

# SmartPiggy: A Piggy Bank that talks to your Smartphone

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## ABSTRACT

Saving money is usually a tedious task that requires a high degree of self-control for many of us. Some people have one or more specific savings targets in mind and thus need to prioritize them. We propose connecting a savings box with a personal smartphone. Thus, people become motivated to keep track of their savings for multiple targets. Using a savings box capable of counting money and connecting it to an app, we believe people stick to their plans to save with higher motivation and are happier with their behavior. In this paper, we present first evidence for the success of this concept. We gathered feedback through an online user study in which participants were shown a video prototype. We propose further research directions with our SmartPiggy, to confirm the feasibility of behavioral economics in HCI.

## Categories and Subject Descriptors

H.4 [Information Systems]: Information Systems Applications; H.4.0 [General]

## General Terms

Human Factors, Economics

## Keywords

gamification, self-control, prototyping

## 1. INTRODUCTION

Saving is difficult for many people. To teach children how to save money through easy small steps, parents give them piggy banks early in their lives. Adults, too, utilize piggy banks to reach a particular savings goal more easily. However, filling up a piggy bank is a serial process which complicates saving for multiple targets in parallel. Furthermore, keeping track of the current balance is cumbersome, so that one can only guess how much money the bank contains. An alternative to piggy banks are savings accounts, but they move away the tangibility of money. This is problematic since assessing *opportunity costs* [7] becomes more difficult when one does

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not spend actual bank notes and coins. To address these issues, we present a conceptual framework and prototype, combining a physical piggy bank with one's smartphone.

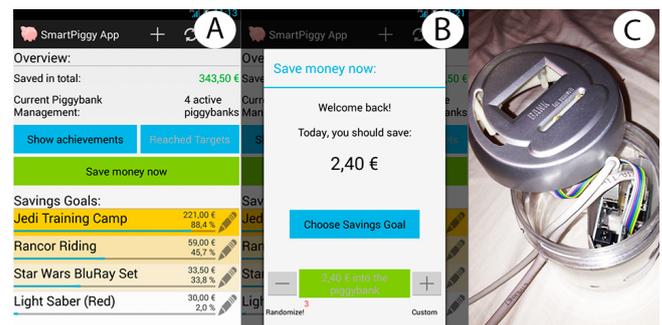


Figure 1: A) Overview of savings progress B) Suggestion to save a randomized amount C) Piggy bank

## 2. CONCEPT & BACKGROUND

In this section, we discuss related work and present a savings box that communicates its balance to a mobile application. The box detects face values of the inserted coins and consequently updates the current savings balance. The app displays the current balance stored on a server. If the user would like to insert bank notes instead of coins, she can update the balance manually. Due to the omnipresence of smartphones, users are likely to be susceptible to alerts and reminders. Thus, we opted to design a mobile application.

Our SmartPiggy app is capable of managing multiple savings targets which it represents by virtual piggy banks, similar to the "Saving Made Simple Money App"<sup>1</sup>. This design fosters theories from the research field of 'Behavioral Economics' which indicate that people categorize spendings and earnings (*mental accounting*, [8]). The users can therefore manage their saved money according to their mental accounts, even if it all goes into one single physical piggy bank.

Furthermore, we integrated multiple forms of feedback to enhance motivation. Research shows that people succeed in better assessing the opportunity costs if they think about items, rather than money [1]. To facilitate this, we let the user choose an image of the item that she desires and for which she saves up the money. Furthermore, the target value

<sup>1</sup><https://play.google.com/store/apps/details?id=com.ootpapps.saving.made.simple>, last accessed on Oct 14 2013

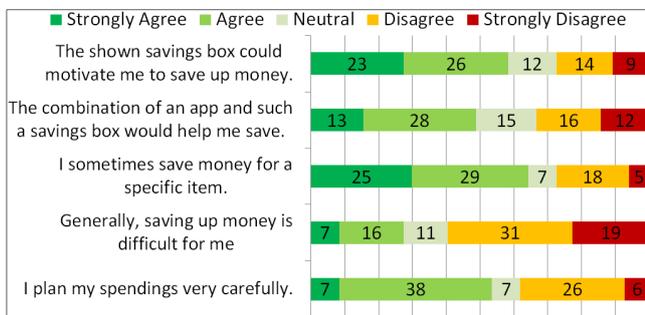
corresponding to the purchase price can be entered when creating a virtual piggy bank. Thus, the app can visualize the current status through a color-coded progress bar (see Figure 1 A). In the future, the progress bar could follow a non-linear scale to induce a *goal-gradient effect* [4].

People also have the tendency to procrastinate, even when the pending tasks are beneficial for them, like saving up money. However, external stimuli – e.g. in the form of reminders – might be able to alleviate this issue to some degree. The superseded task then becomes evident more often. Our app allows its users to set up alerts reminding them to put money into the piggy bank. We recommend a ‘*default*’ reminder in the evenings, since we expect users to keep the savings box in private space. Thus, reminders would occur when people are near their private savings box.

The SmartPiggy app employs gamification elements, which have shown to be successful even in the automotive area [2]. From this, we expect a reinforcement of extrinsic motivation. Thus, we allow playing in the real world using mixed physical and digital technology [3]. Users earn badges when they, e.g., succeed in saving on every single day of the week. Badges and achievements can be shared on social media. To introduce a slight gambling character to the app, it can be set to display a random number that the user needs to put into her savings box. If the user fails to save the given amount, she loses a badge. Losing a badge is likely to induce a greater emotional impact than gaining a badge (cf. *loss aversion* [5]).

### 3. APPARATUS & ARCHITECTURE

On the hardware side, our prototypical system consists of an Arduino UNO equipped with an Ethernet shield and a mechanical coin detector (cf. Figure 1 C). In the future, we will replace Ethernet connectivity through a WiFi module to enhance the user experience [6]. By software, we implemented an Android application. Additionally, a Java-based server application handles synchronizing the balances of the virtual piggy banks. Every time a coin is inserted, the carriage triggers an interrupt event specific for the type of coin. The Arduino receives this event and detects the inserted coins. Afterwards, it waits a certain time (threshold) and communicates the changes to the server via a HTTP request. The server processes the information and updates the given amount with the corresponding savings target. Finally, the updated balance is pushed to the app. The user can also manually refresh the balance in case the push procedure fails.



**Figure 2: People agree with the motivational character after watching an online video of our prototype. They also claim to save for specific items. ( $N = 84$ )**

## 4. ONLINE USER STUDY

We aimed to gather initial feedback on the concept and the design of our prototype. In this section, we describe the employed methodology and the data.

Since our concept is easy to visualize, we uploaded a video prototype to YouTube. We recruited 84 participants (37 female, 47 male) through social media to watch the video and fill out an online questionnaire without compensation. In average, they were 25 years old ( $SD=7.1$ ). In order to ensure that participants had watched the video, the study started with a ‘*gatekeeper*’ question evaluating a detail shown in the video. If a participant failed to answer this question correctly, the study ended at this point. All 84 participants succeeded in answering the gatekeeper question.

46% of the sample claim to own a physical piggy bank, of which 52% regularly put money into it. Concerning motivation through our SmartPiggy, we found that 58% agree that the concept could motivate saving up money. Furthermore, the results indicate that people often have a specific item in mind when they put money into their savings box/account. Details and further results are depicted in Figure 2. Our results indicate that there is high potential for a sophisticated piggy bank, since traditional piggy banks are still in use. Besides, appropriate visualization of the savings progress appears to increase motivation and endurance.

## 5. SUMMARY & DISCUSSION

We presented a concept inspired by psychological phenomena to help users keep up their motivation to save. Additionally, the progress of their savings efforts remains visible at all times. We plan to conduct long-term research with a small set of users through a diary study. Furthermore, we are exploring how contextual nudges can persuade users to put money into the piggy bank during a non-related task.

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