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# Onto-Frogger: The Making Of

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## ABSTRACT

This paper presents the making of a game-like interface to an image collection. Having previously claimed that video games can be relevant to collections as interfaces to support exploration, we proceeded with developing a prototype game as a case study for an image database. The making of this game and, specifically, of the game's interface has been an iterative process the stages and challenges of which we discuss here. In our approach, we deliberately adopt a HCI standpoint but our practice has been heavily influenced by concepts particular to games. The resulting artifact is intriguing both as a product in the context of our database and as a research tool to explore the potentials of game-like interfaces to collections.

## Author Keywords

gaming interface, arcade games, image repositories

## ACM Classification Keywords

H.5.2 [User Interfaces]: Graphical user interfaces (GUI).

## INTRODUCTION

What do video games and collections have in common? Our recent research [5] investigates the idea of producing video games based on the underlying structure of existing repositories and as interfaces to those same repositories. We propose video games as a suitable platform for an interaction for exploration and suggest that a game can potentially improve the user's mental model of the data organization, if the later is properly encoded into the game logic. The resulting game is, then, intended as a game-like interface to the collection and an utmost incarnation of playful interaction.

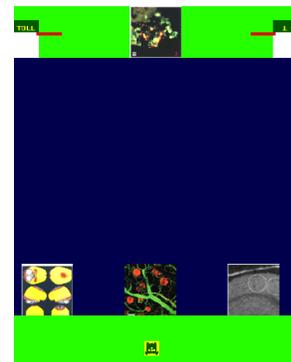
Although we have argued in favor of a game-like interface on theoretical grounds, we realize that our ideas can be

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properly researched only by means of an actual prototype. Therefore, we proceeded with a case study for a scientific imaging database maintained in our research group. The database in question is a multi-modal repository for image data from the life sciences [4]. Entries in the database are thoroughly annotated by their owners with part of the annotation being expressed in ontology terms from various life science ontologies. These annotations allow us to establish connections across images and derive an emergent graph representation of the collection to be further used as the base for game logic.

The path from a database to a game concept to a product was not without its challenges. This paper will focus on the development of the actual interface given a defined game concept. For the rationale behind this concept, the reader is referred to [5]. It is worth mentioning, though, that our game concept was produced by deliberately appropriating an existing game. Specifically, we attempt an analogy with the classic arcade Frogger (Konami Industry Co. Ltd, 1981) [1] which we modify to meet the characteristics of our dataset. The resulting game concept, Onto-Frogger, is a somehow more elaborate game that focuses on the user annotations with ontology terms and on the connections implied by these annotations. In a nutshell, the rules of the game (Figure 1) are as follows: The player needs to reach the opposite bank of a river, by jumping on floating image tiles using the target image as a guide. The target image is



**Figure 1. Onto-Frogger, active area upon game start. The frog needs to cross the river by jumping on floating image tiles using the target image as a guide. The target image is inaccessible behind the toll station as no coins have been collected yet.**

tiles, while collecting sufficient coins for the toll station on the other side. To collect coins, the player needs to land on appropriate image tiles, i.e. image tiles that share annotation terms with the target image. To achieve a high score, the player will need to collect as many coins, i.e. shared annotations, as possible.

### THE MAKING OF

The development of Onto-Frogger's interface was influenced by ideas of fast prototyping and iterative design, with evaluation sessions being incorporated very early in the development process. We particularly focus on the interface of the game as we feel that interface issues are equally important to gaming ones for the acceptance and success of our game. Generally speaking, we endorse the view that usability is a matter of concern to all video games as it can affect the player's experience [7]. Besides that, Onto-Frogger is also meant as an interface to a collection and, as such, it should provide a legible information display for the data communicated. Last but not least, Onto-Frogger is developed with a non-gaming audience in mind and, as such, it should be straightforward enough to allow non-gamers to immediately start playing. To lower the entry threshold for our players, we aim for simplicity in controls and gameplay as well as a self-explanatory game environment. While the first is directly related to the game concept, the later is mainly an interface issue.

A first version of Onto-Frogger's interface (prototype A) was used to examine how understandable the new game is. Two users (1 biologist, 1 computer scientist) were asked to play Onto-Frogger and figure out its rules without prior explanation. The results were discouraging: our players did not realize that a coin rule was enforced and were very frustrated when losing the game due to a lack of coins. Simply put, they were only trying to play Frogger but not Onto-Frogger. During this evaluation, we identified particular interface flaws that may have obscured the

type	prototype A	prototype B
layout	collected annotations and coin annotations appear on the top left part of the screen	collected annotations and coin annotations appear on the right panel of the screen
layout	collected annotations and coin annotations displayed in a term cloud	collected annotations and coin annotations displayed per lane- a HUD display summarizes the total accumulation of coins
graphics	player is a yellow square	player is a green frog
graphics	yellow squares as coins	coin icons- visual distinction between silver and golden coins
narrative	-	toll station added
training	-	tutorial with in-game training

**Table 1. Major changes between prototype A and B.**

significance of coins in the game. We, therefore, believe that our players did not resolve the rule of collecting coins simply because the interface failed to place coins in focus.

In response, we radically re-designed the interface so that collected coins are more prominently placed. A comparison of the in-game screens of the two prototypes can be seen in Figure 2. Moreover, we decided to count less on the



**Figure 2. prototype A (left) vs. prototype B (right): Collected annotations from each selected image tile are now displayed on the right panel and for each lane separately. Coins are designated on each lane and on the score summary.**

analogy with Frogger and treat Onto-Frogger as the new game that it rightfully is. Eventually, we included a complete tutorial with supportive text and storyline. The new prototype (prototype B) was subject to expert evaluations by 5 HCI literate users. This evaluation was focused on the clarity of the in-game interface and tutorial, as also suggested in [6]. Proposed improvements were further incorporated in the current version of the interface. Major differences between the two versions of the interface are summarized in Table 1.

A special note should be made on the look and feel of Onto-Frogger. From early on, we were aware that the resulting product should be perceived and accepted as a 'real' game. To that respect, a proper look and feel of the game and consistency with gaming conventions are essential: the interface should look like a game and play like a game. Respecting industry conventions in controls is a frequent guideline in game design [2, 3] and we further strive for consistency in terms of controls and feedback as well as of visual and sound design. Throughout the development of Onto-Frogger, we were fortunate to conduct expert evaluations with a game developer who reported on gamer expectations (e.g. button response) and commented on the style of the game. Obviously, the look and feel of Onto-Frogger mimics that of Frogger and of arcade games in general: the visual style, game controls and soundtrack of Onto-Frogger were selected accordingly. This intention is apparent in both versions of the interface (cf. color schema and coin sounds) but prototype B significantly improves on the graphics, within the aesthetics of the genre.

**USER EVALUATION**

The two versions of the interface were further evaluated by 4 novice users, new to both the game and database (4 life science students). The players interacted with the web interface of the database, the original Frogger game and prototypes B and A, in the given order. Prototype A was introduced as a game that may or may not have the same rules as prototype B. Both prototypes were assessed by a questionnaire including also open questions to test the players on the rules of the game.

While results are only indicative, we are pleased by the level and quality of the current version of the interface. Overall, Prototype B is better received in terms of legibility and clarity as well as look and feel of the interface (cf. Table 2). In respect to the major aim of the re-design, i.e. to better support the learning of a game by means of interface improvements, we observe that prototype B allowed all players to resolve the game rules accurately. Prototype A, on the other hand, introduced confusion, particularly due to the absence of coin icons (cf. Table 2), but our players did not have as much difficulty as previous testers of prototype A. This observation, however, does not render prototype B redundant since the players highly valued and often commented on the missing features. Instead, it may be an

topic	quotes
interface: graphics	<p>“a frog is better than a square” [P1], “I liked playing with a frog better than with a yellow square” [P3]</p> <p>“This [prototype A] is less easy to understand because there is no coin system, it only shows a few squares and they are all the same color, so it's a bit difficult to tell how many points you got and how you really got them” [P3]</p>
gameplay: challenge	<p>“I understood the first game quicker but at least this [prototype A] is a bit more challenging” [P3], “[prototype B was] faster, better, more fun” [P1], “let the tiles come by faster because it takes a lot of time to see them all, it was better the second day” [P4]</p> <p>“if you are getting good at it, it will be fun to turn up the speed or reduce the amount of time” [P1]</p>
mental model	<p>“you have to understand that the tiles have connections with each other” [P1], “in how annotations are sort of linked” [P4]</p> <p>“you can learn to relate pictures to text and annotations and you can relate back from annotations to pictures to get the search results you want” [P2], “what kind of annotations are required to find certain images” [P3]</p>

**Table 2. Relevant quotes extracted from think-aloud session and questionnaires (player id indicated as P#).**

indication that prototype B allowed players to successfully internalize the game rules, a knowledge they could later use when interacting with a less supportive interface.

Interestingly enough, prototype A seems to score better than prototype B in terms of user satisfaction. Previous observations suggested that a clearer interface and, hence, a more understandable game would increase satisfaction. Yet, our players, although they appreciated prototype B more, visually and in terms of clarity, they found prototype A more challenging and more fun to play. The players themselves justified their preference to an increased speed of the passing tiles in prototype A. Such a feature should be easy to implement in prototype B, but it may indicate a conflict in the aims of our game: a faster pace has been in

times perceived both as a welcome challenge and as a hindrance in studying the available information. Of course, increased satisfaction could simply result from previous exposure to the game: the players, free from the load to understand the game, could now enjoy playing and would even request more challenges. Further ideas to expand gameplay with new rules or new levels are still to be considered. But the exact impact of the interface on perceived challenge is yet to be determined. Would e.g. a more adaptive interface, i.e. one that simplifies its layout as the player becomes familiar with the game, be more appropriate for our purposes?

## DISCUSSION

This paper documents our efforts toward a usable and self-explanatory interface for the game of Onto-Frogger. Given a defined game concept, our design iterations and evaluations have been predominantly focused on the interface elements of the game. Having secured a proper interface should allow us to further examine the less straightforward aspects of our product such as its playability or its relevance as a collection interface. This step-by-step approach is certainly not foolproof but, in lack of standardized methodology, is an attempt to better coordinate our research. The assessment of a game-like interface is a multifaceted problem and it will require combined evaluation methods that better address usability, playability and fun as well as the added value of the provided experience. The later is of particular significance: After all, Onto-Frogger is a case study to tackle the potentials of video games as interfaces for collections and, as such, it should be evaluated on the effect of its use.

Some anecdotal evidence, however, seems to support our ideas on the contribution of the game as an 'unconventional' interface to the image collection, especially on its impact on the user's mental model. Overall, all of our student players reflected on the collection as a connected structure and discussed the game rules in terms of establishing links between images (cf. Table 2). But the most promising potential of Onto-Frogger lies in the confrontation with the image annotation process. By interacting with the game, the players eventually reflect on the varying quality of the annotations and the different annotation strategies. Consider e.g. the following remark: One of our expert players argued that the game is inherently unfair as different images have different numbers of terms assigned to them and, hence, permit different score maxima. The observation was repeated by one of our student players, who noted that "the point system isn't completely fair" and that "sometimes only one golden coin could be collected which was needed to win" [which was more difficult to achieve]. The player

proposed strategies to normalize the score but we are actually reluctant to correct this inherent unfairness. Another expert player complained that an obviously right image choice was not rewarded as such because the image has been annotated differently by its owner. These discussions are highly desirable in the context of our database and were entirely triggered by the game: Converting an aspect of the system into something relevant for the player, e.g. score, allowed the player to react on an important aspect of the system, i.e. annotations. Such exposure to the database's principles can facilitate our users in their regular database tasks, especially in data entry and annotation. To date, we are still to examine the (long-term) usage of the game by users that are actively involved with the database. But, all in all, we believe that Onto-Frogger can function at least as a good introduction to our database.

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