Skill Atoms as Design Lenses for User-Centered Gameful Design

Sebastian Deterding

Hans Bredow Institute for Media Research

Warburgstr. 8-10

D-20354 Hamburg, Germany

s.deterding@hans-bredow-institut.de

Abstract
This paper describes the use of skill atoms as a design lens for gameful design that focuses the optimal structuring of challenges inherent in a user's goal pursuit.

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Gameful design; skill atoms; gamification

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H.5.m [Information Interfaces and Presentation (e.g., HCI)]: Miscellaneous; H.5.2 [User Interfaces]: Evaluation/Methodology, User-Centered Design; K.8.0 [Personal Computing]: Games

Introduction
There has been little systematic work on the actual design process of "gamified" or gameful systems [7]. In addition, existing industry gamification applications and design methods have received criticism on at least four accounts:

- **Not systemic**: They merely add game design elements, whereas game design approaches games as *systems* where experiences emerge from the dynamic interaction of users with all system components [6,11].
- **Reward-oriented**: They focus on motivating through rewards instead of the intrinsic motivations characteristic for games, like competence [6,14].
- **Not user-centric**: They emphasize the goals of the system owner, often neglecting or even being detrimental to the users' goals [1,6,14].
- **Pattern-bound**: They limit themselves to a small set of feedback interface design patterns (points, badges, leader boards), rather than affording the *structural* qualities of games that give rise to gameful experiences [6,14,17].

The question thus becomes how to devise a method for gameful design that is (1) systemic, (2) appealing to game-characteristic motivations, (3) transcending the application of existing patterns and (4) user-centric. We suggest that using skill atoms as a design lens to structure a system around challenges inherent in the users' goal pursuits fulfills just these criteria.
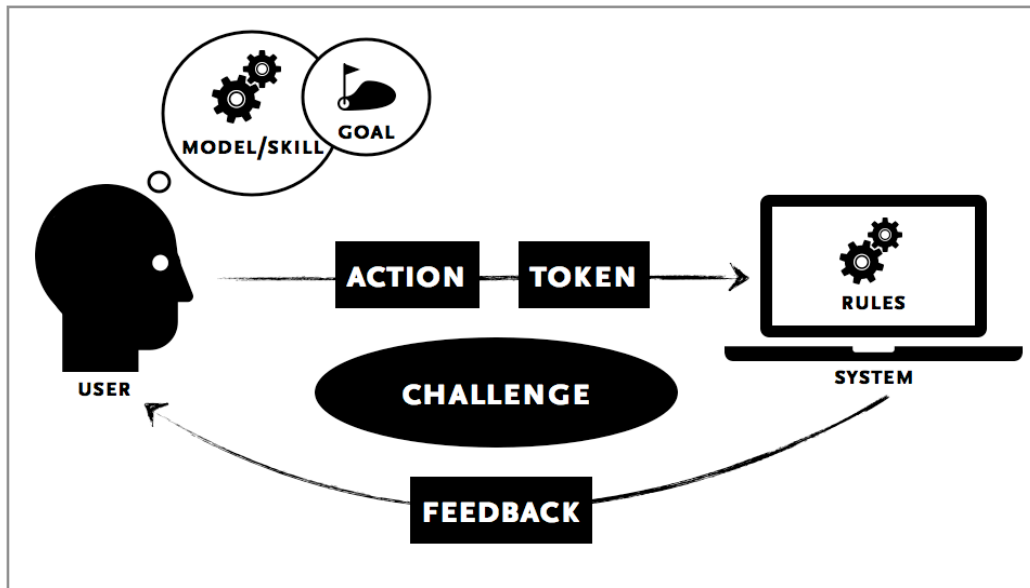
Figure 1. A skill atom.

Goals: Goals articulate a certain game state the player wishes to achieve.

Actions: What a player can perform to approach her goals.

Tokens: Entities a player can act upon; their configuration embodies the game state.

Rules: Algorithms determining the effects of the player's actions on the game state.

Feedback: Information by which the game informs the player of its current state in response to her actions.

Challenge: The central skill that has to be mastered.

Model/skill: The player's understanding of the game and capacity to achieve her game goals.

Box 1. Components of a skill atom

Skill atoms

The concept of skill atoms [5] stems from an ongoing effort in game design to formalize the central building blocks of games into a practically useful 'grammar' or 'Unified Modeling Language' [2-5,9,11-13,15]. Authors variously suggest that games are nested, interlinked systems of systems, with "skill atoms", "game atoms", or "ludemes" being the smallest self-contained system, which itself consists of recurring elements, yet cannot be broken into these without losing its 'gaminess'. These 'atomic' units thus fulfill the first criterion of systemicness. Cook's "skill atoms" [5] stand out as the most holistic yet parsimonious model that is also explicitly linked to challenge and competence.

A skill atom describes a feedback loop between player and game that is organized around a central challenge or skill that the player is trying to master [5]: A player takes an action, which forms an input into the game's rule system, whose results gets put out as feedback to the player, which the player integrates into her understanding of the game. Through interacting with the game – multiple 'run-throughs' of the skill atom loop – a player masters the central skill of the atom: understanding its rules and working strategies to affect

it, training the required hand-eye coordination, etc. [5] Because Cook's model describes *phases,* not *components*, we slightly amended his model, inspired by Dignan's *Game Frame* [8]. A skill atom thus consists of goals, actions, tokens, feedback, a rule system, challenge, and the user's model/skill (see box/figure 1).

Challenge

The skill atom model explicitly grounds in the assumption that humans are intrinsically motivated to learn, and that the mastery of skills for either intrinsic reasons of curiosity and experiencing competence, or the skill's utility for some other context, is what drives game play [5]. The flipside of this is "burnout": Once a skill atom has been fully mastered, engaging in it generates no intrinsic interest in the player anymore. To sustain interest, a game therefore has to vary and increase its challenge, for instance by integrating several atoms into a more complex composite [5]. This notion of challenge, curiosity, and competence as central to game play motivation is congruent with current psychological research [16] and thus fulfills the second criterion.

User-Centricity

To organize a design around a challenge immediately raises the question: *What* challenge? Like game-based learning, gameful design cannot focus on whatever challenge is most entertaining. It has to align with some outer purpose. Also, because challenges are not engaged with for their own (entertainment value's) sake, throwing challenges in the user's way might actually increase friction and frustration. In game-based learning, one recent promising approach to this issue is "atomic intrinsic integration": A game ought to be "incorporating the learning material ... within the

core mechanics", delivering it "through the parts of the game that are most fun to play." [10]

Now in gameful systems, the purpose is not conveying learning material, but facilitating user activity. And to fulfill the third criterion (user-centricity), this activity has to flow from the user's goals and needs, only *then* asking how it might pay onto the goals of the system owner. By analogy to atomic intrinsic integration in learning, then, to design intrinsically integrated user-centric gameful challenges means to tease out what goals and needs a user pursues, and what challenges are *inherent* in that pursuance, that is: are not due to poor usability or similar, but represent the core skill(s) the user has to master to achieve her goals through the system. These challenges should then be translated into the core skill atoms of the gameful design.

Design Lenses
Design lenses are a concept initially developed for game design [18] that was quickly adopted in user experience design, specifically to transfer game design insights [19]. A design lens articulates a single design principle in a form that is inspiring and guiding design without prescribing known solutions – like a design pattern would. Practically, a design lens combines a concise statement of the design principle with a set of focusing questions that allow the designer to take on the "mental perspective" [19] of the lens. This fulfills our fourth criterion.

Summarizing the above considerations in the form of a design lens, we arrive at the "lens of skill atoms" (box 2). This lens effectively allows viewing any interactive system from a game design perspective – as if it were a game. It firmly focuses the designer's attention on

the user's goals and provides a conceptual model of a systemic whole that serves as the starting point for deeper evaluation and ideation, using further design lenses that focus on either the systemic whole or individual components. E.g., one could use the lenses of "balance," "flow," or "interest curve" to evaluate and evolve the system as a whole, or use lenses like "goals," "meaningful choice" or "visible progress" to evaluate and improve single components like goals, actions, or feedback [18]. All of these do not delimit designers to the mere application of existing design patterns. Rather, they enable designers to view the system and its components 'gamefully', asking the kind of design questions game designers would ask.

Outlook
The above model was tested and iteratively refined in 14 design projects and workshops across various domains and non-game designer audiences (n=104) (see box 3 for an illustration from a recent workshop). It yielded promising results, but also came with several limitations. First, it focuses almost exclusively on affording experiences of competence, although there are more motivations and pleasurable experiences characteristic to games [11,16]. This limitation is not inherent, however: Skill atoms arguably tease out the fundamental game-like structure within a given system or activity that can then be 'tuned' towards any kind of experience [11] by bringing the experience in via design lenses or replacing "challenge" as the organizing principle with that experience. More problematic is that the model focuses exclusively on the gameful *structuring* of a system, ignoring how to afford a playful *framing* of the user's engagement with it [6]. We are currently exploring the use of "play design lenses" and "curiosity atoms" as a solution to this problem.

The task was to ideate a gameful system that would support new employees to quickly get to know and build social ties with their co-workers. Analysis suggested that this was indeed a personal need for new entrants, and that a central **skill** missing in certain user groups was to actively pay attention to their co-workers beyond immediate project needs. This translates into the central **challenge** of the design to notice things that had recently changed about one's co-workers, prompting two user **actions**: Putting in your own recent changes (e.g. "Got a new hair cut two days ago"), and answering every morning a change question with a multiple choice set of co-worker names and avatars (e.g. "Who got a hair cut two days ago?"). Change statements/ questions and avatars thus constitute the **tokens**. As short-term **feedback**, guesser and author of a change both get a notification upon a correct guess; long-term, guessers can see percentage bars next to each co-worker's avatar indicating how well they notice that person, implicitly indicating whom they did not yet know very well. One **goal** was to be the "best noticer", i.e. having the highest percentage of correct guesses in a weekly resetting challenge, according to the **rules**.

Box 3. An illustration of using a skill atom for design ideation.

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