"Don't Whip Me With Your Games" – Investigating "Bottom-Up" Gamification

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ABSTRACT
In this paper we investigate "bottom-up" gamification, i.e. providing users with the option to gamify an experience on their own. To this end, we review commonly used gamification elements in terms of their suitability for such an approach and present the results of an online questionnaire (N=75) complemented by semi-structured interviews with employees of a manufacturing company (N=8). In a twelve-day-long study (N=20) we investigated the usefulness of a task managing app implementing a "bottom-up" gamification concept. With these studies, we derived requirements "bottom-up" applications should fulfill. The study results reveal that people want to use such an approach and are open to the creation of their own gamified experience, thus suggesting that "bottom-up" can be an alternative to "top-down" gamification often used today.

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

Author Keywords
Gamification; user-centered design; bottom-up; task management; customization

INTRODUCTION
Gamification, the use of game elements in a non-game context [10], has become more meaningful in recent years. It has been a topic in academia (cf. the number of publications [17]) and in the media (e.g. [41]). The idea of gamification is to make tasks more fun by using elements known from games [40] (e.g. receiving points) and thereby provide incentives that make fulfilling the task more rewarding. While gamification is also often used for inducing behavior change (e.g. [27, 42]), from an employer's point of view, gamification can not only make tasks more interesting, but can motivate employees to do tasks more efficiently. This has led to the term "Exploitationware" [7], which refers to the issue that employees are exploited in the guise of a game. For example, laundry workers at Disneyland in Anaheim saw the introduction of leaderboards comparing their speed (a game element) as an "electronic whip" [2]. This reveals a problem: The users are rarely the ones who created the system. As discussed in [9], playing games is normally a voluntary activity that now becomes mandatory and the autonomy/self-determination options games normally offer are now missing, which can lead to negative effects [19]. Even if not forced, similar to other persuasive strategies, a one-size-fits-all approach is potentially not the best solution for all users, but so far no generally usable solution for a tailored approach is available (cf. [35]).

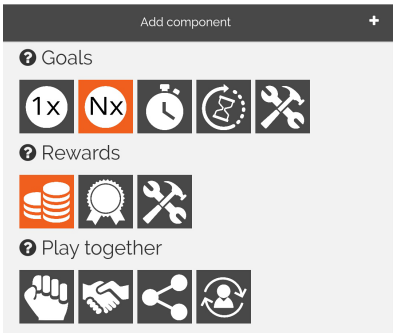

Figure 1. Game element selection screen of our task management app

In this paper, we investigate whether gamification is still useful if we change the "top-down" approach currently used to a "bottom-up" approach[1], i.e. the users themselves decide *what*, *when* and *how* specific aspects of their life will be gamified (e.g. selecting game elements as they see fit, cf. Figure 1). This overcomes the mentioned drawbacks as users remain autonomous and can tailor the gamification to their needs. To receive insights into this topic, we started the investigation by analyzing commonly-used gamification elements for their suitability in a "bottom-up", domain-independent application. The latter is important, as we conceptually do not want to restrict "bottom-up" to either work or private life (comparable to the multi-faceted view in the quantified self movement [29]). With this in mind, we conducted an online study with the goal to assess whether people are interested in (self-)gamifying their life, followed by semi-structured interviews with employees of a large German manufacturer, to investigate whether they would be open to using such an app in their working

[1]This should not be confounded with bottom-up game design [1].

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environment. The results of these studies were complemented by a twelve-day-long user study with a task management application allowing for "bottom-up" gamification of tasks. With the questionnaire and interviews, we not only follow a user-centered gamification approach [34], but enable the user in the prototype to alter the gamified experience, as they see fit for themselves, which can be seen as user-led design [23].

We contribute an investigation of "bottom-up" gamification and present data that suggests that "bottom-up" gamification can be an alternative to the usual "top-down" approach, as people appreciate the autonomy they have in such systems, and would use them. We also found evidence that a mixture of both might be interesting for some participants. Based on the three studies, we provide insights into different "bottom-up"-related questions and derive requirements for digital systems following this concept, which can be a starting point for practitioners and other researchers to explore this field further.

RELATED WORK AND "BOTTOM-UP" GAME ELEMENTS

The design of gamified systems today is mostly done by people that are not necessarily the subsequent users. An example of the usage of gamification in private contexts can be seen in [27]; here, Lessel et al. introduced a system consisting of a mobile game and a gamified public trash can. The goal was to motivate and educate people to recycle correctly. Every user was treated the same way and was exposed to the same game elements. An example for the work context can be found in [25, 26]. Workers in manual end-assembly are motivated by games elements considering their current performance. In both cases, it remains questionable whether the effectiveness of the game elements would improve, had an adaptable approach been used, accounting for individual differences (cf. [33]).

Orji et al. investigated this question for game strategies in the health domain [35]. In a large-scale study, they derived player types (e.g. [15]) of more than 1,000 participants and analyzed how specific game elements are perceived. Based on this, they propose a model that should motivate the majority of users and one model that should motivate a particular type of user. Their work shows that there are individual differences and that these moderate how game elements are perceived. It remains questionable, though, whether it is sufficient to consider the player type/personality [13] alone, as evidence exists that the domain [17], demographics (e.g. [11, 24]) and the development context [36] also play a role. Additionally, the question arises whether an automated approach can incorporate all aspects. In this work, we investigate whether users are able to equip their own tasks with game elements they appreciate and to let them adapt the elements to the situation as they see fit.

Such an approach is motivated by research that provides evidence that people indeed develop their own games to make tasks more rewarding. An example is the work of Donald Roy, who investigated the situation of machine operators [37]. They chose to play voluntarily, and decided how to play their "game" by using game elements to make their monotonous task more fun, without any manager that decided how this should be done. An interesting aspect here was also that the game itself was motivating, not the promise of any (potentially monetary) reward. The survey of Seaborn and Fels provides an overview of theoretical foundations in gamification frameworks [38] and highlights various works that stress the importance of accounting for individual differences and that personalization and customization in gamification is a way to accommodate individual user preferences during runtime. Nicholson [34], based on the Organismic Integration Theory (a sub-theory of the self-determination theory), also stresses the importance of autonomy in gamified systems (see also [31]), that users know best what is meaningful for them and thus should be directly asked what they want in such systems, to the extent of letting them create their own systems. Mollick and Rothbard [32] provided an extensive literature review of game scenarios at work that are and are not manager-imposed, and also investigated the potential problems of "top-down" gamification approaches, which they called "mandatory fun". They found that consent of employees plays a significant role in whether or not gamified processes are perceived positively, highlighting that the voluntary nature we want to follow with our approach is an important aspect for the acceptance of a gamified intervention.

We considered the literature overviews in [17], [21] and [38] in which commonly used game elements were analyzed and checked them for their suitability in a "bottom-up" approach, i.e., whether users can adjust the element to their needs:

Receiving *points* seems to be suitable for a "bottom-up" approach, as users could easily assign points for solving tasks. This element is already used in a "bottom-up"-like approach (cf. [22]) in which users set up and receive experience points for solving tasks in a task management app. An issue that might appear is that the amount of points, if user-generated, is not easily comparable across tasks. *Achievements* [18], such as visual badges and/or textual ranks, could also be added as a reward after solving a task. The (self-)creation of visually attractive badges in a "bottom-up" process is theoretically possible (and can be supported by a badge creation tool). Nevertheless, badge placement is an important aspect here, i.e. finding a balance between task difficulty (neither too easy nor too hard) and receiving the badge [3]. As users can decide what they can/cannot achieve, this seems theoretically feasible. *Self-defined rewards*, i.e. rewards that are not only available inside the app, e.g. buying a new CD after finishing a task, are another option. In general, this motivates users extrinsically [6] and is by definition "bottom-up".

The elements *progression*, *clear goals*, and *feedback* in the form of receiving a reward for advancing in a task, having the option to set up rewards that are tiered, and seeing how much progress was made towards a specific goal are aspects that can be added into a "bottom-up" approach. The application needs to assist users in setting up these elements easily, and users should be able to define the specific rules to reach a set goal, e.g. how many points are necessary to reach a new level, or when they want to unlock intermediate rewards.

Competition, *cooperation*, and *social recognition* are another group of elements that are also possible in a "bottom-up" approach. Competition, according to [20], can be a motivator/demotivator depending on the player type. It is important for a "bottom-up" approach that the participation in competitions remains voluntary, as peer pressure might be an issue

otherwise [15]. As challenges involve other users, there is a need for some kind of anti-cheating mechanism. For specific tasks, this can be done to a certain extent with sensory input (e.g. "who is running more in a week?"). For other tasks, making users submit proofs which are reviewed by a third party before rewards are received is also an option in a "bottom-up" scenario. The competitive element should also be seen in conjunction with *leaderboards* in which performance is directly compared to others, or used implicitly, e.g. by showing how often a specific badge was collected by other users in total. As long as leaderboards remain task-specific (and thus rewards remain the same for every user), they also remain comparable. Cooperation could be implemented by offering tasks that can be solved together with other people. Individual progress could also be checked by the same mechanisms as mentioned before. *Social recognition* can also be motivational, especially as evidence exists that virtual rewards such as points become more meaningful [16] when "shared". In a "bottom-up" sense this could be realized by (voluntarily) informing people that a task was started/finished or that rewards were received.

Story elements range from simple description of situations [15] to the simulation of complex worlds in which the user can improve a virtual *avatar* through rewards or *virtual goods*, which can then also be used to compete against other users' avatars. For a "bottom-up" approach, story elements seem unsuitable, as these impose more work on the user. What could work is to allow the creation of such content and to make the results accessible to others. In comparison to other elements, though, it seems difficult to justify why users should generate something that is demanding to create. Using an avatar and virtual goods without story elements is possible, but is then effectively another way of displaying achievements. Self-expression through creation of virtual goods could be beneficial for motivation, but also imposes more effort for the user in the application, as opposed to mere visual badges.

S1: ONLINE STUDY

We used an online questionnaire with the goal of assessing openness to gamification in general and whether a "bottom-up" approach seems plausible. More specifically, we wanted to gain insights for the following questions:

- **Q1** What are unpleasant tasks in daily life that need additional motivation?
- **Q2** Are people in general open to using (gamified) applications for motivational purposes?
- **Q3** Can people imagine defining their own gamification?
- **Q4** Are there differences in how people gamify on their own?
- **Q5** What are requirements for "bottom-up" apps?

Method

We set up a German online questionnaire with 78 questions. These fit into the following categories: demographics and questions on participants' gaming affinity, experience with gamification, questions assessing how they motivate themselves day-to-day to do unpleasant tasks, and questions on how participants perceive our "bottom-up" approach in different contexts. To this end, we presented the abstract idea of a mobile application that realizes this concept and provided four scenarios (see Table 1) in which participants were given the task to indicate what kinds of gamification elements (if any) they wanted to utilize in those situations. Scenarios were selected to cover work and private life, as well as one-time tasks (Sc 1, Sc 2) and behavior change tasks (Sc 3, Sc 4). We provided scenario-specific examples for the different game elements, to make their function clearer for the participants. The questionnaire consisted mainly of questions to be answered on a 5-point scale with labels for every option (mostly translating to "disagree" to "agree") and with 3 being a neutral choice, yes/no questions and (optional) questions that allowed for free text answers. All questions were generated by us and can be found as supplementary material. The questionnaire was promoted via (student) mailing lists and the social media channels of the different authors.

Scenario
Sc 1: Cleaning kitchen: Imagine the kitchen is due for cleaning. You want to motivate yourself with the app to get this done.
Sc 2: Piece work: Imagine you work for a manufacturer and build furniture by piece work. The work is monotonous and you want to use the app to make it more exciting today.
Sc 3: Exercise: Imagine you want to exercise more, i.e., you want to go for a run multiple times a week. You want to use the app to motivate yourself to reach this goal.
Sc 4: Saving energy: Imagine you want to save energy at your company, e.g., by turning off the lights after work. You want to use the app to motivate yourself to reach this goal.

Table 1. The four provided scenarios.

Participants

75 participants (29 female) completed the questionnaire. The age distribution was skewed younger (<21: 2; 21-30: 55, 31-40: 9, >40: 9), a consequence of the way we promoted it. Mainly participants reported being students (48%) or employees (37%). 92% own a smartphone or tablet and assess themselves as experienced on a 5-point scale (Mdn=5, AR[2]=92%). Concerning their affinity to games, 57% reported playing video games regularly for an average of 8.9 hours per week (SD=8.4), and 53% reported playing parlor games regularly (2.7 hours per week, SD=3.3). Only 19 participants already knew about gamification, and they tended to have positive experiences with it (Mdn=4, AR=63%), but were indifferent on whether it motivated them to use the app more (Mdn=3.5, AR=50%).

Results

We analyzed the data to gain insights into the five questions previously mentioned. To answer **Q5**, we derived requirements from the results where applicable, and will reference these accordingly. We also directly asked participants, before we introduced our "bottom-up" idea, what apps with the goal to motivate should (not) offer. 55 different aspects were mentioned, and we considered those mentioned at least twice. Figure 2 shows the elicited requirements from the participants on the left, with the ones derived from all studies on the right.

[2]% of participants answering with 4 or 5 on a 5-point scale.

S1	Online study – Requirements directly elicited from participants
R1	The app should offer a to-do-list-like interface (10x) and provide an overview of already-done tasks (4x).
R2	The app should not generate overhead, i.e. adding/handling tasks should not take longer than doing the task (12x). This requirement was also supported by the other results from S1.
R3	The app should offer the option to formulate intermediate goals and progress made should be visualized (4x).
R4	The app should offer social elements like collaboration, competition or the knowledge that other users can see one's own progress (6x).
R5	The app should offer a reminder functionality (3x).
R6	The app should offer a timer functionality that could also be used to improve one's own performance over time (5x).
R7	The app should offer rewards for tasks and progress in these tasks (7x), such as achievements (3x), points (5x), or real incentives (3x) and unlocking them should be possible (2x).
R8	Users should be able to decide which functionality they want to use (2x) and the app should offer enough options to provide flexibility and variety (2x). This requirement was also supported by the results from S1 and S2.
R9	The app should not put pressure on users (3x) or dictate when tasks should be done (6x). This was also supported by results of S2.
R10	Users should be able to customize the notification frequency (10x).
R11	Users should be able to share only data they want to share (12x).

S1	Online study – Requirements derived from results
R12	The app should be usable independent of domain, as the results show that users want to gamify different parts of their life.
R13	Demanding user effort should not be necessary to use game elements, and if elements exist that request user-generated content (such as stories), it should be easy for users to add new content.
R14	The app should offer the option to let task executions be reviewed by others. In the sense of a "bottom-up" approach, a user should always be able to select whether a reviewer should be integrated.
R15	The app should offer the option to inspect how other tasks have been gamified (without contradicting R11), as inspiration for users who might not know how to gamify specific aspects of their life.
S2	**Interview with employees in manufacturing**
R16	The app should allow voluntary participation in social features, i.e., only users that want to receive such invitations should receive them.
R17	The app should make rewards comparable in competitions.
S3	**Study with "bottom-up" prototype**
R18	The app should offer the option to use parts that are defined "top-down" as a basis for one's own gamification.
R19	The app should offer offline capabilities for elements that do not need online synchronization.
R20	The app should always offer the option to edit game elements, to correct errors but also to allow adjustments of measures.

Figure 2. Requirements overview. Left: Directly elicited requirements from participants in the online study (numbers in parenthesis represent how often a requirement was formulated). Right: Requirements based on results of our three studies. They will be referenced in the corresponding sections.

Tasks today

83% (60%) of our participants reported having unpleasant tasks in their private (working) life. In free text fields, participants reported various kinds of tasks; most often mentioned were grooming (29×), tidying up (14×), monotonous work (11×), chores in general (10×) and doing homework (9×). We also asked how they motivate themselves to do such tasks (again in free text fields): tasks need to be done (18×), creation of a motivational atmosphere (9×), using a checklist and seeing progress (7×), receiving a self-defined reward after doing the task (6×), prospective joy about solving the task (6×), social pressure (5×) and receiving an external reward (grades/salary) (5×). An application that motivates them to complete tasks in their private (working) life could be imagined by 61% (50%) (asked as a yes/no question). 16 participants who disagreed reported that they do not expect an app to be motivating (in a free text field). We also explicitly asked all participants whether they could imagine solving tasks in a playful fashion in their private/working life (Mdn=4, AR=67%/Mdn=4, AR=63%). We found no significant difference for participants that play games regularly (either video or parlor games) in the answers to these questions. These results show that there are in general many tasks, either in work or private life, that are unpleasant, and how participants motivate themselves today. Thus, offering additional sources of motivation seem beneficial (cf. **Q1**) and as (more than) half of the users could imagine using an application for motivational purposes, digital (gamified) assistance could be such a source (cf. **Q2**). How participants motivate themselves varies; thus, a flexible approach that is able to address various needs seems beneficial (which supports requirement **R8**; see Figure 2).

Perception of "bottom-up" gamification

After introducing the "bottom-up" idea, participants were asked to assess it (Mdn=4, AR=63%). Chi-squared tests showed that people that claim to be open to using an app for motivation in their private/work life were significantly more open to our app concept ($\chi^2(4, N=75)=32.24, p<.001, V=0.65$ / $\chi^2(4, N=57)=28.13, p<.001, V=0.70$). The same is true for people that want to solve tasks playfully in their private/work life ($\chi^2(16, N=75)=90.27, p<.001, V=0.55$ / $\chi^2(16, N=75)=34.48, p<.05, V=0.34$). This indicates that our "bottom-up" approach fits into users' expectations (cf. **Q2, Q3**). We also asked whether participants want to use a motivational app in all areas of their daily life, but only a small majority would do so (Mdn=4, AR=54%). Nonetheless, this highlights that a domain-independent approach seems beneficial (establishes **R12**). Participants who were not completely against using such an app (92%) were presented with further questions. Concerning the game elements (cf. **Q3**), the wish for influence was expressed, as our sample wanted to select game elements on their own (Mdn=4, AR=83%; supporting **R8**), but only a minority would create new content (e.g. for the narrative) (Mdn=3, AR=35%) or want to think more about the game elements (Mdn=3, AR=29%; supporting **R2**). This indicates that a "bottom-up" system should offer a rich variety of game elements and should not necessarily integrate elements that are too demanding in terms of user-generated content (which establishes **R13**). As in a "bottom-up" approach, it is questionable how to handle rewards in general, we asked whether the sample wanted to decide for themselves or let others decide on a reward, but the answers were inconclusive (Mdn=3, AR=40% vs. Mdn=3, AR=46%). We also integrated questions on whether there should be anti-

	Game element variation n=54	
	$SD_{=0.0}$	$SD_{\leq 1.0}$
Receiving points	50%	85%
Virtual character receiving a benefit	52%	94%
Receiving badges	59%	88%
Unlocking new functions inside the app	40%	80%
There is a narrative setting around the task	33%	80%
Seeing a progress bar	46%	85%
Competition against other users	22%	69%
Cooperation with other users to do tasks	24%	76%
Receiving a reward defined by myself	43%	83%
Receiving a reward from friends/employer	43%	70%
Informing friends about starting the task	65%	83%
Informing friends about finishing the task	52%	83%

Table 2. Game element variation across all scenarios and participants that selected game elements (asked on a 5-point scale) for at least two scenarios.

	Acceptance rate per scenario			
	n=47	n=38	n=54	n=22
	Cleaning kitchen	**Piece work**	**Exercise**	**Saving energy**
Receiving points	74%	68%	70%	64%
Virtual character receiving a benefit	64%	66%	61%	50%
Receiving badges	72%	66%	70%	69%
Unlocking new functions inside the app	60%	53%	61%	50%
There is a narrative setting around the task	49%	53%	50%	59%
Seeing a progress bar	87%	82%	89%	68%
Competition against other users	57%	74%	59%	73%
Cooperation with other users to do tasks	51%	82%	67%	73%
Receiving a reward defined by myself	53%	29%	41%	18%
Receiving a reward from friends/employer	53%	82%	37%	73%
Informing friends about starting the task	10%	18%	17%	9%
Informing friends about finishing the task	17%	5%	19%	27%

Table 3. Acceptance rates per scenario (% of participants responding with 4 or 5 to the question of whether they would use the element here).

cheating mechanisms (as a multi-select question): 6% think that monitoring whether or not a task was fulfilled correctly (before receiving the reward) is necessary for tasks in which only the user is involved, 20% think that monitoring is unnecessary, 36% stated that it is necessary whenever other users are involved (e.g. in competitions) and 38% think that a check is always necessary. Some kind of review mechanism that can be activated by the user, if requested, seems reasonable to comply with these views (establishing **R14**).

Scenarios and Game Elements

We analyzed how participants perceived the scenarios (see Table 1). Consistent with the unpleasant tasks, "cleaning kitchen" was not perceived as convenient (Mdn=3, AR=30%), nor was "piece work" (Mdn=3, AR=42%). The other two scenarios were perceived as significantly more convenient ("exercise": Mdn=3, AR=55% "saving energy": Mdn=3, AR=49%), as a Friedmann test with step-down follow-up analysis revealed for these two groups ($\chi^2_F(3)=32.52$, $p<.001$). For every scenario participants were asked to indicate whether they could imagine completing the corresponding task playfully (as a yes/no question). 83% of the participants could do so in at least one scenario. If they disagreed, we asked for reasons. For the (cleaning kitchen/piece work/exercise/saving energy) scenario, (18%/11%/38%/43%) of the participants that disagreed (28/37/21/53) stated that the task itself is motivating for them and (57%/63%/33%/48%) stated that they cannot imagine a game in this scenario. While the latter indicates that hints on how specific tasks could be gamified might be helpful (establishing **R15**), the first indicates that a domain-independent "bottom-up" approach, in which users can decide for themselves *where* they want to gamify an experience, seems beneficial (supporting **R12**). For every scenario, participants that could imagine a playful approach for it were asked to select game elements they would use (cf. **Q4**). We checked how much individuals vary per scenario by averaging over all ratings per element and participant. Table 2 shows that they do not vary at all (SD=0), or only slightly (SD<1.0). This suggests, at least for our scenarios, that most participants would stick to the same game elements for motivating themselves. Table 3 shows which elements would be selected. From this we can conclude that nearly every element we asked for can be of relevance to participants in specific scenarios, which also supports **R8** and **R12**. The results in both tables should not be overestimated, due to the artificial situation posed in the questionnaire. Interesting results can be seen in that competition, cooperation and receiving rewards (from myself/from others) seem more likely to be influenced by the context. Additionally, the elements that inform others about starting/finishing tasks are not perceived well by the participants in general.

Discussion

The study provided aspects that are of relevance for gamification in general (e.g. interesting areas to gamify) but also specifically for the "bottom-up" idea, and thus serve as starting point for further exploration: We have seen unpleasant tasks in private and work life that would benefit from additional motivation, potentially through motivational applications. Gamification could be a tool here, as more than half of the participants could imagine solving tasks in a playful fashion. Some participants reported already using game elements for motivation, such as seeing their own progress or rewarding themselves. We also found indications that our "bottom-up" approach is reasonable, as our sample was open to defining their own gamified experience. This also seems necessary, as we learned across questions that there is a need for defining or selecting one's own game elements to account for individual differences. The study contributed a set of requirements for "bottom-up" applications, either directly elicited from the participants, or derived from our results. The study itself has some limitations: First, we had only German participants, which is a threat to external validity. Second, we only provided an abstract idea of a "bottom-up" app, and scenarios had to be imagined, so it remains questionable whether the

results directly can be transferred to real settings. For an initial "bottom-up" investigation, this seems acceptable to collect first expectations. Our prototype study, using a specific app and participants' daily tasks, will provide complementary insights. Third, the sample consisted mainly of younger people. Thus, it is questionable how these results transfer to an older population with potentially less affinity to games, but work such as [14] suggests that the desire to play is age-independent.

S2: INTERVIEW WITH EMPLOYEES IN MANUFACTURING

The S1 sample consisted mainly of a younger, gaming-affine population. We wanted to complement the insights by working with a different one (i.e. older and less gaming-affine) directly in a working context, the area in which exploitation [7] can happen. This might also reveal certain limitations of our approach that were not necessarily present while participants responded to S1 (most likely done in their spare time). As we are currently developing an issue tracking system [28] in a German manufacturing company, which should also make use of gamification (not yet integrated in this system) to motivate better documentation quality, we decided to use this environment to conduct semi-structured interviews with employees. The main interview questions were: which experiences the participants have already had with gamification, which processes in work and private life they have already handled in a playful fashion, (after it was introduced, similar as in S1) how they perceive our "bottom-up" approach, how they would use it in their working context, what problems they see with it and how they would also use it in their private life. The interviews were conducted by one experimenter, while a second transcribed them. The different topics were later derived using the transcriptions and iteratively refined through discussion by these two experimenters.

Results & Discussion

Eight semi-structured interviews with employees (8 male, age: (21-30: 2, 31-40: 1, 41-50: 2 , 51-60: 3)) were conducted. The participants reported being open to technical innovations on a 5-point scale (Mdn=4, AR=75%), but only one had known of gamification beforehand. The sample cannot be considered to have a gaming affinity: Only one plays video games occasionally (3-4 hours per month) and parlor games are played by seven participants, but only monthly or even more infrequently—only one plays 1-2 hours per week. They slightly disagreed to the question of whether they would play more, if they had more time (Mdn=3, AR=38%). None of the participants reported having playfully done tasks at work, and only one did so in private. The interview further revealed that this was not something they had considered before. Thus, the sample in this study can indeed be seen as different from the one of S1. The lack of experience with doing tasks playfully and with gamification were a small (but anticipated) drawback, as some of our main questions could not be answered conclusively by the participants, or in a way that would have demanded complementary questions on the topic, resulting in rather short interviews (around fifteen minutes each).

After introducing our "bottom-up" concept, we asked whether they could imagine using it. Even though they had not yet thought about completing tasks playfully, they were open to such an approach. Only two would not use it, but they had no problem with other colleagues using it, which is important regarding our goal of voluntary participation. Three participants were concerned about systems in which they could not decide how to use game elements, as this might be used to add more pressure, also supporting **R8** and **R9** (see Figure 2).

Competition was a concept that the participants considered when asked for potential game elements, but it was perceived as problematic by five participants, as this would cause pressure. Only one participant emphasized that competition would be motivational for him, but he also thought the majority of employees would be against it. In general, this leads to the establishment of **R16**. One participant states that he would appreciate a system in which no explicit competition happens, but in which he could simply compare his performance. Another reoccurring theme in five interviews was that rewards need to provide something beyond being there "virtually". Keeping in mind that the sample had no gaming affinity, this is unsurprising. One participant (with authority over employees) imagined that he could use the voluntarily shared data to provide a better incentive, as he needs to evaluate the performance of his employees on an annual basis and could use this as justification. For good comparability, e.g. points would have needed to be specified in a "top-down" manner (leading to **R17**). One participant added that he sees transparency as a major benefit such an application offers. He would use it, not for comparing others, but rather to see what he has achieved so far. For the question of where they would use such an approach, participants would use it at work to motivate themselves. They would not necessarily use it in their private life. One reason for this was mentioned by a participant: *"I would not know what I should do with it in my private life"*. Considering the characteristics of our sample, we think that this is not surprising, as they had not yet used playful approaches toward tasks in their daily life (which supports **R15**). One exception was a participant who found it difficult to gamify processes in his work area; here, the case is inverted. He already had ideas on how to gamify his private life (sports), and would use gamification there primarily.

We learned that the majority of our sample would try an application in which they could decide for themselves how they would gamify tasks at work. This indicates that the general acceptance found in the online study, with a younger, game-aware sample, seems to be transferable to an older sample less familiar with games. If they did not want to try such an application themselves, they were still open to colleagues using it. For the "bottom-up" idea, this is an important prerequisite. Additionally, the majority was able to think of more use cases for the app at work than in their private life (unlike in the online study), revealing that the context switch was indeed reasonable to also account for this view.

PROTOTYPE

To complement S1 and S2, we developed a prototype following the "bottom-up" idea that should be used in S3. We decided to create a task management application, as this seems reasonable concerning our requirements (cf. **R1** in Figure 2) but also from a domain-independent viewpoint, as every as-

pect that might be gamified in private and work life can be considered as a task (cf. **R12**). In contrast to existing gamified task management apps, such as Task Hammer or Epic Win [22], the interface and experience of our system is not (necessarily) game-like, nor do we have a fixed theme (such as a role-playing context). Nonetheless, we offer the option to make the app more game-like visually, as the users' scores or badges can be visualized on the dashboard, if they are interested in them. For every task, users can decide whether they want to use game elements or not. Thus, a user can simply use the app without touching any game-related features, providing an additional layer of autonomy. If users want to use game elements, they can decide—for every task—which they want to use (cf. **R8**): Several elements are offered and users can combine them as they see fit (see below). Besides the mentioned two related apps, there are other apps (not yet investigated scientifically) that gamify task management (e.g., LevelUpLife, HabitRPG, Stikk or ChoreWars). These apps vary in their degree of customization options, but to our knowledge, offer less flexibility concerning the game elements (i.e., amount of game elements, customization options per element and combination options) than we do.

Task Management Features

An informal review of 30 task management apps shows a large variety of functions. To our knowledge, so far no analysis reports which feature sets are beneficial. As solving this was not the focus of this paper, we decided to implement a core set of functions that seems reasonable for managing tasks. The app was created as a single-page web app, to ensure better compatibility across different devices. We allow naming tasks, categorizing them, adding notes, prioritizing, them and adding due dates. Additionally, tasks can be set to be reoccurring, and reminders can be added and configured. To allow an easy and fast creation of a task (cf. **R2**), only the name is mandatory. Optionally, during task creation users also have the chance to add game elements to the tasks as they see fit (cf. **R8**). In general, through the "bottom-up" approach, users can also decide how much pressure they want to put on themselves, and can always decline task invitations of others (see below, cf. **R9**). An overview of tasks is used as the primary view (see Figure 3), which is sortable and filterable. Every task is depicted with its name and category, its due date and whether it is reoccurring. Tasks (but not the game elements) can be edited and can be checked off after they have been done. Reminders are provided as e-mail notifications (cf. **R5**). Concerning **R10**, we decided to disallow customization of notifications, to ensure that all were received in the study, but in general only social element requests (see below) and reminders (that the users can set themselves) produced e-mails. Game elements are hidden behind a "more" button to avoid cluttering the interface, especially when several are selected for a task.

Integrated "Bottom-Up" Elements

Users can decide on a per-task level which game elements they want to use for this specific task and can add several combinations to one task. In the element selection these are grouped as "goals", "rewards" and "play together" elements (cf. Figure 1). If the user wants to use game elements, we only require that the user defines at least one goal and at least one reward (mainly a programmatic restriction). Every attached element can configured further, and we do not limit the number of elements per task. For example, a user could set up the task "to do the dishes 5 times this week, while one set needs to be done in under 5 minutes. If completed, receive 200 points and a badge". The task would appear in the overview and the app would offer buttons to stop the time, helping the user to keep track. In this example, *what should be done*, *how often*, *how fast*, *the amount of points* and *the appearance and name of the badge* could be defined by the user. Thus, users can define the "content" of the elements, their composition and the elements themselves. We followed our game element review to decide which elements should be available in this prototype. To allow social features, other users can be befriended (cf. **R4**) and as long as it is permitted (cf. **R11**), others can inspect their friends' profiles to see their points and received badges. We have not integrated the *social recognition* feature (i.e. informing when a specific task has been started or ended), as this was not perceived well in our online study. We have also not integrated the *narrative* element, together with *virtual goods* and the *avatar*, as we judge it as too much effort for users (especially considering **R2**) and assistance tools (e.g. a graphical tool to create virtual goods in the app) would shift the focus away from the core task management app (cf. **R13**). To avoid introducing a bias towards specific game elements, we have also not integrated **R15**. Thus, the integrated elements in the prototype are:

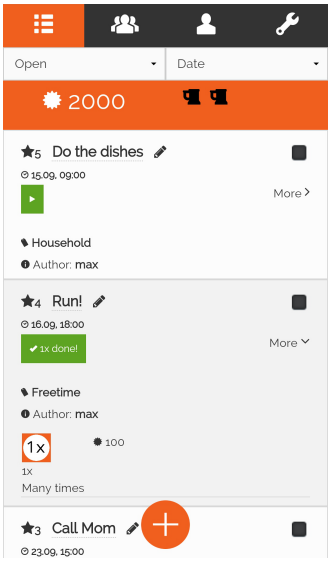

Figure 3. Main screen of our prototype app

- **Goals**: Users are able to specify that tasks need to be done once or multiple times. Selected rewards are only then unlocked. A time frame can be specified, and users can set up goals to be reachable several times (e.g. receiving a reward whenever the goal was fulfilled twice a week). Users can indicate that they have done a task once by clicking on an additional button in the main screen. They are also able to specify that a task needs to be done for at most or at least a certain duration (cf. **R6**). A timer in the app is then

shown and can be used for this. Finally, a user can also define a custom goal (e.g. lose 10 pounds) which users need to manually mark as achieved. This category fits the *clear goals* gamification element. We also added progress bars (*progression*) and provided *feedback* for tasks that need to be done multiple times (cf. **R3**).

- **Rewards**: Users can assign *points* as rewards for the fulfillment of a goal. The amount is completely up to the user (and can also be negative). Another reward type we offer are *badges* (cf. **R7**), which can have an icon and/or a textual representation (e.g. "Master runner"). Icons can be selected and colored as users see fit. We also offer the option to assign *self-defined rewards*, e.g. "buying ice cream."
- **Play together**: The app offers social features (cf. **R4**): A user can invite friends to tasks and start a *competition*. Their performances are visualized on *leaderboards* with metrics that can be adjusted by the task creator (e.g. points or time; cf. **R17**). Friends can also *cooperatively* handle tasks and can accumulate (for example) points together; how much users contributed is then shown for each task. For every task, it is possible to assign a *reviewer* that checks that the task has been done (only then is a reward unlocked; cf. **R14**). Friends also have the option to assign tasks to each other with rewards that they have defined. Invited users always have the option not to participate (cf. **R16**).

S3: USER STUDY WITH "BOTTOM-UP" PROTOTYPE

We used the aforementioned prototype in a study to analyze how people utilize an app that offers "bottom-up" gamification. The goal of this study was to find out how the "bottom-up" elements are perceived and whether people appreciate the autonomy offered in such a system.

Method

We provided a questionnaire that assesses gaming affinity and how the participants currently manage their tasks. All questions were generated by us and can be found as supplementary material. After completing it, participants received access to an online tutorial video, explaining the app and the game elements. Only after watching, they received access to the app, and they were asked to use it for their task management for twelve days, even if they had not used an external task management application before. After six days the participants received access to a mid-session questionnaire, assessing their perception of the app. After the twelve days, a post-session questionnaire was provided, assessing their experience with the app and the gamification elements. All questionnaires consisted of a mix of 5-point scale questions with labels for every option (mostly translating to "disagree" to "agree") and with 3 being a neutral choice, yes/no questions and (optional) free-text questions. Additionally, we logged all interactions with the app to receive quantitative data.

Participants

20 participants (10 female) participated (2 school students, 2 apprentices, 9 university students, 7 employees). The age distribution (<21: 3; 21-30: 15, 31-40: 2) is acceptable for a first exploration, as the distribution for mobile gaming is similar [12] and is also consistent with our online study. The participants were not compensated, so trying out a new app that might motivate them was the only reward. The sample classify themselves as having high gaming affinity (Mdn=4, 75%) and they (partially) could imagine solving private/work tasks playfully (Mdn=4, AR=65%/Mdn=3.5, AR=50%). 85% of the participants reported using analog or digital tools for task organization, with 9 using handwritten to do-lists and only 6 using apps. Our sample agrees that a task management app can help them to better organize their tasks (Mdn=4, AR=80%). 50% a-priori thought that game elements could motivate them to have more fun solving tasks, while 70% thought that tasks would be solved more efficiently with them.

Results

We removed tasks that were obviously meaningless (e.g., "TestTestTest"), and considered only participants who completed all questionnaires and who did not deviate more than one standard deviation downwards in two of these measures: number of tasks created, task interactions[3] or general interactions[4]. This led to the exclusion of 2 participants. From their answers to the questionnaires, it remains unclear why they had so little interaction with the app. To get a better impression on the social features, we ensured that participants knew at least one other participant (and added them as friends in the app before the start). After data cleaning, this goal was not reached, as the exclusion led to one user without friends in the app. On average, users had 3.5 friends in our app. 3 users had in total 7 friends, which represented the largest friend count.

App usage during the study

199 tasks were created, with 11 tasks per participant on average (SD=5). We counted on average 11 (SD=5.3) general and 4 (SD=1.1) task interactions with the app per day. Even though these numbers seem low, it needs to be kept in mind that participants were requested to use the app with real tasks they would normally add to such a list. A similar task creation rate was reported in [5]. On average, 16.58 tasks (SD=12.9) were created by all participants every day. Comparing the activity level in the first with the last six days, fewer tasks were created (157 vs. 42), but the average amount of task interactions remained stable (4.12 vs. 3.87), indicating that even though lower amounts of new tasks were added, the interactions with existing tasks remained. Two reviewers inspected the tasks separately and categorized them (differing decisions were discussed to reach an agreement). Significantly more private (71%) than work tasks (19%) were entered as a paired t-test showed ($t(17)=5.9$, $p<.01$); the remaining 10% could not be classified specifically as private or work tasks. The app was also used not only for common "todos" (e.g., "gas up today"), but also for behavior change tasks (e.g., "eating salad 3 times a week"). A quantification of the latter is not possible, as too little information is available; from a title alone it is often not clear whether a behavior change or a one-time task is meant.

"Bottom-Up" Gamification

Participants created significantly more gamified tasks[5] than non-gamified ones, as a paired t-test revealed (142 vs. 57;

[3]Task execution, finishing a task, starting/stopping a timer.
[4]All potential interactions with the app, subsuming task interactions.
[5]Tasks with at least one game element.

Game element	Times used	Main reasons for not have using it or finding it not motivating
Goal: Solving the task once/multiple times (44%)	134 (119/15)	None of my tasks would have fit for the multiple time element (6×)
Goal: Doing the task within/for some time (45%)	33 (16/9/8)	None of my tasks would have fit (7×)
Goal: Setting a custom goal (16%)	3	None of my tasks would have fit (5×); formulation as task not a goal in the task (2×); other elements were sufficient (2×); why should this motivate me? (2×)
Reward: Points (61%)	108	No further usage options (3×); no comparability option to others (3×)
Reward: Badges (66%)	48	No comparability option to others (1×)
Reward: Custom reward (16%)	3	None of my tasks would have fit (5×); no effect in app, thus no need to enter it (4×)
Social: Sharing the task (50%)	21	None of my tasks would have fit (1×); not seen (1×)
Social: Set a reviewer (56%)	9	None of my tasks would have fit (1×); receiving a task is not motivating for me (1×)
Social: Collaboration (39%)	5	None of my tasks would have fit (5×); compared to task, too much effort (2×)
Social: Competition (61%)	2	None of my tasks would have fit (2×); too complex (2×); compared to task, too much effort (2×)

Table 4. Number of game element uses across all tasks, percentage of participants (in parenthesis) who perceived the element as motivating or somewhat motivating, and main statements on why element was not used or perceived as not motivating.

t(17)=4.297, p<.001). We found no significant difference in the number of gamified work (76%) vs. private (68%) tasks (p=.392). The ratio of gamified to non-gamified tasks created in the first and last six days also did not differ significantly (p=.361), so it seems that the app offered enough elements to keep the participants motivated to use them throughout the study. Gamified tasks were equipped with 2.9 game elements on average (SD=2.5), with 70% of the gamified tasks having exactly two game elements (the minimum our app requested), indicating that participants tended to stick with simple elements instead of using complex combinations. Table 4 shows that there were two favorites: "Solving the task once/multiple times" seems easily explainable because of the nature of "todos". As a reward (which needed to be included), points were easy to add. In contrast, badges needed more effort, and the custom reward would not alter the app after unlocking. When counting game elements that were used more than once (29 times an element was used once), a participant used on average 3.83 different game elements (SD=1.9, Min=0, Max=8), with only one participant having used no game elements at all. In general, this indicates that participants tended to use the same elements. The sample also subjectively agreed with this (Mdn=4, AR=78%). They also had to rate how motivating elements were, and could provide free-text remarks (see Table 4). The table shows that element use and perception do not necessarily correspond (e.g. competition) and many elements were not used, as no suitable tasks (i.e. scenarios) were available during the study. This might indicate that people would use different game elements in different scenarios, but in general stick with a core set of elements. Even though the social features were not used often, our sample explicitly agreed to the usefulness of this element in the context of our app (Mdn=5, AR=83%).

Every participant agreed that choosing game elements for themselves was appreciated (Mdn=5, AR=94%). For selecting a reward for themselves, the sample still tended slightly to assess this positively (Mdn=4, AR=56%). A surprising result was that a minority of the sample stated that they could have forgone the game elements completely (Mdn=3, AR=33%). One explanation for this could be seen in the prototype state of the app, but it might also be an indication that even though selecting game elements is perceived positively, the effectiveness of the gamification might be more limited in comparison to a "top-down" approach, which should be investigated as a next step. We also included questions on participants' impressions on the subjective effect game elements had on them. Only 3 participants thought they solved tasks more efficiently with the game elements, 7 thought that they had more fun solving tasks, 7 thought that they were motivated to solve the tasks sooner and 5 reported solving tasks more consciously. Overall, 12 participants (66%) agreed to at least one of these questions, showing that the presence of game elements subjectively had an effect. Further support for **R15** is established, as our sample agreed that they wanted to see how other users gamified their tasks (Mdn=4, AR=78%) and wanted to have the option to directly copy these elements (Mdn=4, AR=78%). In general, this indicates that certain "top-down" elements are appreciated in "bottom-up" scenarios as well (establishing **R18**).

Qualitative feedback on app

72% of the participants stated that they would also test further iterations of our app and that they generally want to use it, after it has left its prototype status. A third of the sample can already imagine using the app as it is, subsequent to this study, in their daily life. Taken together, these are promising results. We also asked the participants to imagine that their feature requests (formulated during the questionnaires) had been realized, and asked them whether they would use the app in their private and their working life. The sample has a tendency to want to use the "bottom-up" app more in the private than in the work context (Mdn=4, AR=89% vs. Mdn=4, AR=56%), which is in line with the created categories of tasks seen above. The sample is consistent in that they want a native smartphone app instead of a mobile single page web app (Mdn=5, AR=83%). Reasons for that were found in the free-text answers, as some participants mentioned wanting offline functionality (establishing **R19**).

We asked for positively perceived aspects (in free-text fields) of the app: 10 times, a gamification aspect was mentioned (easy self-creation of badges, combination options for game elements, offered reward options or individual highlighting of game elements) and 9 times a social aspect (solving tasks together, assigning tasks to others, option to let tasks be re-

viewed). 6 times the graphical and conceptual aspect was highlighted, and 4 participants explicitly stated that the app has good usability. The most often mentioned negative aspect was the missing option to edit game elements (11×). From the comments, we learned that this not only was a usability suggestion, but would also be used to, e.g., adapt rewards for tasks, in case they turned out to be easier or harder (establishing **R20**). Points were another important topic (7×): Reviewing points in other users' profiles was not comparable, due to the "bottom-up" approach. Suggestions to overcome this focus on functionality in which the app automatically derives points. One user proposed the following suggestion: Based on user-assignable difficulty level, points should be derived and could also be individualized by asking a-priori how hard specific task categories are for the user, e.g., doing sports could be generally easy for a certain user and would lead to fewer points. Another aspect reported was that points should be "usable" for something, e.g. buying predefined, virtual goods or everyday rewards. Both aspects suggest that there are elements in which the pure "bottom-up" approach might be "interrupted" (further supporting **R18**). We learned that there are usability issues with the prototype and received individual (but for this paper inconclusive) feature requests, that can explain the relatively low, but still acceptable [4] average SUS [8] score of 72.36 (SD=11.6, Mdn=72.5), and will be implemented for the next iteration. Nonetheless, we also explicitly asked participants whether the adding of tasks or the addition of game elements was cumbersome. The sample overall disagreed to both (Mdn=1, AR=6%/Mdn=2, AR=22%).

Discussion

The study provided different pieces of evidence that the autonomy offered in our "bottom-up" task management application is appreciated by the participants; investigating this with a concrete prototype was the main goal of this study. The various game elements were seen subjectively as motivational to a certain extent by the participants. Interestingly, variance across game elements used was missing (as also seen in the online study) and participants tended towards simple gamification elements, instead of using more complex combinations, which might be affected by the prototype state and/or the short runtime of the study. This may hint that in "bottom-up" scenarios such complexity may not be necessary, but further research into this is required. As this study was meant to assess the perception of "bottom-up" gamification, we focused on an application which solely consisted of "bottom-up" elements, but the suggestions for how to handle points, the criticism that rewards are not comparable (even though they would be in a competition) as well as the nearly consistent answer that participants wanted to see how other people have used game elements for tasks and want to be able to utilize them directly, showed that certain "top-down" elements in "bottom-up" apps might be relevant. There is also the chance that some users actually want to make use of gamification without bothering with customizations (even though our studies suggest otherwise for the majority of participants), so these approaches should not be seen as mutually exclusive.

Two-thirds of the participants reported that they had more fun completing the task, or finished it earlier, more consciously, or more efficiently through the game elements (or a mix of these aspects). This was not explicitly measured quantitatively and might also be explained by framing [30]/novelty effects, but it might also indicate that our approach fulfills the goals of using gamification (at least short-term) to make activities more fun and more motivating [10]. Nonetheless, it currently remains unclear how a "bottom-up" approach performs in comparison to a "top-down" approach. Even though this was not yet the focus of our studies, this can be seen as a major limitation and doing such a comparison is an important next step. With the foundations laid in this study, i.e., confirming that such an approach (in which users need to invest more thought and effort) and the app itself is accepted by users, this now becomes possible. Further limitations can be seen in that we found some usability issues and features that participants missed, and that our sample did not necessarily consist of task management application users; thus, it is questionable whether the "bottom-up" approach would have been perceived differently, in another "host app". Both aspects limit the expressiveness of the study to a certain extent, but in this sense, the participation perception is more likely underestimated than overestimated. Finally, we only considered digital gamification solutions and restricted ourselves to a set of well-known game elements for this first exploration. In the future, extending this to more game elements (even analog ones) might also be an interesting research direction.

CONCLUSION AND FUTURE WORK

In this paper we investigated "bottom-up" gamification, i.e. whether users want to decide when, where and how to gamify aspects of their life. To this end, we conducted an online study, interviewed employees in their work context and did a user study with a "bottom-up" task management application. Our studies suggest that "bottom-up" gamification is indeed perceived as valuable (even though more thought and effort needs to be invested by users), as people have higher autonomy compared to "top-down" gamification often used today. When users decide what they want themselves and are able to adjust this in an application, such an approach might also be a reasonable solution to account for various individual differences, as discussed in this paper. What our work currently lacks is a direct comparison to a "top-down" approach to quantify the effectiveness of "bottom-up" gamification. This is the most important next step for future work, and this paper has prepared for such a comparison as it demonstrates that "bottom-up" is indeed an option for users. Comparing these two approaches is especially interesting, as work such as [39] indicates that there are also wrong "top-down" gamification uses, posing the question of whether users also might decide wrongly for themselves. Such a comparison should also be done over several weeks, to learn whether these approaches are also perceived differently in the long term. Additionally, we focused only on well-known and commonly used gamification elements; in the future, extending this analysis to more gamification techniques also appears to be worthwhile.

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