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The Tactics of Everyday Practice: A Semiotic Approach to Appropriation

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Abstract. This paper presents a semiotic approach to the phenomenon of appropriation, focusing on the tension between technology design and the users' practice. On the one hand, we focus on how the technology itself, through its design, guides its users. On the other hand, we investigate how users appropriate technology, developing specific practices to meet their own needs, resisting the guidance offered through the design. We present two case studies in educational technology: children's appropriation of an educational game, and teacher's appropriation of a learning management system to fit their specific communication needs. Based on the case study results, we describe how the semiotic approach leads to a better understanding of how the structure of technology mediates users' appropriation practices.

Keywords: Appropriation; Semiotics; Multimodality.

1 Introduction

The fact that users do not always use technology as intended by designers has been observed and discussed in Human-Computer Interaction (HCI) since the 1980s. The 'adoption process that changes the ways in which technology is used' [44] has been analyzed from a variety of angles, including cognitive science [44], design [18,21], Information Systems research [9], and Science and Technology Studies (STS) [1]. Even though the theoretical perspectives above offer a wide variety of insights into e.g. social structures and relevant cognitive processes, individual users' appropriation is often described in HCI as either fascinating – people are more creative than designers expect – or a failure – the designer has failed to account for people's real-life practices [43]. Such descriptions, however, are not often studied in more detail, trying to account for the mechanisms that underpin appropriation. This need for deeper understanding has been reflected recently in various workshops on understanding appropriation in different forms [29, 37 ,45]. We contribute to this existing research on appropriation by proposing an alternative approach, focusing on the tension between technology design and the users' practice. On the one hand, we focus on how technology, through its design, guides its users. On the other hand, we investigate how users appropriate technology, developing specific practices to meet their needs, resisting the guidance offered through the design of the technology.

Prior research on appropriation in HCI has focused primarily on individual appropriation, describing, e.g., or how individual users' characteristics influence appropriation (e.g., [44]). However, more recent HCI research as expanded the scope of appropriation research, relating appropriation to other specific HCI domains such as captology [36] or sustainable HCI [24], and including social processes [8, 37]. This social view on appropriation, however, has received more attention in STS [23].

Apart from a focus on user characteristics and social processes, approaches that acknowledge the importance of technology design have also been developed. For instance, DeSanctis and Poole have developed Adaptive Structuration Theory (AST) [15], focusing on the relation between structural features of decision support systems, and users' practices in their social work context. Although AST includes an analysis of structural technology features, it focuses primarily on analyzing social practices: later applications of AST have not widely used its technological analysis [40].

Bansler and Havn's [4] method to investigate how users adapt technology to organizational contexts includes an analysis of the technology, based on affordances. However, they do not explicate their procedure for analyzing the technology. More design-oriented approaches [18,21] have identified general aspects of and guidelines for appropriation, including technological characteristics necessary to allow for appropriation. While this work acknowledges the central place of design, it does not offer guidance on how to analyze technology as it is appropriated, or offer a detailed method for analyzing the relation between technology design and appropriation.

In this article, we focus on this relation between technology design and appropriation. Specifically, we consider the technology to be a part of a communication process: interactive technology "mediate[s] between designers' intentions and [users'] interpretations" [11]. In this communication process, we focus on the communication from the interactive device to the user. We present a method to analyze this relationship, in order to tease out specific ways in which users reconfigure technology, and deal with both technological (structural) and social (e.g., negotiating appropriations with other users) constraints. How does the design of technology constrain its use, and how do users reinterpret technologies, seizing appropriation opportunities? We focus on understanding how users seize appropriation opportunities without changing the technology structurally. In other words, we are interested in what Eglash has called [23] 'reinterpretation' and 'adaptation': the users' changes in meaning and use.

We present two case studies in educational technology: children's appropriation of an educational game, and teacher's appropriation of a virtual learning environment to fit their communication needs. Using an interpretive, semiotic approach, we analyze the technology, and how the interaction with it is structured. Combining this semiotic analysis with user research, we identify the elements in technology design that play a role in appropriation, and clarify the mechanisms that underpin appropriation. This better understanding of appropriation benefits designers, who, according to Carroll [9], face a double challenge. Designers need to design flexible technology that can be shaped to fit users' practices on the one hand ('design *for* appropriation'); on the other hand, they need to link users' needs to specific appropriations in order to design new, or improve existing designs ('design *from* appropriation') [9]. The method we present primarily offers insights into how appropriation works as a relation between

technology design and user behaviour. As such, it offers insights to design *from appropriation*.

2 Background

2.1 Design Strategies and User Tactics

We frame the relationship between technology design and appropriation practices as as a relation between *design strategies* and *user tactics* – a distinction based on the work of Michel De Certeau. In his book *The Practice of Everyday Life* [12], De Certeau analyzes cultural production and creative consumption in modern society using a conceptual distinction between *strategies* and *tactics*. *Strategies* are the structures that have been put in place by cultural 'producers' in power; *tactics* are the ways in which consumers read their own meanings into these existing structures, and appropriate the structures imposed on them according to their own needs. This distinction has already been applied to interaction design by Dourish [20]: "strategic practices are the practices of design, whereas tactical practices are the practices of use" ([20]: 302). In other words, design strategies can express a specific notion of how a product should be used. The design of a chair, for instance, can communicate a specific notion of what it is to sit. In reaction, users can develop user tactics to reinterpret that chair: "when someone […] tries to sit on it in a (very) different way" ([42]: 314). In this article, we focus on the tension between these competing forces: while design strategies limit opportunities for appropriation, users can develop tactics to use the available resources creatively [25].

De Certeau's distinction between strategies and tactics offers a specific lens to look at both the structure of technology, and appropriations. The distinction between two competing forces evades both technological determinism (users as passive consumers) and social determinism (minimizing the role of design choices). Moreover, De Certeau's concepts draw attention to the fact that appropriation is not limited to 'strong' cases [23] that radically change the meaning of the technology. As appropriation consists of less visible practices [12] and workarounds, it often remains unnoticed. Attention to small appropriations can uncover an underlying appropriation logic [25] that helps researchers understand user behaviour, and has implications for design [9].

To operationalize the distinction between strategies and tactics, we need a method for more detailed analysis. We find a useful approach in semiotics, the study of signs. The multimodal semiotic approach used in this article ontologically fits well with De Certeau's concepts: both approaches see consumers as active interpreters, focusing selectively on specific uses. Moreover, social semiotics focuses especially on the physical/technical nature of artefacts in relation to socially contextualized use [47].

2.2 Semiotics

Semiotics, a theory originating in linguistics and formal logic, is often defined as the study of signs, concentrating on meaning-making and representation in texts and other media [10]. Semiotics and other language-related theories have been used to understand and inform the design and use of technology: we focus on how a semiotic approach to appropriation fits with semiotic HCI research, and STS research on appropriation.

In HCI, semiotic frameworks have been developed to analyze, guide, and evaluate design. Andersen developed an early semiotic framework, showing how signs mediate human-computer interaction [2]. De Souza developed the semiotic engineering theory [17], framing signs in the user interface as 'metacommunication': designers should embed all communication in the interface signs, which have to be interpreted by users in order to understand the application. Besides semiotics, researchers have explored the usefulness of several linguistic concepts to guide interaction design, including metaphors [7] and blends [30]. In this literature, semiotics and linguistics are used to analyze human-computer interaction mostly from a designer perspective. The overall goal of these frameworks and theories is to guide designers in communicating their intentions clearly, and to evaluate communicative clarity. This guidance and evaluation always takes into account the fact that meanings can never be completely fixed, and that there is always room for creative interpretation (e.g., [17, 30]).

While this interpretive flexibility is acknowledged in HCI research, the social consequences of this flexibility are analyzed in more detail in STS (see, e.g. [1,49]). Oudshoorn and Pinch [41] have called the STS approach that stresses meaning-making in technology use the 'semiotic approach', based on the metaphor that like in texts, the meaning of technology is not completely fixed, but needs to be interpreted. Woolgar, for instance, argued that designers narrow down this interpretive flexibility by 'configuring the user' [49]: by structuring technology in a particular way, designers imply a specific way of interacting. Appropriation research in STS, however, has focused primarily on social processes, not on the design of technology as such.

In sum, our semiotic approach emphasizes the role technology design in appropriation, without adopting the HCI focus on the clarity of the designer's communication. Instead, we attach more importance to the interpretive agency of users, extending the view to broader aspects of meaning-making. We link technology design to specific appropriations and the users' rationale for developing these appropriations, in order to gain insight into the mechanisms that underpin appropriation. This lens will allow us to expose the consequences of design choices in situated contexts of use.

2.3 Multimodality

Multimodality is a relatively new social semiotic approach which is often used to research communication through digital technology (e.g., [19,32,33]). It builds on social semiotics, an approach originating in linguistics, and developed further into an

approach to analyze "semiotic systems in social practice" ([28]: 1). These semiotic systems consist of 'semiotic resources' people use to make meaning: these are "the actions, materials and artifacts we use for communicative purposes […], together with the ways in which these resources can be organized." ([47]: 285). This definition combines two important aspects we will elaborate on below: first, the actions, materials, and artifacts themselves, and second, the way they are used and organized by people.

In multimodality, actions, materials and artifacts are said to communicate through 'modes' that contribute to the meaning of a message. Modes can be seen as "channels" of communication (text, image, sound) that collaborate in communicating messages [32]. As modern technology is inherently multimodal, it is important to include these various modes of communication into the analysis. Each mode contributes specific information to the message: multimodality integrates this modal communication in one holistic study. Furthermore, multimodality distinguishes between three communicative functions, called 'metafunctions' (e.g. [38]), each analyzing different aspects of communication such as content, structure and the social relations between stakeholders that are implied in a technological artefact. Analyzing how messages fulfill these communicative functions across modes can lead to detailed insights in how technology uses design strategies to imply or impose specific interactions on its users. Using design strategies, the system creates its ideal 'model user' (based on Eco's model reader [22]) that complies with the interaction implied in the system.

Apart from the actions, materials and artifacts themselves, the way people use and organize them is important in multimodality: this is captured in the concept of *meaning potential*. Meaning potential is a concept similar to affordances, but with an emphasis on interpretation and meaning-making, instead of perception. In literature on appropriation and creative re-use of technology, it has been argued that Gibson's original concept of affordances does not really account for polysemy [5]: the fact that an artefact can mean different things to different people. In contrast, meaning potential focuses on these differences in (social) meaning. The meaning potential of a technology is the interpretative potential of all possible uses of that technology: how it has been, is, and can be used in the past, present and future (Figure 1).

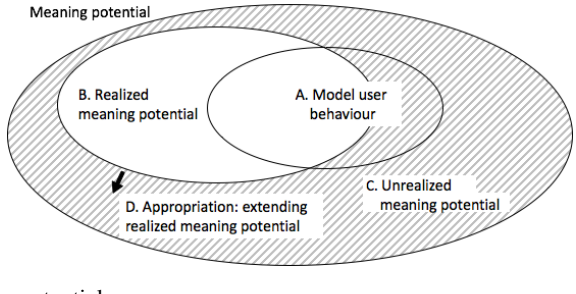

Fig. 1. Meaning potential.

Within this potential, multimodality focuses on common meanings and uses that have already been introduced into society (B in Figure 1): for example, using

turntables to play music. The 'model user' behaviour [22] embedded in the technology through design strategies (A in Figure 1) is typically realized in part by actual users: as such, it overlaps with B, the realized meaning potential – other aspects of the model user behaviour might still remain unrealized (hence the overlap with C, the unrealized meaning potential). While the inscribed model user and social rules typically regulate meanings within the realized meaning potential (B), user tactics and appropriations do occur, and can be seen as an extension of the meaning potential in new directions (arrow D in Figure 1, reaching out into C: the unrealized meaning potential). For instance, using turntables for the innovation of 'scratching' [27],'invented' in the 1980s, was once a new appropriation (arrow D), extending the known uses (B) of turntables to produce unknown, new rhythmic sounds (C). Eventually, however, scratching moved on to become a common part of the rhythmic vocabulary of hiphop and rap music (B).

In our view, design strategies are the way in which the 'model user' (A) is inscribed in an application, as a part of its meaning potential. User tactics, on the other hand, are analyzed as the users' realization of the meaning potential in specific contexts. As such, we can analyze appropriations and user tactics as the realization of meaning potential that extends (arrow D) the already realized meanings, or model user behaviour.

3 Method

This section describes the method we developed to investigate users' technology appropriations. The method consists of two analytic phases (Figure 2): in phase 1, we rely on the multimodal concepts of modes and metafunctions in an analysis of design strategies, while we rely on ethnographic methods and the multimodal concept of meaning potential to analyze user tactics in phase 2. We offer a description of the goal of each phase, and briefly explain how they were implemented in the case studies.

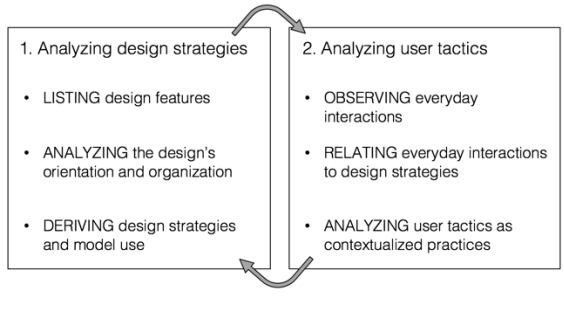

Fig. 2. Analytic phases.

3.1 Analyzing Design Strategies

The first phase analyzes the design strategies embedded in the application, based on a multimodal approach. The multimodal analysis offers insight into the structure of

the technology, and how this structure suggests and imposes specific interactions on the users. In this phase, we do not aim for a prediction about how technology will be interpreted, but we are interested in analyzing how the constitutive elements of the technology interrelate, and form meaning together. We focus on the analysis of communicative modes, and how these modes fulfill the three basic functions of communication ("metafunctions", based on Lemke [38]) as identified in multimodality. These metafunctions (we provide more details below) play a central role in the analytic process of phase one. As this phase consists of a structured semiotic analysis, we explicitly offer guiding questions that structure the research in this phase.

A. Listing Design Features. First, design features are listed in detail. This comes down to describing the 'presentational metafunction'. This description details what is presented in the application, and what activities users can engage in. As such, both functional (actions that can be performed) and non-functional (visual, aesthetic) aspects of the design are described. Listing design features provides a basic description that can be used for further, more thorough analysis. Relevant questions for analysis are: *What does the technology consist of?Which features does it have? Which features stand out? Which modes are used to communicate these features? What are their functions?*

To adequately analyze how the technology communicates, it is important to differentiate between different modes, detailing which design features are communicated in one mode (visual, textual, etc.), which features are communicated across several modes, etc. This analysis will make clear which features are highlighted as the most salient, and which features have been given less attention.

B. Interpreting Orientation and Organization. Based on the design features listed above, the design's orientational and organizational metafunctions are analyzed. The orientational analysis shows how the technology is designed to intervene and change a specific situation, while the organizational analysis shows how the technology is structured as a coherent whole.

The *orientational metafunction* focuses on the relationship between the stakeholders involved in the use of the technology, and the role the technology plays to mediate this relationship. For instance, technology can impose various user roles with specific characteristics (power relations, influence, etc.), and can evaluate situations and actions in specific ways (good or bad, optional or obligatory, etc.). These aspects are analyzed as part of the orientational metafunction. Relevant questions for analysis are: *Which envisioned 'users' or other actors are involved in the use of the technology, directly and indirectly? Which stakeholders are not represented, or only implicitly? What are the relationships among these actors, and how does the artifact mediate them?*

The *organizational metafunction* specifies how the technology as a whole is constructed as an artefact: how individual parts of a message create a meaningful, coherent unity. The organizational metafunction is what ties different parts and modes together, integrating different features and aspects into a coherent whole. The aim is to analyze how different modes work together in order to communicate a coherent

message: do they confirm and reinforce each other, or contradict each other. Relevant questions for analysis are: *How are the various features and attributes brought together into one artefact? How does the technology constitute a meaningful whole (application, tool, etc.)? How are specific messages confirmed and reinforced (highlighted) across modes? Does the analysis lead to contradictory interpretations across modes?*

C. Deriving Design Strategies and Model Use. The different aspects of the metafunctional analysis described above are then combined in an analysis of how the technology presents itself as a coherent application. The analysis of the application's orientation (e.g., envisioned relationships between stakeholders) and organization (the coherence of the application) determines which view on the application domain and/or user activity is (implicitly) expressed in the technology. In other words, the analysis clarifies how the application's orientation and organization suggests or imposes an ideal 'model user' [22] behaviour. This model user, in its turn, is a core part of the application's meaning potential (see 2.3). Relevant questions that are answered in this analysis are: *Which view on the application domain / user is expressed in the application? Does this view impact how the application guides its users? How?*

Level of Granularity. Multimodal analyses can differ widely in terms of granularity, depending on the research question. A brief example can illustrate this. In a thorough multimodal analysis of how a website communicates, web pages can be analyzed starting from the detailed level of individual icons and icon 'clusters' (see, e.g., [3]). This allows for a fine-grained analysis of which design elements (icons, colour scheme, etc.) contribute to how the website addresses its audience. On a more general level, web sites can also be analyzed in terms of larger content zones (see, e.g. [19]). Higher-level analyses offer insight into how communication is structured on a more general level (visual design, content, navigation, etc.), and what this implies for users. For appropriation research, we recommend starting at the general level to get insight in the overall design strategies. When the overall picture is clear, more detailed analyses can be added iteratively, based on the design strategies, or on observations of user tactics.

3.2 Analyzing User Tactics

In the second phase, the meaning potential realized in everyday interactions and appropriations are studied through ethnographic methods (observations, interviews, or diary studies), and related to the design strategies analyzed in phase 1. After having analyzed how the technology communicates, phase 2 concentrates on the users' actual meaning-making and interpretation of the technology. To investigate users' meaning-making, we combine ethnographic methods with the multimodal notion of meaning potential, clarifying how user tactics relate to the design strategies analyzed in phase 1.

A. Observing Everyday Interactions. We study real users' interactions with, and appropriations of the application, investigating how users interpret the technology from their specific point of view (personal background, context, etc.). While various specific user research methods can be appropriate depending on the specific situation, we used combinations of two-week diary studies and in-depth, semi-structured interviews in the two case studies described below. The diary studies gathered information about concrete use situations (length of use, nature of the activities, subjective judgments,…). The interviews built on this information to discuss the users' behaviour in depth.

B. Relating Everyday Interactions to Design Strategies. Everyday interactions can be seen as the users' (tactical) reactions to the design strategies. Analyzing user tactics in relation to the design strategies results in a detailed overview of situations in which the meaning potential realized by users coincides with, or deviates from the model user behaviour. Where users resist or extend this model use, rich user data (gathered in A) provide details on how and why users developed these tactics. This results in a detailed understanding of the user's interpretations and shifts in meaning potential. Where the user tactics deal with design strategies that were still underexplored in the multimodal analysis, this analysis can be extended iteratively to provide more detail.

Furthermore, the analysis of user tactics in relation to design strategies allows for an analysis of the structural logic [25] underlying individual appropriations. Such an underlying logic emerges, for instance, when patterns emerge that combine a specific type of tactic with specific contextual factors, across users. This analysis shows whether the observed practices are idiosyncratic, or whether the appropriation tactics can be generalized to other, similar practices. The aim here is to move beyond the activities or intentions of the individual user [25] to uncover patterns, in order to formulate design implications based on the underlying appropriation logic.

C. Analyzing User Tactics as Contextualized Practices. Unless their use is highly personal, users need to communicate (implicitly or explicitly) about their user tactics in order to make their practices meaningful for other users or stakeholders. Focusing on the context in which the user tactics are developed, we analyze how users use 'social tactics' to negotiate, or communicate their shifts in meaning potential to other users or stakeholders. This analysis of how appropriations are presented to other stakeholders offers valuable information on how they interpret their own behaviour (e.g., as self-evident, as workarounds, or as tricks), and how they present it to other stakeholders.

3 The Case Studies

In the next paragraphs, we will explore two case studies of the appropriation of educational technology, in order to illustrate the semiotic approach presented above.

As an illustration, the case studies are presented rather briefly here. More details on the study procedures and the full, in-depth analyses can be found elsewhere [13,14]. In this article, the analyses are limited to a selection of important aspects. We chose these two case studies to allow for a comparison between a rather rigid application, in which players are guided rather strictly through design strategies (case study 1), and an application that offers less guidance to its users (case study 2).

3.1 Case Study 1: Monkey Tales, an Educational Math Game

The Study. Monkey Tales is a commercially available educational math game for children in primary school, combining elaborate gaming elements with educational content to stimulate children to practice math. The game is available in different difficulty levels, targeted at different age groups. We studied how a small sample of eight children in the 5th and 6th grades of primary school (age 10-11, recruited via Flemish primary schools) played and appropriated the game in their home contexts during 6 months. As the method above specifies, the study involved an analysis of the game's design strategies, as well as an investigation of the children's everyday practices. These were researched through a combination of a diary study, parent and children interviews, and MemoLine [48], a long-term UX evaluation method offering insight into how the children's playing behavior evolved over a longer period of time.

Phase 1: Analyzing Design Strategies. Monkey Tales tells a story about how the player goes on a mission to defeat a central opponent that has evil plans to steal all knowledge from the world: the game is framed around this central story. This story is divided into separate, recognizable game parts (see Figure 3). The main story of the player's adversary is told in the form of cut-scenes of actors explaining the game's goals, without interactivity. Framed by this story, players move through the game levels, which are separate rooms in a 3D world. In these rooms, they deal with various obstacles and adversaries, always including a monkey with an arcade game machine. The monkey can be freed by winning this arcade game. Here, the educational aspect of the game is located: players leave the 3D world, and play the arcade games, which offer a combination of game elements (shooting, avoiding obstacles) and math exercises.

The most prominent design strategy in Monkey Tales is the *organizational* distinction between the game narrative and the math content embedded in the game. The analysis of design features showed that various modes (narrative, visual design and interactivity) all communicate this central game structure described above (Figure 3: see also [13]). The story layer, explaining the quest, and the 3D world layer with obstacles and adversaries are game and narrative-oriented. The math component is embedded in the arcade games. Following this structure, Monkey Tales is a 'game of progression': "the player has to perform a predefined set of actions in order to complete the game" [34]: freedom to make choices and to explore is limited. The rigid structure in the game forces players to follow the level sequence, and win the math games to make progress. These design strategies seem to leave few

opportunities to broaden the game's meaning potential: structurally, there is relatively little room for appropriation.

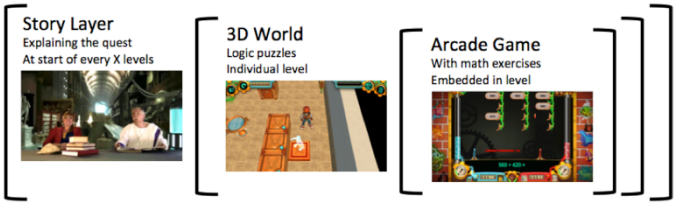

Fig. 3. Monkey Tales game layers.

Orientationally, the game is centered around the interaction between the player and the in-game adversaries: the 3D world adversaries are the central opponent's accomplices, and the arcade games with the math content are played against the monkeys. As such, the game focuses entirely on the interaction between player and the creatures in the game world. Stakeholders, such as parents, classmates, or brothers and sisters that might also be interested in the game have no role in the game: a multiplayer option is not available. Based on these characteristics, the design strategies imply a single player that is attracted by the gaming aspects, but is required to complete compulsory math exercises to make progress in the rigid game structure.

Phase 2: Analyzing User Tactics. After investigating the design strategies used in Monkey Tales, we researched players' daily practices. This research showed that while players structurally had little room to appropriate the game, they did find ways to focus on the 3D world levels, which was the content they were most interested in. As such, players constructed their own 'reading paths' [35]: through their playing choices, they succeeded in 'reading' the game in a specific way, manupulating the organizational distinction between the game narrative and the math content. The story layer, with no interactivity or gaming elements, was easily skipped: it provided a story line, but no crucial information to understand the game. Immediately after the fragments started, players skipped to the next interactive game level. The arcade game layer, however, could not be skipped, as winning these games is a condition to move to the next level. However, five out of eight respondents reported tactics to minimize the math effort. Three general tactics were found, ranging from small adjustments in playing order to overturning the game's design strategies. While these tactics seem quite diverse at first sight, they serve a similar purpose: avoiding putting effort into the math exercises.

1. Finding the optimal playing order. The game lets players choose whether to start each level by completing the 3D world mission, or by playing the math arcade game. However, when players first play the arcade game and then get killed in the 3D world, they have to replay the entire level, including the math game. To avoid unnecessary math games, respondents altered their playing strategy, finding the most efficient way. For instance, R2 stated in the interview that *"it seemed better to find the*

bananas first, because in the end, I sometimes had won the monkey game for nothing".

2. Guessing and estimating. The parents of two respondents reported extensive guessing and estimating behavior. As some of the mini games involved multiple choice questions, respondents tended to choose the most probable answer, without actually calculating the result. As such, players avoided investing energy in the math exercises.

3. Focusing on game play. An extreme example of the behaviour was reported by respondent 8, who developed strategies to focus on the gameplay rather than the math exercises in the mini games: instead of shooting the right answers to math problems, this respondent ended up shooting randomly, assuming that the right answers shot 'by accident' would be enough to pass the mini-game: *"With the cannon, I always win: I just keep the space bar pressed, and I move from right to left, and it's over."*

Taken together, skipping the game narrative and avoiding the arcade games allowed players to focus as much as possible on the 3D world layer in the game. Despite the rigid structure, the players found ways to trace their own reading path, highlighting one aspect of the game at the cost of others. These user tactics shifted the game's meaning potential, limiting it to the game aspect, and diminishing the educational value.

Apart from the in-game tactics to appropriate the *organizational* distinction between the game narrative and the math content, children also developed social tactics to communicate about how they played the game. In contrast to the behaviour described above, these social tactics amounted to emphasizing and *overstating* the importance of the math exercises in the game. The children in the study were aware that their parents had a more positive attitude towards educational games than towards 'regular' video games. This different attitude was used in negotiations about when and how long the respondents were allowed to play. Even during interviews with both parents and children, some children continued to convince their parents that Monkey Tales is a game worth playing, emphasizing the educational content and stressing how difficult the exercises were. For instance, when R8's mother commented on the fact that sometimes, it was easy to guess the right answer in multiple choice exercises, R8 reacted indignantly: *"But no, mom, sometimes you had to choose between 4,23; 4,24 and 4,25. (indignant) Hey, that's really difficult!"* This quote shows that R8 was able to stress the difficulty of the math towards his parents, despite his own math avoidance tactics. In other words: R8 combined the main *organizational* strategy of the game (the distinction between game elements and the math content) with the *orientational* strategy of a single-player game (implying that parents or other stakeholders do not track their children's scores) to develop specific social tactics (i.e., overstating the role of the educational content). The player used the math content as an important element to influence how parents see the game, and to negotiate the rules surrounding the game (e.g., getting to play longer). Although respondents like R8 stressed the educational value when talking to their parents, in practice, they wanted to minimize the math effort.

The tactics outlined above show that even in rigidly structured games like Monkey Tales, players can develop personal reading paths to focus on specific content. As such, they succeeded in narrowing down Monkey Tales' meaning potential as much as possible to the 3D world levels, avoiding the math exercises that make the game

educationally relevant. In addition, the misleading attitude of some players towards their parents (overstating the importance of the math) shows that children are well aware of their tactics, foregrounding different aspects of the game, depending on the context. As such, the game's design strategies targeted at providing a balance between game elements and math content became a negotiation space in which the meaning of Monkey Tales was at stake: primarily a game, or education [13].

The observed user tactics point to an opportunity for game designers to design more flexible games that leave more room for appropriation [46], allowing players some choice to focus on the content they choose. The challenge in designing educational games, then, shifts from enforcing the ideal behaviour (engaging in educational content), to designing more appropriable educational games, in which players no longer feel the need to develop avoidance tactics. Based on these findings, we can offer specific guidance for designers of educational games. Educational games should balance a tight integration between education and game elements while also leaving players some room for choice. For instance, game designs can allow for personalization by offering a choice between a minimum of tightly integrated learning content, or engaging in additional educational content to gain extra points. While this additional content should still be integrated tightly, it can be left to the players to decide whether to score extra bonuses by engaging in it. This is but one example of how an educational game could be designed in a more appropriable and personalizable way.

3.2 Case Study 2: Toledo, a Virtual Learning Environment

The Application. In the second case study, we discuss teachers' appropriations of the virtual learning environment (VLE) used at the KU Leuven Association, adapting the platform to their specific communication needs. The VLE is called Toledo, and is based on the Blackboard platform. The platform is the common VLE across all institutions that belong to the KU Leuven Association. We studied how a sample of 24 teachers from various disciplines, across the university and university colleges, appropriated the VLE in their teaching practices. The study involved an analysis of the design strategies of the platform, and an investigation of everyday teacher practices in a combination of a two-week diary study and in-depth, semi-structured interviews.

Phase 1: Analyzing Design Strategies. The courses available in the VLE offer various tools, each targeted at a specific type of content (blogs, wikis, journals,…) or learning activity (peer assessment, discussion boards, tasks,…). The content itself is to be provided by the teacher and the students, while Toledo offers the infrastructure to set up the activities. As such, the design features of an 'empty' course are limited to putting various functionalities at the disposal of the teacher. This leaves a lot of freedom to teachers, as they can select and combine tools in a flexible way, to suit their needs. The platform has a flexible structure, imposing few restrictions on tool combinations.

Orientationally, Toledo mediates its users' orientation towards each other based on different user roles: there are 'teacher' and 'student' roles. Each tool available in the platform configures the relation between these roles differently. For instance, in the document repository, teachers provide the necessary material, while students only have a receptive role. However, in tools such as the discussion board, teachers make the tool available for students to work in, expecting them to provide the content themselves. Here, the students' role becomes more active. Besides teachers and students, a third stakeholder, on a higher level, is the institution itself. The institution's influence is visible in the course division (i.e., curricula), and in the visual design of the platform.

Apart from its orientational function, making learning content 'belong to' the university, the visual design also plays an important role on the *organizational* level. As various tools can be combined in various ways, individual courses can be set up in radically different ways. However, the visual university-branded platform design establishes cohesion and stability. From a multimodal perspective, this uniform look provides visual unity but contrasts with the platform's functional richness. While the platform can accommodate a variety of teaching styles through its wide range of functionality, the visual design is uniform: it presents the platform as a coherent whole, but leaves little room for visual separation between tools and functionalities.

A second important organizational aspect of Toledo is the default functionality. Within the large variety of tools, a limited subset is highlighted as 'basic', default functionality. This default navigation structure of a new course stresses the information transfer tools: default functionalities include teachers' announcements for students, general course information, a repository of course material, etc. These default tools are significant: they position the default use of the VLE primarily as a way to transfer information from the teacher to the student. Only on a secondary navigation level, the default functionality includes a small, specific subset of other tools, including community-building tools, such as a discussion board. As such, Toledo highlights a basic structure with a limited amount of mainly information-transfer functionality.

The analysis outlined above shows that while Toledo provides a wide range of configurable tools to accommodate content and learning activities, the platform is not really presented as such. The analysis of the design strategies (the application structure, the default settings, and the unifying visual design) presents the platform as a coherent, but rather static, uniform VLE, highlighting information transfer functionalities.

Phase 2: Analyzing User Tactics. 10 out of 24 respondents saw themselves as modest or moderate users of the Toledo platform, meaning that they used a relatively small portion of the functionality. Only four users reported more extensive use, including tools that move beyond information transfer. This finding confirms previous research, indicating that lecturers generally favour a limited amount of 'classical' tools (document repositories, discussion boards,…) over advanced features [26].

Teachers used applications and tools outside Toledo (16 respondents, using both generic tools (e.g., Google Drive), and specialized, course-specific applications), but they also appropriated several tools *within* the platform (8 respondents). The study

revealed several examples of this behaviour: e.g., the discussion board was used by R1 and R23 to let students upload assignments (despite the dedicated assignments tool). The assignments functionality was, in its turn, used by R22 to let students submit internship contracts and documents; R7 used it for peer assessments, unaware of the dedicated peer assessment tool. R4 let students create portfolios using the Journal tool.

At first sight, these appropriations seem to be a rather heterogeneous mix. However, two common aspects are striking. First, almost all the specific uses targeted by the appropriations above (peer assessment, submitting assignments,…) have *dedicated tools* in Toledo. The respondents appropriated other tools in the VLE, instead of using the dedicated functionality – either because they did not know about its existence, or because it did not satisfy their needs. Second, the tools that were appropriated most often in the study were not the tools offering specific functionality, but more generic communication tools, such as the document repository or the discussion board. These tools, facilitating teacher-to-student (document repository), student-to-student (discussion board), or student-to-teacher (assignments) communication, have a broader meaning potential than more specialized tools (e.g., the peer assessment tool), as they impose fewer limits on their use. The communication tool appropriations share the same characteristics: the tools facilitate a specific *communication direction*, instead of being tools for specific *activities or content*, as suggested by the analysis of design strategies. This observation adds an important nuance to the high amount of 'modest' and moderate users of Toledo. While these teachers only use a limited number of tools, some of the 'modest users' appropriated basic tools for very specific learning activities.

Based on these user tactics, we investigated one widely used tool in more depth: the discussion board. This tool allows for structured, asynchronous communication: discussion threads can be set up around specific topics, and both students and the teacher can post messages, reply to messages, or start new conversations threads. 12 out of 24 respondents reported having tried to use the discussion board functionality in their teaching. However, 10 out of 12 reported variable success rates at best, because students, being used to lightweight communication via Facebook and other social media, considered the structured way of communicating as too rigid and inflexible.

R1 and R23 used the Discussion Board to let students upload assignments in a structured way, even though a dedicated assignments tool is available. For instance, R23 used a very rigid structure for her students to post assignments and peer corrections of these assignments by other students, complete with a clear labeling system. These appropriations use the tool's inflexibility, considered a drawback when used for unstructured discussion, as a *strength*. They use is a structured list of assignments, and even a very rigid hierarchy of submissions and corrections. The design feature that prevented the uptake of the tool in one situation (too rigid for unstructured interaction) actually became the strength of the tool in a specific appropriation.

It became clear that the use of the discussion-board-as-submission-system is not a part of the common, accepted Discussion Board use. The tool's meaning potential is extended on an *orientational* level: while the 'accepted' discussion board use focuses on student-to-student activity, the appropriation extends the tool as a student-to-

teacher container for assignments. For instance, R23's extension of the discussion board's meaning potential needed additional social tactics: R23 negotiated her use of the discussion board with her students. *"For me, the labeling doesn't matter, the fact that it's a discussion board and I use it as something else, but some people say: 'Oh, but we don't discuss, then. […]' And their expectation is it's going to be chat."*

In this context, R23 mentioned the visual design of Toledo as an important driver of student expectations. While the uniform visual style functions as an important *organizational* element, presenting Toledo as a coherent unity, it is also serves an important *orientational* role. Being 'in Toledo' raises students' expectations. *"If there are ten professors, and one of them doesn't do the same things as the other nine, they say: why don't you do that? It comes with expectations.* [...] *Now you think: ah, we are 'in Toledo'."* (R23) They expect to behave in a certain way; for R23, these expectations presented a barrier for her specific appropriation of Toledo.

The appropriations outlined above show that although teachers appropriate tools in various ways, a common appropriation logic does emerge. While the VLE offers a variety of dedicated tools for specific learning activities, teachers often appropriate a smaller subset of tools based on specific situational needs, and on the *direction* of their communication needs. Based on these findings, we can offer the following guidance to designers of VLEs. VLEs should provide a limited set of open, appropriable communication tools with a broad meaning potential, apart from more dedicated tools and functionalities. The most important characteristic of such open communication tools is not the learning content type, but the direction of communication (teacher-student, student-teacher, or student-student).

4 Discussion

The two case studies described above have been analyzed using the multimodal framework presented in this paper. Although the case studies seem radically different at first, we will highlight similarities in the findings. Based on these similarities, we will summarize the characteristics and added value of our multimodal approach.

4.1 Multimodal Analysis, Designers' Intentions, and Meaning Potential

In the method outlined above, we conceptualize appropriation as a tension between design strategies and user tactics. As such, we focus our analytic attention on the designed artefact on the one hand, and on the users' appropriations on the other. We consciously do not include the designers' intentions in our analysis, as this leaves room for *unintended* messages in the design: while a designed artefact can express some of the designers' intentions, it can also communicate messages that were *not* intended.

In literature, different positions coexist regarding the inclusion of designers' intentions in the analysis of appropriation. In HCI, it is common to include designers' perspectives as a source of valuable information on the design process (e.g. [31]). STS approaches [49] have also stressed the designers' agency in 'configuring the

user', and AST ([15], p. 126) encourages researchers to consult with the designers to triangulate the analysis of the technology 'spirit' (defined as "general intent with regard to values and goals" presented by the system) of the technology.

In contrast to this stress on designers' intentions, other researchers, including Crilly et al. [11], have stressed the role of the artefact: "designers and consumers [are] separated in space or time so that any correspondence between intention and interpretation must be attributed to the influence of the mediating artefact." (p. 426). This positions the artefact between designers and consumers, mediating between intentions and interpretations. In appropriation research, Markus and Silver advocate a similar position in their critique of AST. They draw upon semiotic engineering [17] to conceptualize interactive systems as a communicational devices. While the interactive system, as a message, can express some of the designers' intentions, a system can also communicate messages that were not intended. As not all communication is necessarily effective, messages "are only *potentially* communicated to users" [40, p. 623].

Our multimodal framework follows the line of Crilly et al. [11], and Markus and Silver [40]. Seeing the interactive system as communication, the multimodal framework allows for an analysis of technology appropriation as a realization of the meaning potential of technology. With designers and users being separated in space or time [11], the multimodal framework focuses on one specific aspect of the communication: the communication between the interactive device and the user.

Semiotic methods are well-suited to analyze interactive systems as communicational devices (e.g. [17). However, it is important to stress that semiotic analyses do not generate neutral knowledge [16]: a semiotic analysis is an interpretation itself. The resulting interpretations are the result of a systematic, verifiable analysis of the technology [16]. Based on observable design features of the technology, the analytic process is systematic and strongly determined by the social semiotic ontology (assuming that communication consists of communicative modes, and that each interpretation is the realization of a specific meaning potential). Such a structured approach makes the interpretation results traceable to their origins.

By not referring to the designers' intentions, the semiotic framework allows for a non-normative analysis: it does not consider appropriations in line with the designers' intentions to be more 'faithful' than others [15]. While some appropriations can be socially accepted, and others are not, they are all equally valid. For instance, in the Toledo case, the use of the discussion-board-as-a-submission-system was not a part of the usual Discussion Board use. Extending the meaning potential, this appropriation needed additional explanation from the teacher. Once this was clarified, the tool functioned well in the specific context. This shows that appropriations, as small ways of 'making do' [12], can be effective, equally valid interpretations as the model use.

4.2 Design Features, Orientation and Organization

The analysis in design features, orientation and organization of the technology (based on the different metafunctions identified in multimodality) stresses the fact that technology is not merely made up of functionalities, but that, for instance, social relationships are also inscribed into technology (in the orientational metafunction).

While this observation has been made elsewhere (e.g., [6]), the semiotic approach presented in this paper offers tools to trace this relationship in more detail in the design of technology. The case studies have shown that these functions can shift when technology is appropriated. For instance, the analysis of the orientational metafunction confirm Bødker and Christiansen's observation that social factors are an important aspect of appropriation [8]. While Monkey Tales is designed as a single-player game, social relations with parents inevitably influence how the game is perceived and presented. The division in game layers is a design strategy that structures and balances the game content with the educational content, but in daily practice, this balance can shift. Depending on the stakeholders involved, the arcade game layer is variously emphasized (in parent negotiations) and de-emphasized (when playing alone). In Toledo, the visual design that unites the platform (organizationally) also plays an important orientational role, as it raises students' expectations about roles and communication within Toledo. As such, the metafunctional analysis of design strategies allows for tracing the shifts in meaning of specific aspects of the technology.

4.3 Technology can be Appropriated Based on Partial Interpretations

The case studies have shown that appropriations are often based on very specific interpretations, in which some parts of the technology are in focus, while other parts are downplayed, or even unknown. In this way, users interpret the technology based on the reading paths they construct. Some studies of user behaviour assume implicitly that users have a balanced overall picture of what the technology can do (see, e.g., [39], p. 35). For instance, Adaptive Structuration Theory posits a theoretical distinction between core features vs. optional features: core features are considered more important when describing the effects of technology on users or organizations [40]. The case studies have shown that such a decontextualized distinction is not necessarily accurate: users construct their own reading paths [35], deciding for themselves which functionality they focus on (and therefore, is 'core' functionality). In the Monkey Tales case, the players chose to focus on a specific game layer, while developing tactics to avoid the other layers. In the Toledo case, the impact of reading paths was even more prominent. Several teachers developed appropriations based on the surface level of the platform: with their limited understanding, they appropriated the tools they knew, without knowing about other, dedicated tools. Therefore, in order to fully understand how and why appropriations are developed, it is important to determine which reading path users follow, and analyze how they construct their appropriations based on their specific reading. Furthermore, as users' reading paths can change, interpretations can change as well. For instance, teachers might still explore Toledo in more detail. As their knowledge of the platform changes and broadens, they might start developing different practices. As such, changing reading paths can trigger new appropriations.

5 Conclusion

Technology appropriation is a multi-faceted phenomenon, including users' cognitive characteristics, the processes of learning to use the technology, social and other processes. In the complexity of this phenomenon, the semiotic approach presented in this paper focuses on the interplay between design strategies embedded in the technology, and the interpretive flexibility apparent in the users' appropriation tactics. Based on De Certeau and multimodal semiotics, we offer a framework that highlights the shifts in meaning that occur when users deal with technology in creative ways.

The semiotic approach acknowledges that while appropriations can be highly personal and unpredictable, they should not be dismissed for being exceptional, or not being representative of the behaviour of a large population. Rather, these idiosyncratic practices often share an underlying appropriation logic. This logic can be seen as a shared need to creatively deal with a technological structure in order to satisfy specific needs. Gaining insight into this logic furthers our understanding of appropriation, and how technology structure mediates it. On a more practical level, this can be an inspiration for design, as designers can use their understanding of users' appropriation practices to design new technologies, or future versions of existing technology.

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