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# The Grumpy Bin: Reducing Food Waste Through Playful Social Interactions

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**Abstract**

Domestic food waste is a world-wide problem that is complex and difficult to tackle as it touches diverse habits and social behaviors. This paper introduces the Grumpy Bin, a smart food waste bin designed for the context of student housing. The Grumpy Bin<sup>1</sup> contributes to the state of the art of food waste prevention solutions by challenging the traditional approach on pervasive technology, which is commonly based on system-driven judgements and persuasive data representations. Instead, this design empowers users and their social acquaintances to collectively judge their actions, hence adding a layer of social mediation that is likely to increase the chance for behavior change.

**Authors Keywords**

Playful Design; Food Waste; Design Intervention; Interaction Design; User Experience.

**ACM Classification Keywords**

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

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<sup>1</sup> A video of The Grumpy Bin's functionalities can be found on the following link <https://www.vimeo.com/200001848>

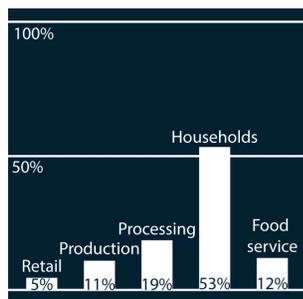


Figure 1: Amount of food waste per sector in the EU, according to the European project Fusions EU [3].

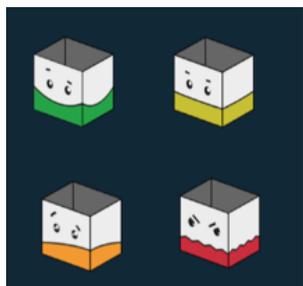


Figure 2: The different mood states of The Grumpy Bin.

## Introduction

Nowadays, one third of the food produced globally for human consumption is lost or wasted - that is, approximately 1.3 billion tons per year [4]. Nevertheless, there is little awareness of this problem in everyday life of society. In fact the, sector that adds a higher amount of food waste to the system by far are households (Figure 1) [5, 7]. The lack of visibility of the effects of food waste makes it hard for people to engage in more sustainable food consumption habits, and then to sustain these habits over a longer period of time.

This project suggests an approach to raising awareness about the need for more sustainable food consumption habits in the household context. In particular, we focus on student and shared housing as a form of early adolescent living with high degree of autonomy, experimenting, and potentially scarce resources. Student shared housing is a very particular context in which the responsibility for household-related tasks is shared, and that often makes it difficult to spot the source of problems [3, 7]. For example, a bunch of bananas might be thrown into the bin by someone who is actually not responsible for buying too many of them. Furthermore, we target the first generation to enter adulthood surrounded by technology-mediated devices.

## Related work

Pervasive technology products and services have been designed with the aim of addressing this issue. Winnow [11], a smart scale for restaurant bins that records the day's waste, is an example of this – although designed for the restaurant context, this concept could possibly fit the (shared) home environment as well. Samsung's Family Hub refrigerator [8] proposes a slightly different approach: a

smart fridge that allows checking its content anytime using built-in cameras helping users to do a more efficient grocery shopping (thus, reducing food waste). Bump Mark Label [2], on the other hand, is a sticker that reacts to the state of the product instead of showing a static expiry date.

The available solutions on the market are rather informative: they lack of intention. Through making food-related data visible, they aim to persuade users about the need for a more sustainable food consumption, empowering them to improve their behavior. However, effective social means to behavior change are not strongly involved.

Further steps have been taken by several academic projects by adopting social means to trigger behavior change in users. Euphoria [10] is an application for smartphones that tracks the fridge content in different households and suggests recipes to cook in a group using the food that is about to expire. Eco-Feedback for Non-Consumption [6] harnesses effect of social comparison to support behavior change.

An augmented bin is used to track a household food waste, which is compared with the national average score. The Bin Cam [9] also uses social influences as a trigger to reduce food waste, in this case through a more playful approach.

A smartphone installed on a kitchen bin captures pictures of food waste and uploads it to a Facebook application where all the pictures can be viewed by different users of the BinCam system. By consulting the online content, the users are invited to reflect on their own food waste behavior while comparing it to other households.

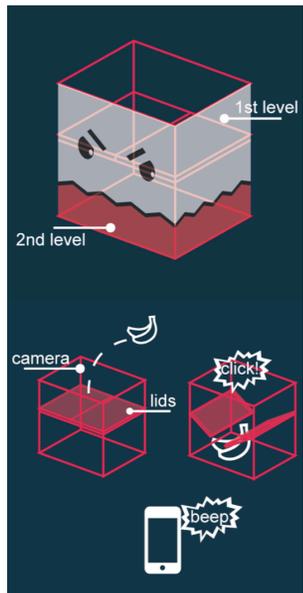


Figure 3: The functioning of The Grumpy. The illustration at the top shows the different elements of the bin. The three steps at the bottom illustrate the events happening when food is wasted. First, the food stays in the upper part, where a camera takes a picture of it. Second, a lid opens and lets the food fall to a lower compartment. Third, all the house members receive a notification about the waste of food.

## From informative solutions to user-driven regulation and judgement

The state of the art in technology-mediated solutions for food waste prevention is based on products as social actors which take initiative. They suggest users what to do and the core weakness lies in the limited leverage they have in a social environment. Providing users with data about food waste does not necessarily lead to behavior change [1].

Therefore, we aim for a solution that is grounded in a different attitude towards the problem: we are presenting a tool aimed at rather a fun and social experience through which users socially regulate and judge their performance in terms of food waste. We believe that if we are to engage users in persistent behavior-change we need to let them be the ones who take agency. As opposed to the informative solutions described in the previous section, our proposal empowers and encourages users to be critical about their food consumption habits.

## Concept design

The Grumpy Bin is a smart container for food waste designed to encourage a reduction in the creation of food waste in student housing. As its name indicates, the Grumpy Bin can express a very particular mood that changes depending on the wasting behavior of the members of the household. When food is thrown into the bin, it takes a picture and sends it to all the members of the house through an app notification. Then, the members are asked a few questions to determine who was responsible for the food waste. With this information, the Grumpy Bin decides who was responsible for the food waste and posts a sarcastic message on her Instagram account.

The Grumpy Bin is a rather small container with two compartments separated by an automatic door (Figure 3). When food is disposed, it stays in the upper level until a camera takes a picture of it and sends it to the house members' phones. Then, the internal door opens and lets the food fall to the lower compartment (where all the food waste is stored until thrown into the container in the street).

The lower compartment includes a load sensor that enables tracking of the amount of food waste thrown (measured in weight). It allows for data collection that can be used to determine the bin's mood (Figure 2). In order to visualize its mood, the surface of the Grumpy Bin is covered with an e-ink display. An internal speaker adds sound effects to the mood expression. Through an animated face and generated speech, the bin has communication capabilities that establishes a direct feedback loop towards the person disposing food.

When food is thrown into the bin, a picture is taken and sent to all the house members through a notification on their phones (Figure 4). The users can either ignore it or use their right to give their opinion. If the user chooses to do so, he will be asked some questions (Figure 5).

First, she must state whether she thinks that the food wasted in that particular situation can be considered abnormal or problematic (step 1 in Figure 5). If she argues it is not, she does not have to continue answering any other question; if she argues it actually is a problem, the questioning continues. Next, the user is asked to point to a responsible and a cause behind the food waste generation in that situation (steps 2 and 3 in Figure 5).

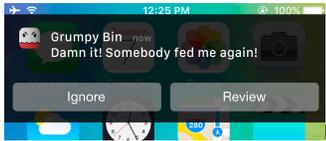


Figure 4: Notification sent by the Grumpy Bin when food waste has been thrown.



Figure 6: After throwing away some rotten bananas, the Grumpy Bin takes action. This is an example of an Instagram Stories post, inspired by the photo uploaded by one of the house members that shows a mutant banana which is already part of the household.

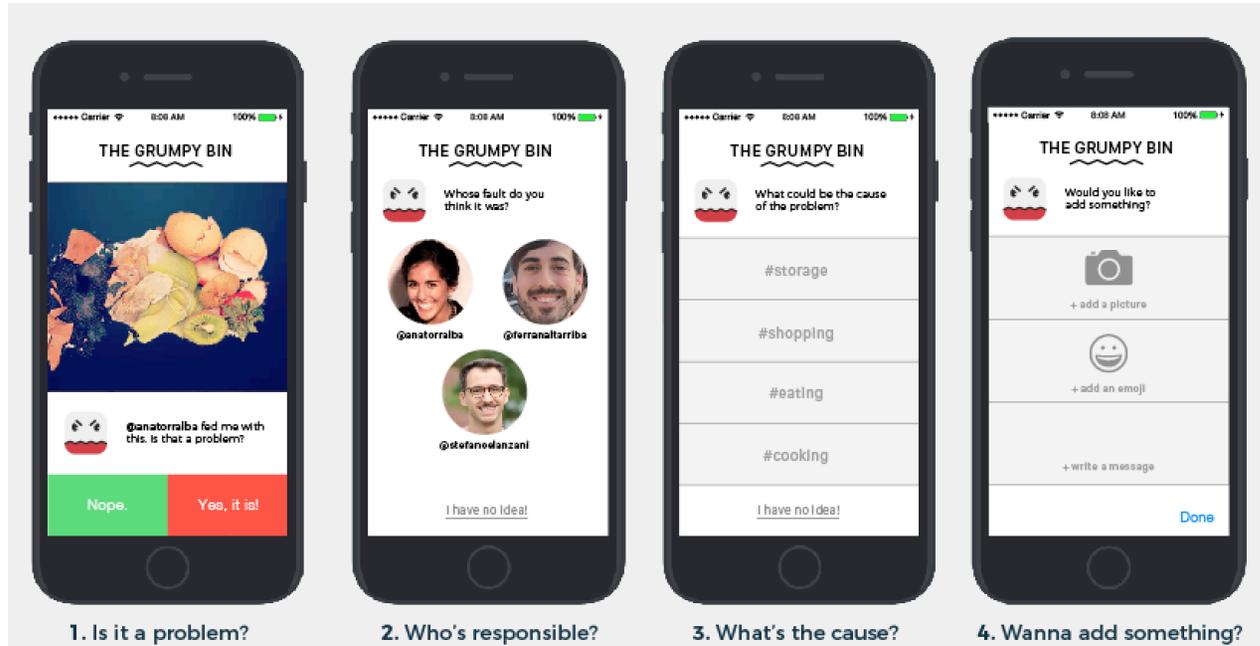


Figure 5: Screenshots of the design of the app, including the questions The Grumpy Bin asks the house members in order to make a judgement. First, they are asked whether the waste of that particular food is a problem. Second, they are asked to point at a responsible. Third, they are asked for a potential cause for the problem – either bad storage, shopping, eating or cooking. Last, they are asked to include any material that could be used for the Instagram post – a funny picture, an emoji, a text, etc..

Finally, the user is allowed to use her creativity to add any additional information, such as a funny photo, a text or emoticons (step 4 in Figure 5). All the information will be later used by the Grumpy Bin to build the contents of the Instagram publication that will be posted on the account of the user who is finally held responsible. In that manner, the final outcome cannot be fully controlled - it is a combination of all the inputs by the users and a share of randomness.

With the information provided by the house members, the Grumpy Bin makes a decision on who should be held responsible for the food waste generated. Since the responsibility for food waste management is shared by all the members of the house, there needs to be an objective entity who takes all the opinions into account in order to

make a final judgement. In addition, this adds unpredictability to the whole experience, and makes it more playful. Having the Grumpy Bin be that entity ensures that the interests of any of the house members do not prevail of the others'. Once the decision is made, the picture of the food waste is posted on the responsible's Instagram account, together with a sarcastic message and, possibly, any of the additional materials submitted by the users (e.g. a photo, emojis, a text, etc.).

The publication can take the form of a private message, a story or a post on the personal feed (Figure 6). Instagram was chosen since it is the most popular social network for sharing food-related photographic contents, especially those that are likely to be considered nice. By engaging in the dynamics of the Grumpy Bin, users commit to the risk

of showing the negative side of their food consumption behavior to their followers.

### Future work

The Grumpy Bin is a design concept that is not yet a fully-functioning prototype. Instead, a low-tech tangible prototype, a functioning virtual prototype and a concept video were produced in order to convey the idea. Future work would include the development of a fully-functioning prototype of the Grumpy Bin for validation through user tests, with which we would be able to evaluate the intended social dynamics in a real-life context over time.

### Conclusion

The Grumpy Bin is a novel pervasive technology concept aimed at supporting better food waste habits in student housing. It benefits from the power of pranking and social dynamics between friends in order to create food waste awareness. It builds on the state of the art by empowering users to take agency of their own performance, allowing them to regulate and judge each other's actions. A playful design approach is used, articulating the experience through game mechanics.

### References

1. Bernstad, A. (2014). Household food waste separation behavior and the importance of convenience. *Waste management*, 34(7), 1317-1323.
2. Daily Mail. End of the best before date? Food label made from gelatine becomes bumpy when meat is no longer safe to eat (2014). Retrieved February 25th, 2017 from <https://goo.gl/jo5X0h>
3. Ganglbauer, E., Fitzpatrick, G., & Comber, R. (2013). Negotiating food waste: Using a practice lens to inform design. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 20(2), 11.
4. Gustavsson, J., Cederberg, C., Sonesson, U., Van Otterdijk, R., & Meybeck, A. (2011). Global food losses and food waste. Food and Agriculture Organization of the United Nations, Rom.
5. Stenmarck, A., Jensen, C., Quested, T., Moates, G., Buksti, M., Cseh, B., ... & Scherhauser, S. (2016). Estimates of European food waste levels. IVL Swedish Environmental Research Institute.
6. Lim, V., Jense, A., Janmaat, J., & Funk, M. (2014). Eco-feedback for non-consumption. In *Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication* (pp. 99-102). ACM.
7. Quested, T. E., Marsh, E., Stunell, D., & Parry, A. D. (2013). Spaghetti soup: The complex world of food waste behaviours. *Resources, Conservation and Recycling*, 79, 43-51.
8. Samsung. Home has a new hub (2017). Retrieved February 25th, 2017 from <https://goo.gl/uQCGDk>
9. Thieme, A., Comber, R., Miebach, J., Weeden, J., Kraemer, N., Lawson, S., & Olivier, P. (2012). We've bin watching you: designing for reflection and social persuasion to promote sustainable lifestyles. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 2337-2346). ACM.
10. Social recipe recommendation to reduce food waste (2014). In *CHI'14 Extended Abstracts on Human Factors in Computing Systems* (pp. 2431-2436). ACM.
11. Winnow Solutions (2017). Technology to cut food waste in half and boost your kitchen profits. Retrieved February 25th, 2017 from <https://goo.gl/ZUEmqk>