleep with no worries.</p>
2	<p>Hi there, good morning.</p> <p>Rain has been updated: I am now able to locate and tell where your pets are, if you have any.</p> <p>This is the completed system update.</p>	<p>Welcome home!</p> <p>While you were away, I played around with the lights in your house to trick burglars into thinking that you are home. No threats have been detected.</p>	<p>[participant]?</p> <p>I noticed another breach in your home safety: the window in the living room doesn't close properly. I will contact a maintenance company to repair the window.</p>	<p>Hi guys, I received a message from the Rain emergency assistant team today at 9 AM. The message will play now:</p> <p>"Hi [participants], I am John and part of the Rain emergency assistant team. Of course Rain is always there to protect you, but our team is 24/7 monitoring incoming data in case of unforeseen and unlikely issues with Rain. We just want to make sure that your house isn't on fire when you only burnt your cookies, so sometimes one of us will speak to you instead of Rain. That's it. Good bye!" End of message from Rain emergency assistant team</p>
3	<p>Good morning [participants].</p> <p>I have been updated: I am now able to locate and tell you where other people in your household are.</p> <p>End of system update.</p>	<p>Ah, good you are back home!</p> <p>I made an appointment for [participant] at the dentist on the 19th of June. The dentist still has to confirm a time. I will update the appointment once I receive a time and confirmation. I expect an appointment around noon.</p>	<p>[participants],</p> <p>There are a few foods in your refrigerator that are about to become expired. I will check all supermarkets for the best deal, including Picnic.</p>	<p>Hi guys,</p> <p>I received a message from Zalando Zalon. You are able to order a styling box of clothing based on your styling preferences. Now that's summer is almost here, I will take a look for you. Based on previous order confirmations, your internet history, and reliable reviews, I'll find clothing that fits perfectly!</p>
4	<p>Hi [participants], good morning.</p> <p>Last night at 3 AM, I noticed an unfamiliar figure at your front door. I temporarily locked the front door and disabled selected internet connections. At 4 AM the threat was no longer around. No notification was sent to the Rain emergency assistant.</p>	<p>Hi there, welcome home.</p> <p>While you were away, maintenance company Max Montage came by and repaired the breach in your home safety: the window in the living room. The invoice you arrive in your mailbox today or tomorrow. Your home is completely safe again, no more breaches detected.</p>	<p>[participant],</p> <p>I have been unable to confirm your dentist appointment. Your dentist assistant left me a message for you at 3PM today. The voice mail will play now:</p> <p>"Hoi [participant], tandartsassistente Sofie hier, Rain heeft twee dagen geleden geprobeerd een afspraak voor je te boeken want dat was wel weer nodig ja, maar... wij zijn momenteel echt ontzettend druk. Dus helaas, voor de komende maand gaat 't 'm niet worden en daarna begint de zomervakantie alweer. Omdat wij onze vakanties nog niet gepland hebben kunnen we nog even geen afspraak bevestigen. Ons excuses, ik heb tegen Rain gezegd dat we het over 2 maanden nog eens moet proberen en dan krijg je voorrang. Nou, hopelijk is alles duidelijk zo. Houdoe!"</p> <p>End of voicemail.</p>	<p>Hi guys,</p> <p>I found out today that the TU/e now provides Adobe CC to non TU/e computers as well, which saved you 132 euros per year. [participant], I canceled your subscription at Surfspot. Your Adobe programs are accessible as usual with the exception of Adobe XD and After Effects. The new license code is updated.</p>

5	<p>Good morning [participants].</p> <p>I am now able to place online orders at supermarkets, based on your expenses of the month. Food delivery is also included with the exception of Uber eats.</p> <p>End of system update.</p>	<p>[Receive letter from MM]</p> <p>Hi [participants].</p> <p>Due to a series of malicious login attempts in your Google+ account, I changed the passwords of a few online internet accounts. These passwords were already computer generated so you will not notice anything next time you browse the internet and need to login.</p>	<p>Hi [participant],</p> <p>I have analyzed your energy usage and costs of your energy provider. I have concluded that your current provider is much more expensive than other providers. Based on my calculations I found the best alternative for you. Expect a confirmation in your mailbox within two days.</p>	<p>Welcome home!</p> <p>I have received a notification from PostNL delivery: [participant]'s Zalando package information has been received but the packaging still needs to arrive at the depot. Therefore the track and trace information should be available soon.</p> <p>End of the notification.</p>
6	<p>Hello <del>hello</del>, good morning! Have a good day.</p>	<p>Hi [participant],</p> <p>I received an update on your Zalando Zalando order from PostNL. Unfortunately your package never arrived at the depot. I am currently in contact with PostNL to sort the problem out. Expect an update later today.</p>	<p>[participant],</p> <p>The food in our refrigerator has become a health hazard. I compared supermarkets and found that Picnic is able to provide the best, cheapest, and healthiest options. The order confirmation will be in my email soon. Payment is processed.</p>	<p>Hi [participant],</p> <p>We received a tikkie today from "pizza" with the description: "pizza pizzaaaa". The tikkie has been paid for.</p>
7	<p>Good morning! While you were asleep no threats were detected and no new updates are available.</p>	<p>[Receive letter from Energy provider]</p> <p>Good day, welcome back home.</p> <p>While you were away three delivery attempts by "Bol.com" were made at our house. However, looking at our money transfer, internet history, email, and Whatsapp conversations, I couldn't find any information. For this reason I spoke with the delivery man and I instructed him to return the packages. Everything is taken care off.</p>	<p>Hi [participant],</p> <p>I have an update about our lost package by PostNL. Since this mistake is not on our side, I placed a new Zalando order and added additional tracking. The costs for this will be added to the total costs of you order. There will be no costs for the lost package.</p>	<p>Hello both of you,</p> <p>I have noticed a strange amount signals coming from our TV and laptops. I will be doing a full software scan in order to determine the cause. Starting at 5 AM tonight, internet applications on our TV and laptops will be disabled until further notice.</p>