

A CRITICAL CURATION OF SOLUTION REPERTOIRE BY FIRST TIME DESIGN STUDENTS

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ABSTRACT

Design education has a nuanced relationship with examples. Although they are considered useful teaching tools, their use is often restricted to illustrating the design theories and principles around which the curriculum is structured. In contrast, professional designers view examples as autonomous entities and use them to initiate a critical dialogue with their current problem space. Therefore, students should be facilitated in cultivating their own repertoire of solutions and learn to initiate conversations between existing solutions and design challenges to gain a better understanding of the problem space and generate new designs. This paper outlines a small-scale experiment conducted with master's students in Applied Data Science at Utrecht University who took a course on designing recommender system interfaces. The students were provided with a set of examples of recommender interface designs as their main instructional tool. They could use this set to curate their own solution repertoire. As a result, the majority of the participants' work displayed more diverse designs, and they used design patterns distilled from those examples generatively, developing innovative designs. Based on this case study, we tentatively conclude that a design curriculum built around examples, complemented by theories, could be advantageous, as long as special attention is given to helping students initiate fruitful iterations between their challenges and a set of solutions.

Keywords: Solution repertoire, professional practice, problem space, exemplars, curriculum design

1 INTRODUCTION

Studies on design practices over the past half century consistently show that designers tend to approach design challenges with a solution-oriented mindset [1–8]. They engage in reflective conversations with their design challenge and use existing solutions or precedents as conversation starters [2, 7]. Dorst & Cross, for instance, noted that designers iteratively evaluate and appreciate existing solutions within their specific challenge, enhancing their understanding of the problem space with each consideration [3, 9].

That is in contrast with how design curricula within HCI are generally organized [7, 10]. Currently they tend to emphasize high-level conceptual knowledge, supported by intermediate knowledge such as design heuristics [3], design patterns [4], strong concepts [5], or annotated portfolios [6]. Examples used in these curricula are exclusively tied to high-level or mid-level knowledge. For instance, topics covered in HCI courses typically include Nielsen's heuristics, user research, creating a user journey, persona's, human-AI interaction, etc. [11], rather than examples of specific interfaces such as Netflix, OkCupid, Waves, or Roblox. High-level and intermediate knowledge are considered generative design tools, while examples serve as illustrations of these principles [9]. In order for design curricula to align more closely with professional practice, greater emphasis should be placed on actively and consciously building students' collection of precedents or a 'solution repertoire' [9]. This would help students develop skills to facilitate conversations between their repertoire of precedents and the design challenges they encounter.

This paper reports the results of a small-scale experiment conducted in the Covid'19-winter of 2021 with 37 master's students in Applied Data Science at Utrecht University. It aimed to recreate the solution-oriented professional practice by structuring part of the design course around a set of precedents. After briefly reviewing the status of exemplars as a form of knowledge in design curricula, we describe the experiment and provide a preliminary analysis of the results.

2 THE STATUS OF EXAMPLES IN DESIGN CURRICULA

Back in 1982 already, Cross has stated that design examples in and of themselves should be considered autonomous knowledge entities [12]. Structuring design curricula around design theories, in which examples function as illustrations, is, therefore, problematic for various reasons. Firstly, it implies that examples are determined by higher types of knowledge: the example is the way it is because of this principle. However, design examples can and should be viewed through multiple theoretical lenses [9], and tend, in fact, to be ‘underdetermined’ by theory [13]. Secondly, it prevents students from building their own conceptual network of examples, since the examples are taught in the context of specific theories, and, as a result, they will be mainly accessible through those theories rather than individually and interrelatedly [9].

Finally, and most importantly, denying examples a status in their own right does not echo the actual design practice. As Boling and Gray show, students will use precedents, whether they are aware of it or not [7]. If they are not taught to use those precedents consciously, and consider them properly and critically, their resulting designs will suffer.

Van Turnhout & Smits, therefore, introduce the concept of ‘solution repertoire’ as a founding principle for design curricula. They define ‘solution repertoire’ as “the competence of appreciating and handling solutions in one’s design discipline and to use them as an anchor point for design-relevant knowledge that goes beyond the anecdotal experience” [9]. In this approach, a solution repertoire is a performative concept: students build their own repertoire, carefully curated from formally or informally encountered, and self-designed precedents. A design curriculum could then be organized as in Figure 1:

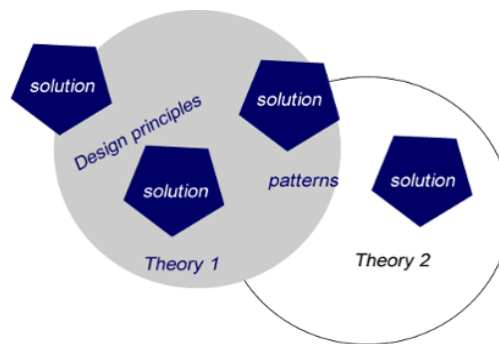


Figure 1. A curriculum design organized around examples or solutions

In this organization, solutions are the central elements that connect sets of abstract knowledge, and the various theoretical lenses serve as means to analyse the examples from different perspectives. Solutions are in this vision the foundational blocks of the curriculum. This curriculum structure is geared towards helping students curate a solution repertoire and support their skills of critical analysis of examples in specific contexts. It does, however, not imply there is no place for design theory and design principles. It just means that those are not the structuring elements of a curriculum; rather they take the auxiliary position that was earlier reserved for the examples.

3 EXPERIMENTS: A SOLUTION REPERTOIRE-BASED DESIGN CURRICULUM

In the winter of 2021, our design research group Human Experience & Media Design (HEMD) and our teaching staff at the Master Data-driven Design [14] were asked to provide a course on interface design of recommender systems for 37 master’s students in Applied Data Science at Utrecht University with little to no prior experience with interface design.

This course provided an opportunity to experiment with the notion of examples as an organizing principle in this curriculum. Our main instructional tool was, therefore, a set of examples of recommender interface designs. An inclusion criterion for this set was that they all had to contain some form of ‘algorithmic affordance’, that is: they all had to provide their users with “interaction options that give tangible control over the algorithm” [15]. During the classes, the examples were examined through various lenses, such as the theory of value sensitive design [16], human-centred design, and the design of human-ai-interaction (see Figure 2).

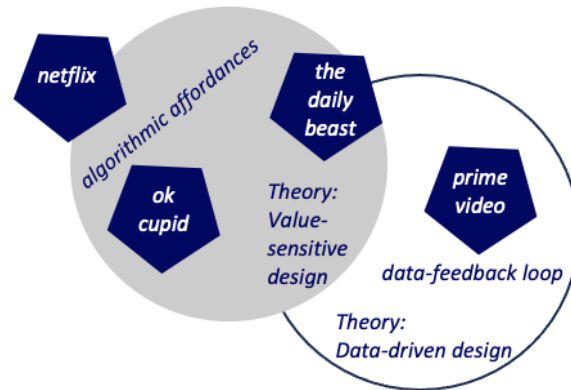


Figure 2. Part of the recommender interface design curriculum structure

In phase 1 of this experiment, we first assigned the students the task of designing ‘an interface’ for ‘a streaming service’, just to explore options and get familiar with the practice of constructing interfaces in general. At that time no precedents had been provided yet, nor had the general idea of designing with precedents as (generative) design tools been discussed. In phase 2, however, students were provided with precedents, as well as with explicit and implicit instructions to consider precedents carefully and to curate their own set of precedents. In this phase, the assignment was again to design a recommender interface for a streaming service, but this time for a specific user group that students had selected themselves. The interface had to include algorithmic affordances and therefore, it had to provide users with control. From their user research, students distilled values that were relevant to their selected user group and those values were to drive the types of control that would be implemented in the interface. The students’ final interface design had to be accompanied by a document in which they had to reflect on their consideration of various exemplars and how they did or did not use them to build upon them. The reflection documents were analysed by the teaching staff, based on the assessment criteria formulated in the assignment. Relevant statements were highlighted during grading and later analysed for generative power. Statements that were included were for instance ‘I considered Tinder’s interface and decided, you could use such a one-by-one judgment for movies, too. The selection process would then be slower, but at the same time, every next movie would be a better match, rather than having to plough through 20 irrelevant movies’ (S6). This was considered a generative statement.

4 RESULTS AND DISCUSSION

The students’ work on these two assignments led to three main conclusions. Firstly, we established again that, designers (experienced or not) use precedents as a starting point. Most of the results of the assignment in phase 1, in which they had to design an interface for a streaming service, showed an uncanny resemblance to Netflix’s, Audible’s and HBO’s interfaces (see and in a variety of contexts of use. They were clearly not viewed as illustrations of ‘just that value’, ‘in just that context’, for ‘just that feature/use’. In one design, the algorithmic affordance of the ‘data toggle’).

Table 1. Traces of exemplars in assignment 1

26 assignments	- literal traces of Netflix/Prime Video-type of services
3 assignments	- literal traces of Netflix/Prime Video-type of services - generative traces of Netflix/Prime Video-type of services
5 assignments	- literal traces of Netflix/Prime Video-type of services - traces of social media interfaces (sharing, commenting, tagging)
2 assignments	- literal traces of Netflix/Prime Video-type of services - generative traces of Netflix/Prime Video-type of services (e.g., using profiles differently) - generative traces of social media (sharing, commenting, tagging)
1 assignment	- literal traces of Netflix/Prime Video-type of services - generative trace of social media (sharing, commenting, tagging) - generative trace of another online service (Tinder’s judging)

recommendations one-by-one)

Consciously or not, students had used clearly recognizable examples as their starting points for their assignment and had implemented literal traces in their designs. In this study, literal traces are conscious or unconscious copies from existing examples: similar feature, similarly implemented, similar context-of-use. Generative traces are elements that have a similar use but are implemented differently in the student's design (for instance, rating is a sliding scale rather than a set of five stars), or that are used differently (for instance, rating implemented as blacklisting rather than supporting provided recommendations). Elements transferred from another context, such as social media (tagging other viewers) or dating sites (such as the Tinder-like judging of each individual movie) were in this study also considered generative traces, even when the implementation was similar.

For the assignment in phase 2, we observed an expected improvement in designer skills (simply because it was their second assignment). More importantly, however, and this is the second conclusion, for a majority of the students we could also establish they had actually used examples as generative design tools, resulting in their own original designs. Examples of similar algorithmic affordances were used to implement a variety of values, for different target groups and in a variety of contexts of use. They were clearly not viewed as illustrations of 'just that value', 'in just that context', for 'just that feature/use'. In one design, the algorithmic affordance of the 'data toggle'. In one design, the algorithmic affordance of the 'data toggle' was, for instance, used to allow users to see explanations for their recommendations, facilitating the values of diversity and transparency (see Figure 3a), while in another design the same example of the data toggle was used to implement transparency again but in this case also to tune the algorithm, weigh parameters differently, and consequently, adapt results (see Figure 3b). In sum, more students had started to use examples in a generative manner.

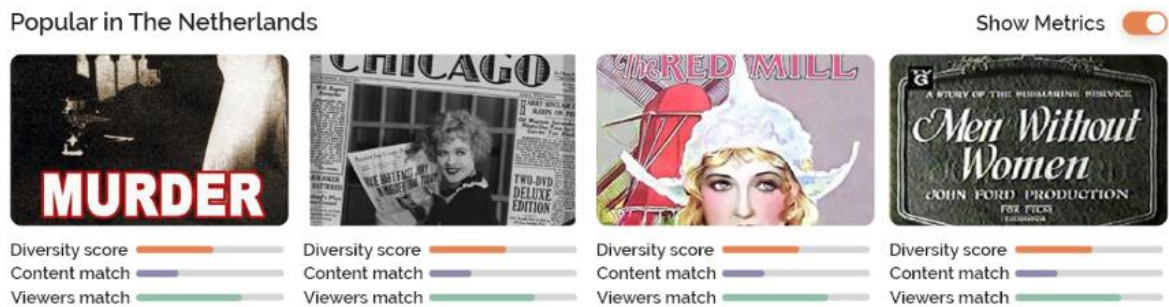


Figure 3a. Toggling explanations for recommendations

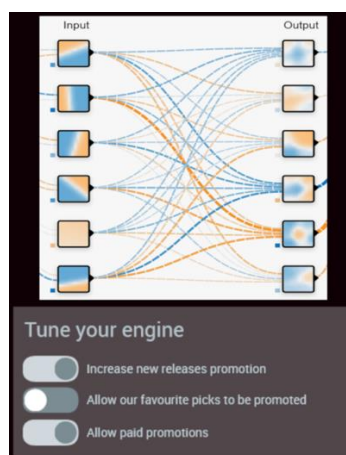


Figure 3b. Toggling explanations for recommendations

The solution repertoire also triggered students into developing their own variations and innovations. Figure 3a is already an innovative example of how explanations of recommendations can be visualized, by the student's own admission, for "people who are as techy and nerdy as I am" (S12) [17]. The diagram in this figure visualizes how the recommender settles on specific output, and to what extent diverse input sources (previously watched movies, paid promotions of the company, user similarity, etc.) contributed

to that output. Transparency is here implemented by visualizing decision paths, an example that was present in the provided solution repertoire. The final design, however, implements such a decision path in a completely different way, developed by the student himself. Figure 4 presents a last illustration of generative designs inspired by precedents. This student was triggered by examples of building different profiles. Rather than profiles for individual users, however, they created contextual profiles and made recommendations for ‘Lazy Sundays’ and ‘Fridays with friends’.

In their reflection documents, 23 out of 37 students clearly show how they had taken their target groups’ values as a starting point (‘their problem space’) and had subsequently browsed the solution repertoire to see if and how any of the solutions would help them implement those values (‘critical conversations between precedents and problem space’). They then selected examples that were helpful and transformed them into a solution that worked in their own design (‘creating a new design’). S11, the creator of the example in Figure 4, for instance, stated “I liked the idea of contexts, but not of tying it to a person; for my target group social watching is more important than defining them as individuals”.

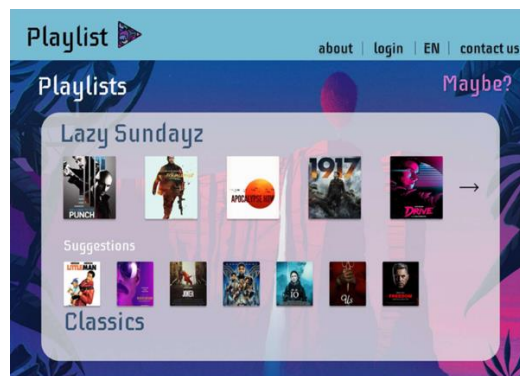


Figure 4. Newly designed means of profile creation

However, this process was not as smooth for the entire student population. As a third conclusion we found that a significant minority of students (14) did copiously use the solution repertoire, but still not critically. Rather, these students seemed to consider the set of exemplars more of a list of ingredients that all needed to be integrated in their assignment, resulting in an unbalanced mix of solutions. See Figure 5 for an example of an unbalanced interface aimed at 6–10-year-olds, that displays no critical appreciation of the various elements:

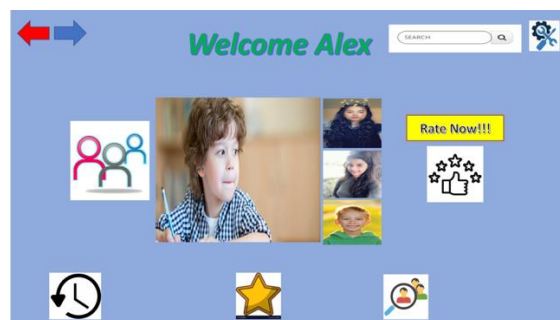


Figure 5. An unbalanced combinations of examples

In the discussion following the hand-in of their work, the creator of this work stated, “I am just learning to speak ‘design’; I did not know what to do with those examples and thought I had to use something from all of them, to show I had looked at them” (S24). In short, they considered the examples prescriptive rather than inspirational. Crucial for a curriculum centred around examples, therefore, is to make sure the examples do not attain such a status that students feel they *cannot* be changed and *have* to be used.

5 CONCLUSION AND LIMITATIONS

Based on the results of this experiment, we tentatively conclude that it is beneficial for design curricula to explore constructing their curriculum around examples, allowing students to build their own solution

repertoire. This small-scale and admittedly limited study shows that providing exemplars in a design curriculum as autonomous entities rather than as auxiliaries to higher concepts can support examples' generative power for new and innovative designs. However, teaching the skill of critical appreciation and evaluation, and having students experience how those conversations enhance their understanding of their problem space is an essential for this approach. That should help give students the confidence that they 'speak enough design' (academic integration into the domain) to employ their repertoire to the fullest and allow them to challenge design contexts and generate their own innovative designs.

REFERENCES

- [1] Darke J. The primary generator and the design process *Design Studies* 1979, 1, 36–44. [https://doi.org/10.1016/0142-694X\(79\)90027-9](https://doi.org/10.1016/0142-694X(79)90027-9)
- [2] Schön D. A. *The Reflective Practitioner* 1992. London: Routledge. <https://doi.org/10.4324/9781315237473>
- [3] Dorst K. and Cross N. Creativity in the design process: Co-evolution of problem-solution *Design Studies* 2001, 22(5). [https://doi.org/10.1016/S0142-694X\(01\)00009-6](https://doi.org/10.1016/S0142-694X(01)00009-6)
- [4] Goldschmidt G. The Dialectics of Sketching *Creativity Research Journal* 1991, 4(2). <https://doi.org/10.1080/10400419109534381>
- [5] Lawson B. *The design student's journey: Understanding how designers think The Design Student's Journey: Understanding how Designers Think* 2018. <https://doi.org/10.4324/9780429448577>
- [6] Gray C. M. "It's more of a mindset than a method": UX practitioners' conception of design methods In *Conference on Human Factors in Computing Systems - Proceedings* 2016 (pp. 4044–4055). Association for Computing Machinery. <https://doi.org/10.1145/2858036.2858410>
- [7] Boling E. and Gray C. M. Use of Precedent as a Narrative Practice in Design Learning In *Educational Technology and Narrative* 2018. https://doi.org/10.1007/978-3-319-69914-1_21
- [8] Gray C. M., Seifert C. M., Yilmaz S., Daly S. R. and Gonzalez R. What is the content of "design thinking"? Design Heuristics as conceptual repertoire In *International Journal of Engineering Education* 2016 (Vol. 32).
- [9] Van Turnhout K. and Smits A. Solution repertoire In *DS 110: Proceedings of the 23rd International Conference on Engineering and Product Design Education (EPDE 2021)* 2021. The Design Society. <https://doi.org/10.35199/EPDE.2021.41>
- [10] Landelijk overleg InCMD *Communicatie & Multimedia Design: Beroeps- en competentieprofiel* 2021. Den Haag.
- [11] UX Design Institute UX Design Course 2023, June.
- [12] Cross N. Designerly ways of knowing *Design Studies* 1982, 3(4). [https://doi.org/10.1016/0142-694X\(82\)90040-0](https://doi.org/10.1016/0142-694X(82)90040-0)
- [13] Boling E. and Gray C. M. Use of Precedent as a Narrative Practice in Design Learning in *Educational Technology and Narrative* 2018. https://doi.org/10.1007/978-3-319-69914-1_21
- [14] Smits A., van Turnhout K., Hekman E. and Nguyen D. Data-driven UX design In *Proceedings of the 22nd International Conference on Engineering and Product Design Education* 2020. The Design Society. <https://doi.org/10.35199/EPDE.2020.10>
- [15] Hekman E., Nguyen D., Stalenhoef M. and van Turnhout K. Towards a Pattern Library for Algorithmic Affordances *Joint Proceedings of the IUI 2022 Workshops* 2022, 3124, 24–33.
- [16] Friedman B., Kahn P. H. and Borning A. *Value Sensitive Design: Theory and Methods* 2001. Washington. Retrieved from www.ischool.washington.edu/vsd
- [17] Terhorst R. and Smits A. Studenten ontwerpen alternatieve recommender systemen *HEMD Missies* 2021, May 20.