

## University of Groningen

### Design for Transfer

Kuipers, Derek

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**Brothers - A Tale of Two Sons (2013)**

A man, clinging to life. His two sons, desperate to cure their ailing father, are left with but one option. They must set out upon a journey to find and bring back the "Water of Life" as they come to rely on one another to survive. One must be strong where the other is weak, brave where the other is fearful, they must be... Brothers.

Image: © Starbreeze Studio / 505 Games, All Rights Reserved.

## Chapter 9: Summary, Key Findings, and Future Perspectives

# Epitome

In the literature surrounding serious games, one often finds reference to the so-called serious game oxymoron. Finding its origins in ancient Greek language, an oxymoron is a rhetorical device wherein two semantically opposite words are combined into one self-contradictory paradox (oxus meaning sharp and moros meaning blunt).

Abt (1970) was the first to identify the concept of serious gaming as oxymoronic, due to the contradictory nature of striving towards serious goals through making use of

an inherently non-serious medium.

After almost fifty years of further research, Games for Health (GfH), due to their inherent characteristics and opportunities, are still seen as promising regarding the possibility of their application in educational settings. However this application is as of yet far from commonplace. More precisely: the digital games and game-like interventions that have been applied within Health contexts are for the most part simulations wherein verisimilitude seems to be an almost necessary condition.

This thesis asserts that this design rationale focusing on realism, while perhaps being a perfectly reasonable choice in approach, upholds the current way of regarding serious games as oxymoronic, and therefore attention should be shifted toward different forms of serious gaming. Apart from the aforementioned simulations that are defined by their truthlikeness and a literal reflection of our reality, we must not forget the existence of games that follow a different design rationale, focussing more on figurative, metaphorical contexts as carriers of the gaming experience. It is predominantly this last type of game that seems most promising for effectuating lasting behavioural change and other educational goals.

Having systematically reviewed medical databases, it has become clear that games of the latter category –those relying on figurative rather than literal contexts- are almost completely unrepresented within Health applications. Tackling this matter through the conceptual lens of educational transfer offers the theoretical foundations for designing and applying this as of yet vastly unexplored type of serious Games for Health. Fundamental to the Game Transfer Model, as introduced in this thesis, is the assumption that the external appearance

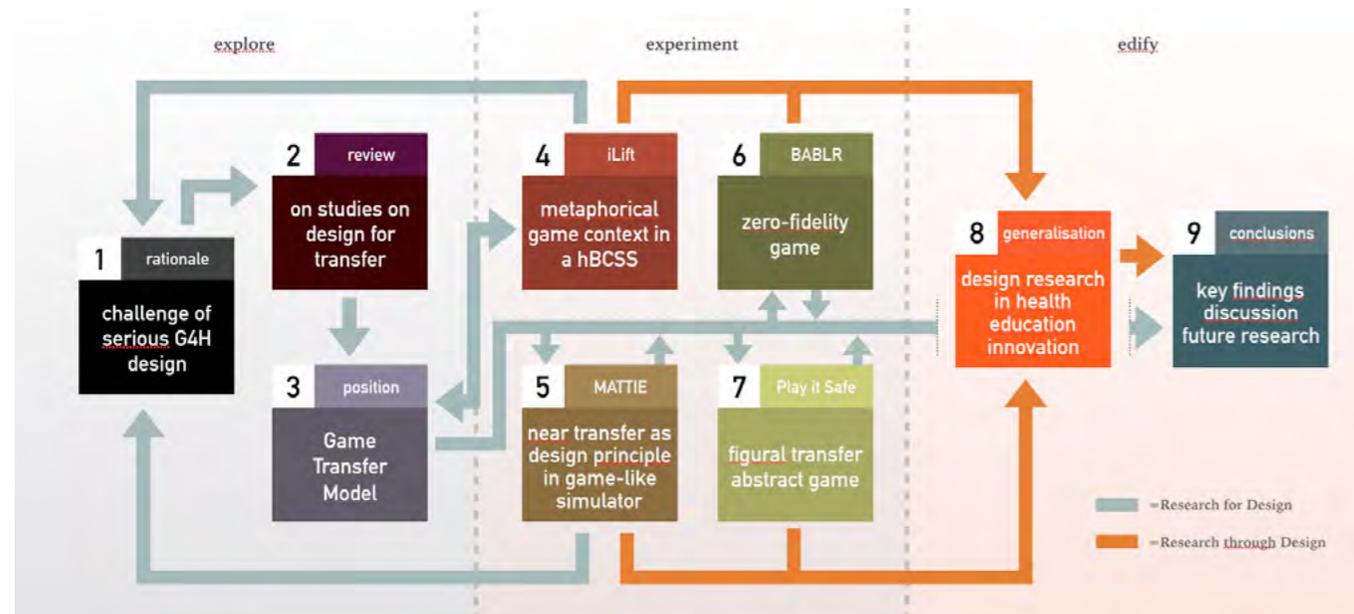
of a serious game foreshadows the type of transfer that said game will ultimately incite. This approach, encapsulated within the moniker design for transfer, has been the driving premise behind four studies focussed on designing non-literal serious gaming prototypes for Health.

## Two tracks

As shown in Figure 1 from the introduction chapter, there are two tracks that run through this thesis. The blue route deals with the exploration, conceptualization, and application of transfer theory in the design of games and game-like interventions regarding various serious goals. It is the key findings and conclusions from the blue track (Research for Design) that form the heart of this dissertation.

In order to carry out the experiments, a design research approach was followed to investigate multiple variants of the game-like interventions for suitability and effect by means of prototypes. It was precisely this applied way of research in various Health contexts that yielded interesting by-catches, which are visualized in orange in Figure 1. However, these by-catches are not merely accidental and are thus to be understood as Research through Design [1].

Figure 1: a schematic overview of the chapters in this thesis in their mutual relationship.



The Layers in Serious Media Design framework (LisMD) was developed in order to elucidate the design research process of the gaming prototypes described in this thesis. While an educational-scientific perspective is already represented by the GTM, which identifies a new route for design rationale, the LisMD-framework works as a blueprint, a constructional plan of arrangements so to say, for creating a design research process for serious game-like interventions. All the while, mutual values from both Health Science and Design Practice are taken into account.

The findings of this thesis are of the utmost importance for both designers of games for Health as well as innovators in education because: a) these findings have deep implications for enhancing the way in which instances of serious gaming can be more directly matched with specific educational or behaviour-changing goals, and b) these findings prove that there are many possibilities for enlarging the arsenal of serious games and game-like interventions within the field of Health. Moreover, this thesis explicates the need for more attention to design research and abductive research methods in Health curricula, in order to prepare for future challenges.

## Pt I: Blue (Research for Design)

Games and game-like interventions are widely regarded as an important carrier of learning and are even mentioned as a new paradigm for e-learning. Although the usefulness and possibilities of this technology are beyond dispute and there is sufficient support from scientific research, there is no widespread use of games in Health. Of course, the acceptance of such media as a serious educational instrument plays a role, but, certainly, in Health and Health care, truly meritable examples of serious games are rare, apart from simulations for training purposes. There (as of yet) is no wide adoption of games and game-like interventions within Health curricula.

It appears to be a wicked problem to design serious games that retain the unique and motivational characteristics that make games as a learning tool interesting in the first place. From an analytical perspective, game research studies the successes of major game titles and then concludes that our own serious games have adopted a number of characteristics, but lack the real look and feel of 'a good game'. Development budget is mentioned as an important factor for this, but that alone is not a tenable argument:

even in indie game development, very attractive and effective games are developed at a fraction of the budget available for educational instrumentation in general.

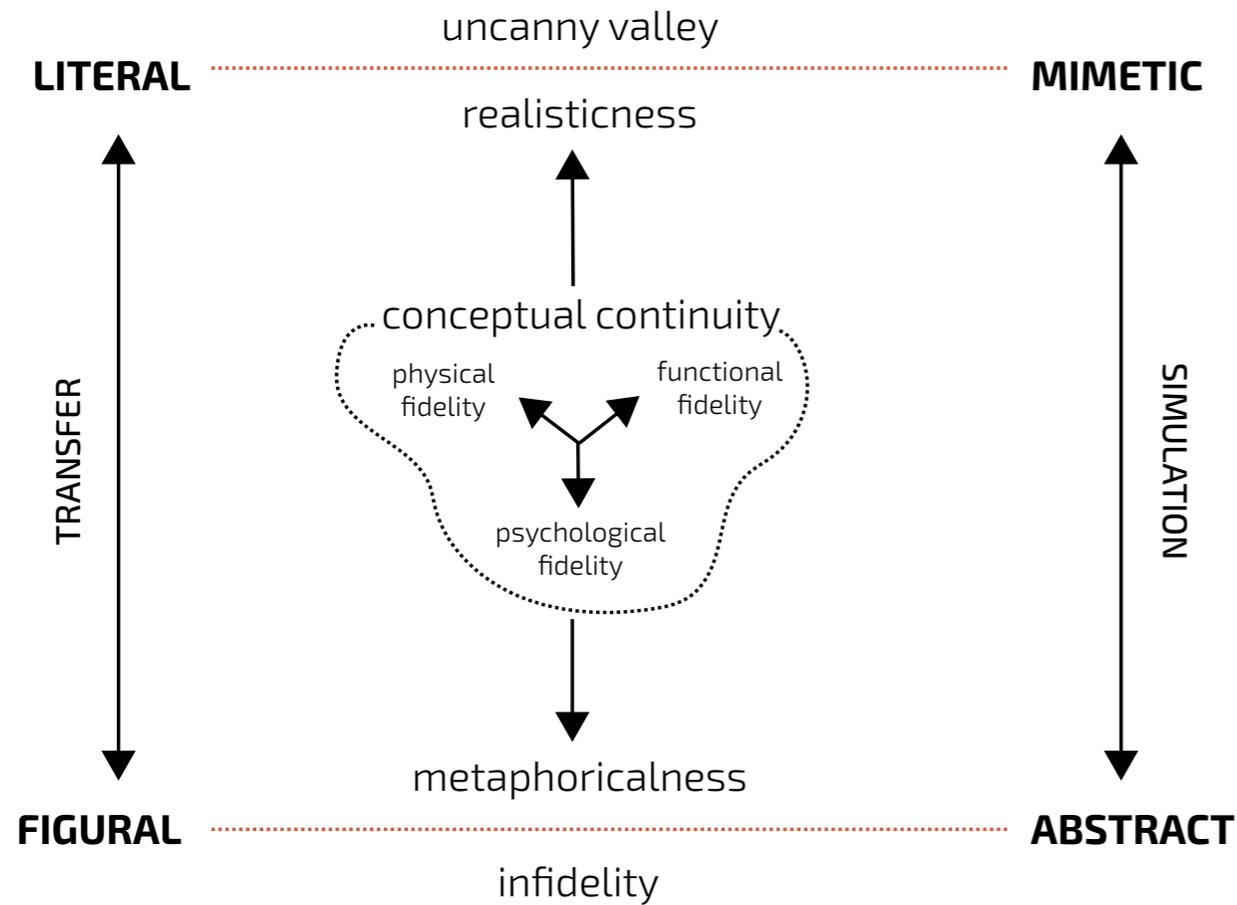
This research explored a possibly novel educational angle on how learning and behavioral change can be embedded in a game. Transfer theory offers an interesting starting point for this, in particular, the idea that one can design specifically and intentionally for learning to take place via a certain transfer road. Serious games, in general, tend to be literal, preferably high fidelity simulations of known reality. This literal approach of games for Health relies, whether intentionally or not, on (a form of) literal transfer. Key for literal transfer to occur is the degree of similarity of the simulation and the targeted context. Verisimilitude is conditional for its expected effectiveness.

At the same time, this rationale excludes other forms of transfer, the so-called second-class transfer types, which could make other, non-literal, manifestations of serious games possible. Game types that do not literally represent reality or lack an instantly recognizable link with reality, are rarely considered as serious games for learning or behavioral change.

In **Chapter 2**, a systematic review was executed through a literature search in medical databases for game research specifically aimed at more abstract, non-literal games. From almost 20,000 articles on serious games for Health, we found 3 studies in which the designed games utilized non-literal game elements. We found that in studies on game-like interventions for Health and Health care, transfer is regarded merely as a desirable effect, not as a guiding principle for design. None of the studies determined the second class of transfer or instances thereof. Games and simulations for Health abundantly build upon the principles of first-class transfer, but the adoption of second-class transfer types proves scarce. One of these 3 studies explained the design rationale, the other studies did not describe why or on what grounds this particular type of game was chosen.

The question remains whether this preference for literal instantiations of serious games is a conscious one or that it is simply because of not considering or knowing alternative transfer types. In addition, the proven one-sided transfer approach in the design of serious games for Health can be regarded as an obstacle in the endeavor to embed serious content into a game: the notorious) serious gaming oxymoron [2].

Figure 2: The Game Transfer Model links transfer types to instantiations of simulation, ranging between realisticness and metaphoricalness.



Loss of sense of time, loss of self-awareness and environment, heightened ability, control and agency, providing an autotelic experience and suspension of disbelief are coveted game features known from the literature. These properties are linked to motivational qualities, often found in imaginative worlds, providing intriguing adventures

and curious quests. These games can be considered serious when in-game actions or experiences are meaningful for the target context. Making these meaningful actions explicit often happens before or after playing the game, which in literature is referred to as the motivational or reinforcement paradigm [3]. Pre- or debrief sessions are an essential part of the design of this type of

serious games and require a specific educational perspective. It is important to point out that the notion of learning and especially the transfer of learning to the target context seems to be a steering mechanism in the design of games or game-like interventions, and may be the cause of a one-sided approach in game design. This dissertation is about the exploration and application of precisely the counterpart of the known literal simulation of reality. Tailored to what needs to be learned, it can be an intentional choice to opt for non-literal game design. Educational science provides the theoretical underpinnings for such an approach in the form of transfer theory, where the various forms of transfer of learning are divided into a clear, literal way and a more difficult to capture abstract way.

**Chapter 3** combines insights from various scientific disciplines (media and cognitive psychology, educational technology and game design) to construct the Game Transfer Model (GTM, Figure 2). This model forms the theoretical framework and design hypothesis for a number of prototypical game-like interventions, in which experiments are conducted with design for figural transfer.

### Passage

An example of a metaphorical, abstract game is Passage. Passage is a very minimally designed side-scroller game, which can be played in a few minutes. You are an avatar, who has to maneuver through a two-dimensional maze as your life unfolds. You become aware of the passage of time through decreasing vividness of colors, the

Figure 3: The protagonist a few moments before the death of his spouse.

Image: © Jason Rohrer, All Rights Reserved.



finding/marriage-and death- of a partner, and your own external characteristics that indicate the dissipation of your life. All of this happens relatively quickly and you become aware of it while playing. Due to the fixed duration of the game and the player's steady aging, regardless of the in-game choices, the game ends with the death of the avatar. In the game, the player spends five minutes experiencing a character's entire lifetime, but that is more than enough to evoke a powerful emotional experience. *Passage* is an example of a game without high fidelity graphics, deliberately set up very minimal, which nonetheless still maintains an immersive character. Although the game has not been designed as a serious game, it does provide a number of lessons. The reminder of life being volatile and thus the importance of being considerate to one another within its relatively short span, perhaps even leading to a reevaluation of one's own existence are possible benefits after playing.

### A game is a context is a metaphor

In **Chapters 4, 6 and 7**, the Game Transfer Model (GTM) was used as a starting point for designing game-like interventions in various contexts. In these design-oriented projects, GTM was applied to design games, wherein

the serious goals are achieved by a second class of transfer type. As proposed in the theoretical exploration in **Chapter 3**, a process of metaphorical recontextualization has been initiated for this purpose. In each project, the essence of the issue at hand was investigated and, together with content experts, possibilities for a non-literal approach were explored. In all cases, a design research approach was used to find the best suitable metaphor for the target group in question and the intended results. The preservation of the described conceptual continuity to prevent fidelity dissonance was fortuitous. The *iLift* game experience (**Chapter 4**) is designed to trigger figural transfer of lifting and transfer techniques (LTTs) by offering a series of carefully chosen and calibrated metaphors. The game mechanics scaffold the players' in-game behavior: static LTTs are recontextualized and repurposed in a game context. Within this research, we have been able to demonstrate that, in terms of Health behavioral change supporting systems (hBCSS), compliance and behavioral change have been realized. In retrospect, also driven by the course of the project, the gaming artifact has worked in a blended transfer manner. The LTTs were automated by repeatedly playing and mimicking the actual necessary techniques in a true-to-life manner. Learning and behavioral change are achieved by low road [4], first-

class transfer. The awareness of the importance of and insight into one's own lifting and moving behavior was triggered by figural elements. In **Chapter 5**, the Design for Transfer rationale led to a design for a game-like simulator for training social problem-solving skills in adolescents with a mild intellectual disability, as an addition to the field of psycho-education. A specific characteristic of mild intellectual disability (MID) is that transfer of learning hardly occurs with this target group. Cause and effect relationships are barely established and lessons learned do not transfer to new contexts. Existing psycho-education is given in a therapeutic setting, whereby transfer (in whatever form) to the real-world context is taken for granted. The literature on MID describes that abstractions (and therefore possibly metaphors) are too complex for this target group and that learning should take place in line with the world of perception as much as possible. In the design, we maximized authenticity and realism, not just in the appearance of the presented video cases, but also in timing and in the presentation in the personal, non-therapeutic setting, contributed to the optimization of transfer conditions. Maintaining conceptual continuity was key in the successful design for near transfer: a first class, literal transfer type.

As stated in **Chapter 3**, a key driver of success for a good serious game is conceptual continuity. Congruence in fidelity types is therefore made conditional. To further explore the possibilities of designing for figural transfer, an experiment with a prototypical game-like simulator was conducted, as described in **Chapter 6**. Magnifying the notion of low fidelity to a somewhat overstated extent, this study deals with a zero-fidelity stimulator, building on existing theories about reducing fidelity. Usually, fidelity is about abstracting all physical and functional elements. But there is a third type of fidelity, which forms the soul of the game experience: psychological fidelity. In the literature, psychological fidelity receives significantly less attention, although it correlates strongly to credibility, suspension of disbelief, and engagement. The *BABLR* simulator reduces physical and functional fidelity to a minimum (hence the label zero-fidelity) and explores the use of psychological fidelity as the main carrier of an authentic learning experience. Future learning and meaningful experiences gained within the zero-fidelity simulator can, due to the lack of both physical and functional fidelity, only be attributed to transfer via a figural, second class transfer type (high road, backward reaching). **Chapter 7** describes the design choices and theoretical constructs that have led to the development

of an occupational safety game, going by the name Play it Safe. I was initially hesitant to include this chapter in this dissertation because the intended results were not achieved. In no way have any predictors of success been found, that could indicate the occurrence of transfer towards increased situational awareness. Nevertheless, the article is included, because the experiment with designing for a second class transfer type has been of value in exploring the Game Transfer Model. Play it Safe is a tower-defense game that uses situational data collected by employees during their daily work, to impact the parameters of the game. This data is gathered through a safety campaign called Count Yourself Lucky (CYL) to quantify the amount of times employees used the supplied STAR-safety protocol (Stop Think Act Review). Play it Safe aimed to improve employees situational awareness, creating a shared mental model and bottom-up accountability, meant to improve and align shared safety behaviors. In the game, the real-life data for decision-making encountered in the work environment is recontextualized and was expected to subconsciously reinforce the training of the STAR-protocol and conservative decision-making in real-life.

The main problem with the game was that use context was not sufficiently taken into account in the design -and thus recontextualization- of the gaming artifact. The main reason for the use of a metaphor was not prompted by the desire to consciously design for a specific transfer type, but by the idea that a generic metaphor could be appropriate for all kinds of security issues. This resulted in a game metaphor that was far from recognizable to the intended end user, making it unrelatable to any context and thus untransferable. This conclusion is an important lesson in intentionally designing for non-literal transfer: the metaphor must bring together use context, user context, and technology context [5] in a consistent whole while addressing the right problem.

In summary, it can be concluded that metaphorical recontextualization is effective as a design principle for designing serious games and game-like interventions for Health. An important notion is that learning or behavioral change in such Health contexts occurs through second class or transfer types, and more specifically figural transfer. The main reason for considering design for figural transfer in thinking about serious game design is that it offers opportunities for designing close to the nature of what a game can be. In a number of con-

texts, experiments were conducted with designing for figural transfer. Because of the difficult to capture nature of transfer, it is usually measured on mere learning, something that is often seen in serious games: the decontextualized offering of explicit knowledge in a gamified form. These are the games in which serious goals do not or hardly coincide with the systemic affordances of (good) games: the baby is thrown away with the bathwater, while we are left with only mediocre games, that are marginally enjoyable to play.

If a serious game is seen as a context of its own, designed to optimize transfer conditions, the serious goals must be meaningfully recontextualized, whether or not in a metaphorical way. Monitoring conceptual continuity, carefully weighing up fidelity types in accordance with the goals to be achieved and a deliberate, predetermined choice for the entertainment-educational blending paradigm, will lead to better games. Introducing figural transfer in the design of serious games hands the educationalist tools to explore new (or under-exposed) ways to get serious content across and enables game designers to integrate serious content in more playful ways. It is a known fact that transfer is difficult to

measure, mainly because it is never exactly clear when and in what form it will manifest itself. Measuring the effects of education is therefore often limited to measuring mere learning, or 'memory tests' versus 'different learning experiences' [6].

The use of metaphor is a well-known didactic principle, probably as old as humanity itself. The Greek word μεταφορά (metaphorá) actually means 'to carry over' or 'to transfer'. A metaphor is a designed context within which everything is connected, has meaning or within which truths are packed, waiting to be discovered. A game can very well be such a designed context.

## Key findings

1. In designing serious games or game-like interventions for Health, transfer of learning or skills is seen merely as a desirable outcome, not as a guiding principle to aim for.
2. The intentional application of second class transfer does not occur in the design of serious games or game-like artifacts in Health, which excludes the most immersive and successful game types.

3. The occurrence of transfer of learning is problematic to measure, which is why tests are often limited to determining the presence of mere learning. The result is that mere learning in serious games almost always results in literal or de-contextualized instantiations of serious games.
4. The application of metaphorical re-contextualization is a complex and creative step in translating design choices into a manifestation of the game-like artifact. Based on educational principles regarding second class of transfer, the GTM expands and advances the possibilities of serious game design for Health in accordance with the innate properties of video games.
5. Moderators for triggering learning experiences e.g. wishful identification, parasocial interaction, narrative transportation, immersion and presence, flow experience, mastery of challenges, and suspension of disbelief are particularly suited to be enhanced through abstract, second class transfer game types.

## Pt II: Orange (Research through Design)

The Game Transfer Model is a demonstrated practicable addition to the discourse surrounding the design of serious games for Health. In numerous conversations and presentations, the model has invariably been supported and approved, and the experiments from this thesis yield enough early predictors of success to justify further research. However, in a hypothetical state, it remains a theoretical construct, and thus without tangible implications. The aim of this thesis is to assess the merits of the design hypothesis labeled Design for Transfer in different Health contexts. **Pt I** of this chapter described these contexts and their conclusions, **pt II** reports on a number of noteworthy by-catches, especially regarding the models developed to bridge the gap between Health and Design.

Research and development of interactive digital Health interventions, like games for Health, require expertise in identifying user needs, utilize abductive design techniques and call for the ability to appropriate prototypes towards proven effective interventions. Two of the central areas of expertise required are Health (broadly defined) and Design Practice. In carrying out the experiments, it turned out that these two worlds still seem far apart. I will endeavor to illustrate this with an example.

Figure 4: The Re-Mission video game was created by HopeLab specifically for young cancer patients.

Image: © Realtime Associates / Hopelab, All Rights Reserved.



**Chapter 2** describes a systematic review in which examples were sought of the presence of figural transfer in serious games for Health. In advance of the review, we had knowledge of the existence of the video game Re-Mission [7]. Re-Mission is a well-known example of a successful game for

Health, designed for children with leukemia. Video-game play includes destroying cancer cells and dealing with common treatment-related adverse effects. The player controls the microscopical nanobot Roxxi to battle cancer in the body of a fictional cancer patient. She does this by shooting

bad cells with a chemo-blaster, using rockets loaded with medicines, floating through the lymphatic system. Re-Mission makes obvious use of non-literal metaphors, and, from the perspective of this research, clearly uses second class transfer in achieving its results. In a number of studies, the effect of the game is convincingly demonstrated, especially in terms of increased therapy adherence and self-efficacy among the target group. However, the studies on Re-Mission did not surface in our systematic review, even after broadening the scope of the search strategies. A closer look at the main studies on Re-Mission showed a focus on the effects of the game. These were measured by comparing them to a knowledge test in a control group: testing mere knowledge. A mentioned working ingredient for the expected effectiveness of the game was found in the self-modeling theory [8], without further exploration of how this theory leads to the chosen design of the game. Studies on Re-Mission do not describe why the game looks as it does, nor do they give generalizable clues or design principles for future serious games for Health.

Not explicating the design of Re-Mission, makes the chosen appearance of the intervention, which has proven to be successful, almost seem to be based on coincidence. This is obviously not the case since in Re-mission 2, in the successor of the first game, the purely knowledge-based educa-

tional elements are reduced and the focus is mainly on where the first version proved successful: boosting positive emotion, increasing self-efficacy, and shifting attitudes toward chemotherapy.

Although Health and Design share some research methods and values, interdisciplinary research invariably poses challenges: values, assumptions, terminology, methodology, and culture make interdisciplinary collaborations challenging, often resulting in sub-optimal project outcomes [9]. Testing and validating, on and with the shop floor, the Design for Transfer hypothesis, as conceptualized in the GTM in actual Health practice settings, required a common language necessary to get design research approach understood and accepted in the contexts of Health Innovation.

In an effort to address these aforementioned differences, design through research (orange track) resulted in the development and application of an overarching model. Whereas the Game Transfer Model (GTM) forges a specific, unexplored connection between educational transfer theory and serious game design and is, therefore, a specific addition explicating design rationales within the design space, the Layers in Serious Media Design is a framework for the well-founded design, appropriation, integration, and testing of (digital) artifacts with serious intent. The Design Research

Framework is placed in the design space of the LiSMD which monitors both the iterative and incremental character as well as the required rigor-relevance balance within the design research process.

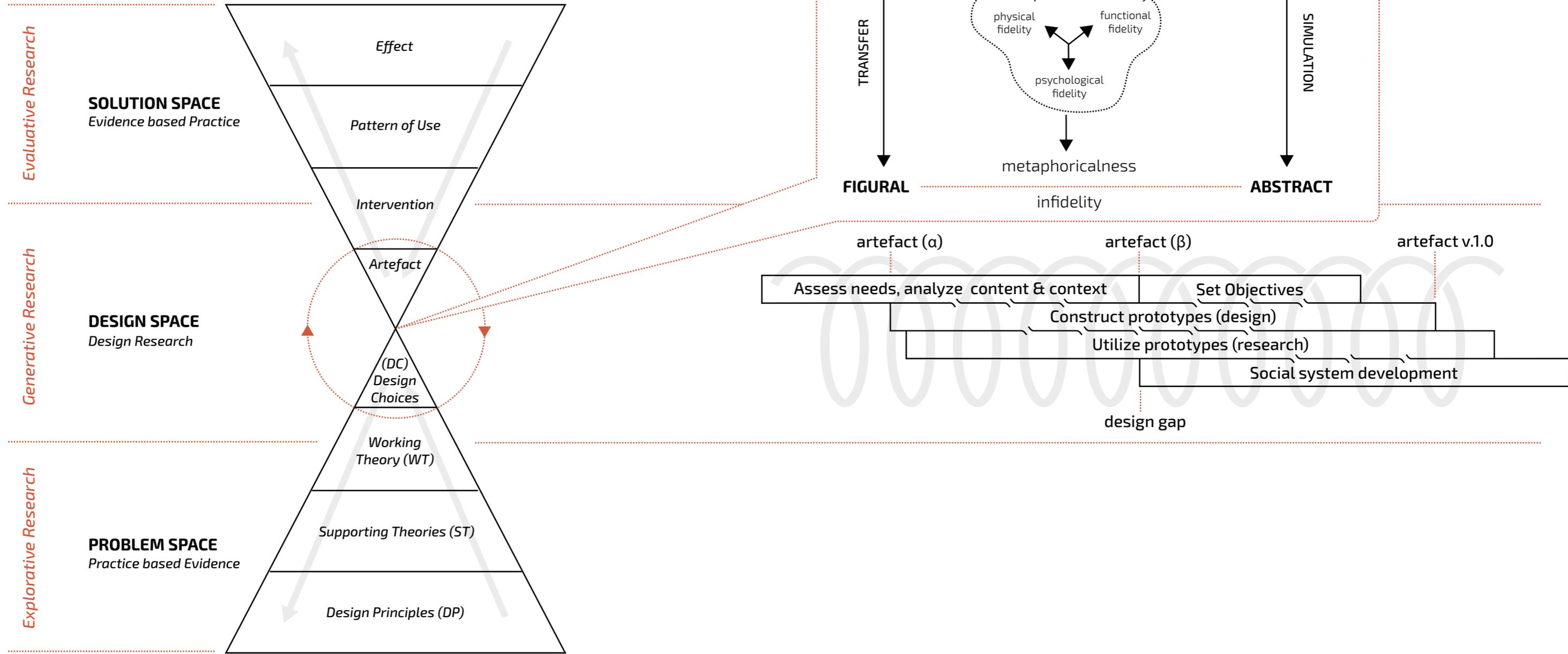
In **Chapter 6**, LiSMD is presented in its entirety and used within the BABLR context. In the previous contexts, initial ideas and precursors of the framework have been used. Chapter 8 is devoted to the difference in Health and Design culture and provides further substantiation for the LiSMD as an in-between object and an explanation thereof. The LiSMD framework fulfills a number of functions. First, it can be used as a means of communication, particularly to unite the world of Health and Design. Besides the professional, cultural, and vocational differences, there is an important distinction in research philosophy. The LiSMD places explorative, generative and evaluative research in its own spaces, each with its specific methods and position in a design research process. Secondly, the LiSMD can be used as a guideline in design research by interpreting the layers in the spaces as (not necessarily consecutive) steps to be taken in the process. Documenting the methods used and the subsequent findings per layer ensures the explicitation and substantiation of the design process. The iterative and incremental character of the research as it

takes place in the Design Space is illustrated by the Design Research Framework. This gives further substance to the way in which design research informs the gradual build-up of an artifact. Thirdly, LiSMD ensures that known evidence-based knowledge is given a clear place in the design process. In line with the serious intentions of the artifact to be designed, the active ingredients from an appropriate, existing Health intervention or theory form the starting point. However, the goal is not to provide a digital, game-like translation of an already existing, analog approach, but to create a new artifact with an innovative approach to the issue at hand, combining the critical appraisal from Health and the abductive character of Design.

In summary, the LiSMD model provides a cross-domain perspective and overview of key areas for achieving an innovative and effective artifact with serious intent. Besides the theoretical foundation and use of practice-based evidence from the problem space, the model places focus on the design space, in which iterative and incremental design research works towards early predictors of success. This leads to a blueprint of an artifact which, besides being the carrier of the working ingredients in a new form, is also a concept trialed on appropriateness and social acceptance before entering the solution space. In this way, the artifact will be fitted to

Figure 5: Layers in Serious Media Design (left) and its relationship with Design Research Framework (right)

& Game Transfer Model (top right).



meet the serious objectives and the chance of an effective intervention will be optimized. All this offers a new understanding of what is now called implementation.

## Key findings

1. LiSMD offers a framework within which shared language, perspectives on research and design practices are combined and can, therefore, play a supporting role in (the discourse on) design-oriented research processes aimed at designing artifacts with a serious approach, such as games for Health or digital innovations in general.
2. Especially design-in-the-large is lacking in Health innovation projects, where implementation often replaces the crucial phase of social system development. Social system development within Health innovation aiming for artifact development should be an integral part of a design process for successful adoption.
3. Designers of Health curricula and professionals in the field of Health innovation are called upon to pay attention to a cross-domain perspective. In particular, the introduction and use of design research for achieving innovation and finding solutions for wicked problems require attention. Creative confidence,

abductive reasoning, and a designer's mindset are competencies that belong to the Health professional of the future.

4. Studies on proven effective games or game-like interventions for Health should explicate their design rationale, so generalizable design knowledge becomes usable for future G4H. Successful game-like interventions are the result of a well-executed design research process, from which lessons must be learned to advance the field of Health Innovation.

## Future work

'Designerly ways of knowing' may sound insubstantial, but is exactly what Health culture should be looking at in its search for innovation through serious digital interventions. Health research has a rich history in the sciences: studying the natural world with profound cultural values such as objectivity, rationality, neutrality, and a concern with truth. Values of Design can be found in practicality, ingenuity, empathy, and concern for appropriateness [10]. In order to master these values and appropriate research methods, the manner in which people are educated is just as important as the matter which is transferred. The above is in itself a wicked problem for future Health education, however insufficient

attention is devoted to the matter in current curricula. en lijkt niet een punt van aandacht in huidige curricula. The values of Design are more easily understood when taking into account the contexts of, for example, the development of serious games for Health or e-Learning purposes. Especially considering the ageing nature of our world's population and an ever increasing reliance on (health) technology, values of design are ever more indispensable in the process theorizing about future proof Healthcare.

As addressed in **Chapter 6**, problem-based learning, defined as learning that results from the process of working toward the understanding or resolution of a problem [11], offers leads. Exposing Health students in multidisciplinary teams to authentic and ill-defined activities concerning design issues with real-world relevance [12] may connect problem-based learning principles to design research.

Furthermore, it must be concluded that Health, when regarded as a subculture in and of itself, has now reached a crossroads where it must either choose the path of complacency toward its long-established habits, protocols and lines of thinking, or, instead of opting for a remissive attitude toward positive change, choose the path of innovative thinking. Of course, it can not be denied that Health's rich history and its ingrained values are of unmistakable im-

portance stature, however when it comes to designing and innovating within Health contexts, these values are decidedly constraining in their effect, rather than conducive. The fact of the matter is that almost no attention at all is devoted to explicating the design rationale behind serious games for Health.

So long as scientific publications constrain their area of research to solely the question of effect, rather than the preliminary design of serious games, knowledge regarding effectively designing serious games will remain marginal and insufficient. However, this dissertation's message reaches further than just the specific practicalities regarding serious games within the field of Health. What has been described here about the matter of serious gaming is a symptom of a far larger problem of negligence toward those skill sets and insights that derive from outside Health research itself. Therefore this thesis also serves as a call to action for all those working on development and innovation (of educational and technological (products/mediums/media)), to be receptive to insights from other fields of study, that might at first seem strange and startling, but in the end may very well have a great chance of sparking much needed innovation. Through the experiences of the experiments conducted in this dissertation, it has become clear that one must be wary of too easily conforming to currently prevailing lines of thinking with regards to education

and research, as they are rigid obstacles on the way toward progress.

Another suggestion that may be helpful in thinking about, designing, and embedding game-like artifacts and serious games for Health is to see innovative attempts to this end as boundary objects. Even though there are different theories about what boundary objects are and how they work [13],[14], the idea that a shared object gets signified from different activity systems, promotes dialogue and mutual understanding. Future research should focus on whether the LiSMD framework in its current state fulfills its role as a boundary object or whether it should be refined by further trials in a novel context. Yet, I would like to conclude this point with the title of **Chapter 8**: don't jump to conclusions, and to approach this subject as a design issue itself, a wicked problem. The fact that the design research framework, as used and discussed in this dissertation, is based on a specific educational design model [15], could serve this purpose.

Then, for future research into design for transfer, there are a number of distinct research directions to formulate. This dissertation explains and substantiates how design for transfer can be seen in literal and figural game instantiations. The Game Transfer Model (GTM) is introduced as a means for designing and thinking about serious game design, stretching the pos-

sibilities from high-fidelity simulations to metaphorical fantasy worlds. The latter is important because it can substantially expand the possibilities of serious game design and is more compatible with the innate properties of a video game. By means of game-like prototypes, the design hypothesis that meaningful play can be achieved by designing for figural transfer by the use of metaphorical recontextualization was tested. The experiments proved that these so-called second class of transfer types of games can actually lead to learning or behavioral change, but at the same time revealed a number of contextual prerequisites. Conditional for a successful learning experience in a nonmimetic game-like environment is the preservation of in-game conceptual continuity defined by the congruence of fidelity-elements, which emphasizes the importance of the quality and inventiveness of the game design itself.

Further research is needed into the classification of what can and cannot be learned through second class transfer games for Health. Creative problem-solving approaches, decision making, lateral thinking, solution-oriented learning, identity development, and cognitive self-regulation are promising concepts for figural manifestations in games for Health and game-like simulations, but this is by no means a comprehensive list. A mapping to specific medical and Health topics has not yet been

created and should be included to find more targeted application areas.

Another question is whether metaphorical recontextualization suits every target group, especially if it seems to concern metacognitive skills in particular. The assumption at the time of writing is that this is not the case. Further consideration should be given to appropriate transfer types in respect of characteristics of the receiving target group.

Finally, it remains necessary to further test the GTM in several Health projects, preferably in studies in which prototypes - in terms of the LiSMD- reach the solution space. Here we will be able to determine whether the early predictors of success from the design space actually result in user patterns with associated data and lasting learning effects.

*Game on.*

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