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# Designing values in an adaptive learning platform

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## ABSTRACT

To a certain extent, the process of design is always driven by guiding values. An ethical analysis, as it has been argued, can help in making such a process more reflexive, highlighting existing conflicts and discussing desirable solutions. These premises guide approaches like Value Sensitive Design or Privacy by Design. This paper discusses the issues of values in technology design in the context of a platform for adaptive learning. To what extent can principles of privacy by design be operationalized in design practices? Using the case of an adaptive learning platform, we describe how values have originally driven developers' decisions and design choices and show how clashes between values are unavoidable. We claim that including a collaboration between ethicists and designers at an early stage of the design process may foster a reflection on the ethical considerations at stake.

## CCS Concepts

• **Social and professional topics** → **privacy policies, computing profession** → **codes of ethics** • **Security and privacy** → **Human and societal aspects of security and privacy** → **privacy protections**

## Keywords

Value-sensitive design, privacy, ethics, learning analytics, interactive learning environments, educational games

## 1. INTRODUCTION

Several approaches in ethics and governance have highlighted that values such as privacy, but also gender equality and social justice, should not only be sought at a stage when the product is ready to go on the market through external regulatory tools (such as Privacy statements or Terms and Conditions). Rather, ethical concerns should be considered at an early stage of product development and “embedded” in the product's design. To a certain extent, the process of design is always driven by guiding values. An ethical analysis, as it has been argued, can

help in making such a process more reflexive, highlighting existing conflicts and discussing desirable solutions. These premises guide approaches like Value Sensitive Design or Privacy by Design. To what extent can principles of privacy by design be operationalized in design practices? In order to address this question, this paper will discuss a specific case of a platform for adaptive learning (Kidaptive). In section 2, we briefly introduce some concepts used in the ethical, legal and sociological literature that convey the idea of “value-rich” design. In 3, we introduce our case and describe how some privacy and social values have guided the design process at Kidaptive. In 4, we discuss how values can conflict in technology design and how such conflicts can be addressed or resolved.

## 2. Value-rich design: Conceptual framework

Technology shapes human behavior by allowing some actions to be performed and by preventing others. A classical example are speed-bumps that enforce drivers' compliance to speed limits by imposing an immediate sanction (damage of the driver's car) to the evasion of the norm. The notion of “script”, articulated in the context of the Actor-Network Theory by Bruno Latour and Madeleine Akrich, captures the idea that technologies contain a “program of action”, that is, a non-written instruction of how it should be used and by whom [1]. The concept of “script” emphasizes how designers un/intentionally inscribe a moral agency in the artifacts.

Along the same line, philosophers in computer ethics have argued that values are “embodied” or “built” into artifacts. The “embedded values” approach [2] “holds that computer systems and software are not morally neutral and that it is possible to identify tendencies in them to promote or demote particular moral values and norms” [3]. Computer systems present built-in moral consequences that are inherent in their design; for example, user autonomy is undermined by software agents that hide relevant information from users [4]. The use of technological artifacts can also promote (or demote) the

realization of moral values, such as privacy. This means that artifacts are value-laden and design can be “value sensitive” [5]: designers can intentionally inscribe values in artifacts, shaping them, in order to support or undermine enduring human values. Ideally the design process of a product follows the principles of Value Sensitive Design (VSD), an iterative design process that involves 3 types of investigations: (1) conceptual investigations to determine which stakeholders are impacted, either directly or indirectly, by the product’s design as well as their values and potential value conflicts, (2) empirical investigations to find out about the use(r)s’ context (e.g. their needs and values), and finally (3) technical investigations to know how values are eventually embedded and whether the product’s technical properties promote or obstruct the values identified during the conceptual and empirical investigations [5].

This concept has also been explored in regulation studies. Scholars have reflected on how technical measures are intentionally used to enforce legal norms [6, 7, 8]. This happens, for example, in the case of DVD players that enforce rules of market segmentation by using ‘region codes to prevent people from playing discs bought in cheaper markets’. The idea of regulating by technology, or technoregulation, has also been explored in the context of data protection regulation. The Draft EU General Data Protection Regulation refers to an obligation for ICT designers to protect data by design [9]. “Privacy by design is the principle or concept according to which privacy should be built into systems from the design stage and should be promoted as a default setting of every ICT system” [10].

While noting that privacy, as a social norm, has evolved over the years, Ann Cavoukian has identified 7 foundational principles of privacy by design and offered ways to operationalize them in product design: (1) Measures protecting privacy should be proactive rather than reactive, namely privacy invasive events should be anticipated and prevented; (2) Privacy should be conceived as the default setting: data should be automatically protected (if an individual does nothing, no action is required); (3) Privacy is to be embedded into design, that is: privacy is integral to the system, without diminishing functionality; (4) Privacy should not impair full functionality of the system, but accommodate with other design objectives. According to this principle, designers should aim towards a “Positive-Sum”, not “Zero-Sum”, and should not draw “false dichotomies” between sets of values, such as privacy vs. security, but rather aim for both, avoiding trade-offs; (5) Privacy by design amounts to a lifecycle protection of privacy inasmuch as privacy is part of the designed system prior to any data collection; (6) Visibility and transparency are at the core of privacy by design, which means accountability and openness towards stakeholders; (7) User privacy should be respected, and more generally design should be user-centered and user-friendly.

As it has been pointed out, however, privacy by design (PbD) is easier said than done: technical burdens constrain attempts at embedding data protection rules in machine code [10]. Moreover, how easily and productively can PbD be applied in practical contexts of product design? To better understand how values and norms in design work in practice and what kinds of problems are encountered, we will consider the specific case of Kidaptive, a startup company that is developing an adaptive learning platform for educational games. We use the case of Kidaptive as an a posteriori reconstruction to evaluate how the principles of PbD can be recognized in the development of their

main product Leo’s Pad and we reflect on the limits of the PbD framework.

### 3. Case study: Kidaptive

Kidaptive’s ALP (Adaptive Learning Platform) aims to combine data from multiple learning contexts (e.g. educational games, parent observations) and dynamically adjust gameplay as learners engage in educational games. The captured data are used to create an adaptive learning environment, generate personalized insights and activity suggestions for each learner and their parents, and update the learner’s psychometric profile to provide a meaningful picture of the learning journey. As learner profiles grow with each child, they provide insights into not only a learner’s strengths and interests but also the efficacy of the educational product.

So far, Kidaptive developers’ focus has been mainly on educational products for preschoolers. Their main product is Leo’s pad enrichment program, which contains 6 “Appisodes” with alternating animated movie fragments and mini-games addressing 25 key early learning skills. To facilitate personalized insights and activity suggestions, Kidaptive created a parent app (Learner Mosaic) which shows a child’s game activity, milestones reached, and personalized tips and recommendations about activities parents can do with their children outside the game environment.

Because of the sensitivity of a target audience in the preschool age, issues of data protection have been deemed as crucial by Kidaptive’s designers. Protecting children’s privacy is in fact paramount for regulators and developers of such products. These concerns have been taken up both at the level of product design and privacy policy elaboration. Here are some examples.

#### 3.1 Transparency on privacy policies

Kidaptive’s privacy policy is written in non-legal terms, understandable and accessible for parents as much as possible (<http://kidaptive.com/privacy-policy/>). When asking for information about a learner (name, age and gender) from parents, it is made clear why that information is necessary to enhance the user experience. This is either stated before the information is asked, or pops up when clicking the (?) icon (Figure 1).

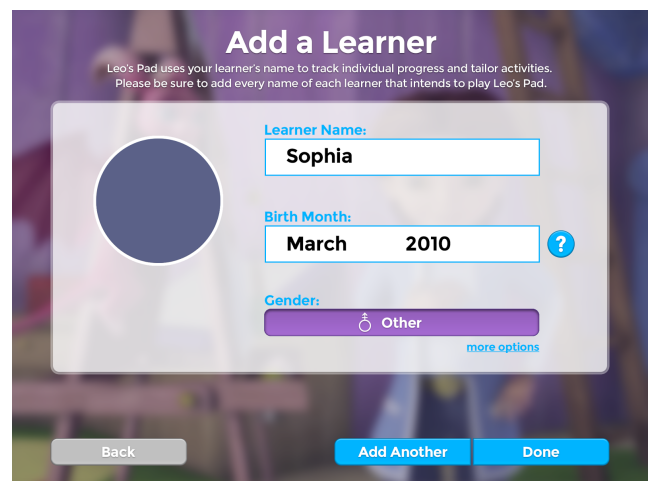
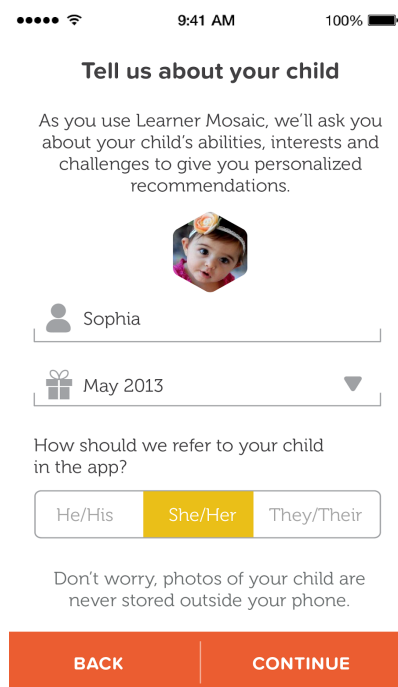


Figure 1. Adding a learner profile

Kidaptive meets some of the PbD principles outlined above: it privileges visibility and transparency (6) by offering continuous information about the purposes for the collection of personal information. When asking the first information from parents, Kidaptive tries to build trust that the company is making the right choices with regards to privacy ethics by providing insight in what each piece of received information is used for and by reinforcing that insight when parents receive feedback about their child's progress. Over time, parents hopefully get a better sense of how the provided data are handled and why they are useful (for example, age can be used to tailor recommendations), and will become more willing to share additional information about their children which can enhance their learner profile.

### 3.2 Collecting only necessary information

*Birth date.* Many companies ask for the exact birth date of users by default. This gives more information about the user than necessary. Age is an important predictor of the level of children, but for age only month and year are needed, not the exact day of birth. Kidaptive developers, therefore decided to only asks for the month and year and not for the exact birth date, thereby collecting only necessary data and minimizing data linkability (PbD's second principle) (Figure 1).



**Figure 2. Concept to ask for gender and pictures in the future**

*Gender.* Sometimes parents are not comfortable reporting a child's gender. A substantial percentage of children do not identify as one gender or as their biological sex. This can create uncomfortable situations when parents are forced to choose a gender for their child. Gender information is not necessary for recommendations or the learner profile, but only for the language used to describe the learner's progress (She reached the next level today!) where it is often hard to find a way around using gender-specific pronouns. Kidaptive designers have been discussing ways to address this issue. One proposed solution

was to ask about preference in how the child is referred to in the app instead of specifically asking for gender. As such, while respecting privacy, full functionality is not only respected but creative solutions are also proposed that show regard for other values, such as gender fluidity, which goes hand in hand with PbD's fourth principle (Figure 2).

### 3.3 Storing information safely

Pictures of children are often considered especially sensitive information. Kidaptive stores pictures of children only locally (Figure 2). This refers to the second principle of PbD, which concerns, amongst others, data use, retention and disclosure limitation and pro-active minimizations of linkability of data.

If a learner's profile is created, however, a profile picture will make it more personal. Also, taking pictures of children within a game can be a fun and engaging activity (Figure 3). Insights from games played by learners show up in an accompanying parent app, usually installed on the parents' phone, while the game is played on a tablet. Kidaptive's approach of local storage means pictures cannot automatically move from the game on the tablet to the parent app on a phone or vice versa. This is in contrast with user friendliness when parents expect that when they upload a profile picture for a child in the game on a tablet, that picture will also show in the accompanying parent app learner mosaic on their phones. Or when they expect the pictures made during gameplay on the tablet will show up in their parent app.



**Figure 3. Using pictures to create engaging game dynamics**

## 4. DISCUSSION

As emerges in the previous section, while in some cases values of privacy are facilitated through the use of explicatory clauses, in other cases specific design choices are made in order to guarantee young users' privacy. This is the case of the modality whereby photos are stored or the quantity and quality of information that is collected about children's age and gender. Although questions related to children's (and parents') privacy and data protection seem to have found a straightforward resolution in Kidaptive, there are situations in which there are frictions between values. Besides the case described above, relating to parents' expectations to see photos in contrast with children's right to privacy, other needs for trade-off can be identified:

- In the beginning of Leo's Pad, Kidaptive did not ask for player information at all in order not to create any boundaries to start playing the game right away. This made it really difficult to get in touch with parents, and later on to make sure they did not have to pay when Kidaptive started asking money for Leo's pad. In order to build a learner profile and communicate with parents, some privacy-sensitive information needs to be collected.
- In another game (Hodoo English), Kidaptive sends parents links in emails to learner reports. To make it easy for parents to interact with the reports, clicking the link in the email takes them directly to the report, while access to their learner's information is normally password protected. There is here a trade-off between user-friendliness and protecting privacy.

As these examples illustrate, values may conflict with one another. Because there is no blueprint to embed them in the design of technology, often there is a trade-off between potentially conflicting values: sending a link to a parent report that is not password protected in an email is more effective in terms of openness and user-friendliness than in terms of protection of the child's and the parents' privacy. Privacy considerations might indeed clash with issues of efficacy, thereby raising questions about (1) the feasibility of promoting and building privacy in every dimensions of learning analytics, and (2) the possibility of having a completely ethical, or at least privacy-protective, product. Other questions also remain open, such as who consents to the game's privacy policy (the parent or the child?) and does the child have any privacy rights before her parents (should the child have the right to hide particular information to appear in the learner's report?). This sheds light onto the difficulties of defining what privacy is and what its protection might amount to.

According to PbD, trade offs between values should be avoided in view of a "positive sum" game. However, our examples show that design practices are all about trade-offs: between values, expectations and demands of different stakeholders. In this sense the PbD approach is not ideal in guiding ethical design as it does not offer any guidance on how such inevitable trade-offs should be tackled. Moreover, the focus on privacy may be reductive. The values at stake in the Kidaptive case go beyond privacy merely. In this sense the Value Sensitive Design Approach offers a more comprehensive approach to guide design practice. Such approach in fact acknowledges that a value driven design is often about defining limits to relationships, not only on the level of data protection (access control between user accounts). VSD brings the attention the user and the challenges this poses in defining hierarchies in between different stakeholders. For example, do we value more that parents have access to data shared by their kids, or do they choose to prioritize this design for children, who are in the end the main users for the app?

Assuredly, these questions will not be solved easily and involve societal discussions; but what these examples and case studies show is that a passive stance is no longer possible for technology developers and designers: asking for users' age or gender, and in which way, are value-laden decisions; what kind of data is collected, how and for which purpose are ethical questions. Fortunately, tools are available that might help recognising and including particular values in the design

process. Value-sensitive design (VSD) is one of them: as a methodology, it encourages designers and technology developers to question the values that inform their visions and worldviews concerning the product they are building [5]. More practically, by offering a unique set of ethical questions related to ICT design, VSD helps uncover and map the values of developers and end-users alike. It also combines these insights with an exploration of their technical feasibility and feeds the results of these investigations (the technical and the ethical/value-driven ones) back into the design process.

## 5. CONCLUSION

Ethical concerns are inherent to the development of Adaptive Learning Platforms, which imposes a certain conduct on its users. In this paper we have explored how ethical considerations may drive the design process in practice through the case of Kidaptive. Although some considerations brought forward in the Privacy by Design approach are indeed taken up in the design process, some conflicts and trade-offs among values are unavoidable. Indeed, privacy considerations can clash with goals of user-friendliness. In this sense, broader approaches like Value Sensitive Design can help designers to map a range of relevant values and the way they can be built into the design of a product.. While compromises can be achieved by being reflexive about these values and addressing them as early as possible in the technology development stages, many questions and issues remain open, including the feasibility of having a completely ethical and privacy-sensitive product. These questions cannot be answered by technology developers alone however, as they interact with our morality at a broader level. Philosophers, ethicists, social and legal scholars might be called upon to play a bigger role in mapping these issues and providing support to technology designers and developers.

## 6. DECLARATION OF CONFLITING INTERESTS

This paper was conceived as a collaboration of social science scholars and the company Kidaptive.

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