

Functions of Prototyping in the Context of Digital Games Research

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Abstract: The field of digital games studies is still in the process of coming to terms with the multiplicity of its approaches; in particular, there are still few attempts at linking theoretical and practical perspectives on game-related phenomena. The article at hand argues that (rapid) prototyping, a common technique in the production of digital games as well as a number of other industries, using increasingly available low-cost, easy-to-use tools could usefully complement text-based research into digital games and, at least for specific types of theoretical problems, can lead to the playful generation of new ideas and arguments.

Keywords: prototyping, digital game analysis, game modifications, independent games, epistemology.

I. Introduction

In his keynote at the DiGRA conference 2009 in Uxbridge, video game scholar Ian Bogost summarized the current state of affairs in the study of digital games rather colloquially but accurately as a “mess” [1] after retracing and challenging key assumptions that have characterized the field. With regard to the multiplicity of approaches towards studying digital games, Bogost aimed at providing an ontological common ground, not to unify these approaches but to reconcile them and to allow for them to peacefully coexist. Bogost’s own methodological suggestion involves taking into account “the constraints of hardware and software design” which arguably constitutes an understudied, yet vital aspect of any discussion about digital games. This perspective is partially congruent with other recent approaches that urge a more detailed look at the technologies enabling recent media phenomena, including digital games, such as the software studies concept proposed by Matthew Fuller [2] and others or also earlier work on the contingencies of digital tools such as Adobe Photoshop and After Effects by Lev Manovich [3].

In order to adequately take into account the implications of increasingly standardized software used in creating digital games, a middle group between established media studies methodology and practical application is important. For example, such a perspective would sensitize the analysis towards contingencies of interfaces or built-in template functionality, which shape production processes. One such example is the real-time modifiability of audio filters in the

industry-standard audio pipeline Wwise which is being routinely used to randomize sound parameters to avoid repetition in MMOGs [4] or to script high-pass filters for psycho-acoustic effects such as temporary hearing loss after an explosion. In order to bridge the gap between theory and practice, the article at hand shall follow up on the research focus proposed by Bogost and explore the use of (rapid) prototyping, a common practice in the digital games industry as well as many others, not as a means of creating games but as a tool to analyze them.

II. Prototyping in Corporate Contexts

Prototypes are incomplete versions of a product that already contain key features, often in abstracted form, and demonstrate how they are supposed to interrelate in the final outcome, thereby giving a development team the opportunity to experientially find and circumvent potential flaws. In many corporate contexts such as software engineering and information and communications technology (ICT), prototypes and demos have long been advocated. [5] In the digital games industry, prototyping services have already reached the point of being outsourced to dedicated companies.

However, prototyping is still often conceived of as merely a technique to streamline production. For example, in the automobile industry, techniques such as selective laser sintering and 3D printing have been introduced since the early 1980s to create small, true to scale models from 3D data; these models can be used to gauge aspects such as aesthetics or aerodynamics more appropriately at an early stage, thus making production more efficient.

Within a corporate structure, prototypes are also at the same time a “basis for dialogue among a range of partners”, thus catalyzing and structuring collaborative work processes. [6] This function of prototypes is based on the assumption that creativity is not primarily a property of gifted individuals but of “creative relationships” between individuals, which create opportunities for innovation; Schrage describes this as an “ecology of collaboration” which usually produces the best results but both needs to be kept active and coherent in order to solve a given problem.

Prototyping can also affect the internal economy of a

department or project; for example, Electronic Arts game audio producer Leonard Paul argues that the audio team on a digital game project can profit from prototyping as a means of communicating its ideas early on during development, since it allows for being integrated into the process earlier and more thoroughly. [7]

The decreasing costs and efforts to produce prototypes both make this technique more readily accessible and, at the same time, extend their spectrum of usage. Similarly, with authoring tools such as Adobe Flash or Unity that allow for code re-use and, backed by strong user communities, enable the comparatively quick sketching of multiple, contingent instantiations of a concept, prototyping is gradually becoming accessible also to non-programmers and, thus, a feasible practice as part of a media studies curriculum with a games research focus.

III. The Impact of Tools and Practices on Knowledge Creation in an Academic Context

While the validity of (re)producing parts of a digital game as a means of theory formation might appear counterintuitive at first, it arguably ties in with other, similarly understudied implications of digital tools and their emergent effects on academic work processes and writing.

Stefan Weber offers a rather pessimistic analysis of a very basic example, the arguably disruptive implications of “copy/paste” phenomena within the cultural studies discourse. [8] While Weber focuses on the issue of plagiarizing, copy/paste can also be beneficial if used in a sensible manner instead of simply reproducing and rearranging fragments of other texts. From that angle, copy/paste processes as a pattern of theory formation can also be understood as a form of working with “textual prototypes” that are read against existing fragments and thereby generate new ideas and arguments.

This way of using text appears reminiscent of moodboards, a tool commonly used in design contexts rather than academic work. On a moodboard, various materials such as images, text fragments, color schemes, maps and diagrams etc. can be easily (re)arranged; among other things, moodboards are useful to generate ideas but also to homogenize collaborative design processes [9]. The materials on the board consciously narrow down the visual imaginary and facilitate discussions by providing all participants with the same set of ready-mades to express their ideas. Thus, applied to traditionally text-oriented disciplines such as media studies, it can be tentatively argued that the reuse of textual elements leads to design thinking and theory formation converge to some extent.

Earlier examples of technologies which, more or less obviously, restructured academic practices and, thereby, patterns of theory formation are the presentation program Microsoft Powerpoint [10] and the overhead projector, [11] which has been described and celebrated as a “forgotten [medium]”. For example, Wyss argues that technologies of collecting and showing images in art history discourse (which were refined and, thereby, further solidified over time) historically fostered the philological fixation of the discipline and its “adversity towards philosophy”.

This argument appears to substantiate the assumed overlap between art and science (or rather the discourses of art and

science) that Paul Feyerabend as well as Peter Galison and Caroline Jones have investigated. [12] Feyerabend describes how scientists necessarily construct their own ‘version’ of the subject matter instead of theorizing it from a ‘neutral’ vantage point; this rather polemic assessment touches upon the valid argument that ‘exactitude’ in scientific discipline is both practiced and ‘constructed’ at the same time. Thus, Feyerabend infers that the success of specific theories can be both due to their explanatory potential as well as ‘communities of taste’ that develop over time, similar to the success of formal styles in the art world. According to Wolfgang Hagen, the later falsified notion of an omnipresent aether in 19th century physics discourse constitutes a similar example of ‘taste’ in the context of theory formation.

The use of prototypes would arguably make this step more transparent and highlight the artificiality of theoretical constructs. On that note, for the purpose of actively embracing the idea of the scientist as an artist, it could well be fruitful to consider the relatively recent attempts at utilizing prototyping in the arts as a reference point. [13]

Recently, prototyping has emerged as a creative practice also in other non-technical contexts. For example, the paper “Rapid Prototyping to Support Experimental History” by William Turkel and Devon Elliott for the Playing With Technology in History conference (April 29-30, 2010) and related works indicate that prototyping as a method of historical scholarship implies a “playful” and “experimental” stance which can provide novel insights compared to established but less “sensuous” theoretical approaches. Similarly, the potential of digital games for historical education has been explored in [14] both theoretically with reference to Seymour Papert and Janet Murray and by building an actual simulation game, *A Journey to the Past*, using *Virtools*, another accessible authoring tool.

Within the game studies discourse, the influential notion of game design patterns proposed by Bernd Kreimeier as well as Staffan Bjork and Jussi Holopainen a couple of years ago [15] already constituted an attempt at utilizing models from computer science for the purpose of game analysis. The underlying goal of describing design patterns was to develop a stable formal language that would be reusable and sufficiently precise to enable other researchers to use the patterns, refining and re-defining them in the process. Thus, the approach reflects the desire to introduce “design thinking”, a production-oriented approach which is still increasingly being applied adapted to non-design tasks [16], into digital games research. In that sense, the patterns themselves can be regarded as conceptual ‘prototypes’ in that they are quick to produce (e.g. using previous patterns as material) and can be ‘tested’ to some degree since the fixed categories used to describe them allow for determining the logical consistency of a pattern with other patterns that have already been ‘tested’ in the same manner. From that angle, producing and comparing actual prototypes appears to be a plausible next step.

A. Theorizing media content via secondary media production

A cursory comparison between the current game studies discourse and the state of the early film studies during the 1920s provides further insights into how prototyping can promote theory formation. Most notably, that period similarly exhibited a growing intermingling of theoretical approaches

and practical experiments such as the so-called Kuleshov experiment.

Kuleshov and his production team actually created several experiments, most of which explored the potential of orientation matching from different angles. In one case, the same shot of a man watching something off-screen is intercut with different scenes, thus making the same gaze appear lustful, mourning our hungry. Another experiment links shot of different areas of Petrograd with orchestrated actor movement, creating the impression that the areas are geographically linked. [17] Thus, different effects of reusing shots in a montage (semantic transfer, spatial contiguity) are being identified by implementing them and allowing for others to evaluate the results or to modify some parameters. These experiments were not explicitly called prototypes but operated in a similar manner, i.e. they were being re-created, applied to different types of subject matter and repeatedly modified and discussed.

The notion of media production as theory formation was later elaborated on in the 1980s by Gilles Deleuze, who argued that filmmakers could not simply be associated with other artists but with “thinkers and philosophers”. [18] According to Deleuze, directors worked with “affects and percepts” rather than “concepts” and thus took a more visibly subjective perspective but still ‘experimented’, for instance with different forms of social or interpersonal organization (as motifs) as well as their corresponding narrative functions.

Arguably, with regard to the negotiation between theory and practice, the digital game studies can be understood as undergoing a similar phase of development as the film studies of the 1920s and could similarly benefit from initiatives such as the Kuleshov experiment in order to catalyze the numerous concurrent concepts and inspire new approaches.

This principle of ‘secondary’ media production designed to analyze ‘primary’ media content is reminiscent of media usage behaviour that both Henry Jenkins and Jason Mittell identified as “spoiling”. For example, Jenkins illustrates how fans of the TV series *Survivor* create a ‘meta game’ in which they gather information about the location and cast for the next season, incorporating that data into collaboratively create maps and other ‘secondary’ media forms. Jenkins describes this as a constitutive practice of “knowledge communit[ies]”. [19] According to Mittell and Gray, fans of the fictional format *Lost* similarly compile facts as well as their speculations on the narrative progression in genealogies, timelines and other paratextual materials that represent contingent accounts of how the story might continue. Again, both the use of ‘ready-made’ building blocks (e.g. screen grabs from the show, images provided by the official web pages etc.) and the ways of using and comparing these ‘secondary’ media texts (e.g. discussing the findings in forums and using verified materials as the basis for new experiments) are closely reminiscent of the aspects of prototyping sketched above.

IV. Game Modifications and Independent Game Creation as Forms of Prototyping

Describing an aspect of a digital game on paper is necessarily deterministic to some degree; observations have to be condensed into a coherent argument and sources are usually not instantly visible as context while reading the text.

Moreover, discussing an idea requires very precise and consensual terminology which game studies as a rather new discipline is still struggling to agree upon. [20]

On that note, a number of small but interrelated prototypes, which present the object of study in different ways, can ‘emergently’ produce an analytical proposition through overlaps but also incongruencies viewed differently by different users.

Thus, the prototypes operate in a way similar to the musical idea of ‘variations on a theme’, which also ‘analyze’ the source material - e.g. highlighting rhythmic intricacies or tonal particularities - by remixing some of its aspects. This musical analogy coincides with a design methodology for independent games that Erik Loyer based on musical performance and jazz history, which can be referred to as “story instrument[s]”. [21] Loyer thereby evaluates digital games with regard to their intensity, comparing sections of games such as *Super Mario 64*, which require a lot of effort to design in order to require as little effort as possible to play. From that angle, designing a game becomes comparable to musical improvisation, which oscillates between more and less intense sequences.

To illustrate the usefulness of a prototyping approach for digital game analysis, independent game design and game modifications shall thus be proposed as quasi-prototypes, which, albeit usually without an analytical agenda, explore the characteristic constraints and opportunities the medium. Again, most independent games are designed using off-the-shelf tools such as Adobe Flash or YoYo Games Game Maker and many designers reuse assets in order to be able produce games more quickly. Moreover, from a reception standpoint, games focusing on the same topic can usually be easily found and compared, either through independent games archives such as the Indie Games Weblog (<http://indiegames.com/blog/>) which extensively tag the games according to themes and game mechanics or through frequent competitions which purposely ‘prototype’ a given concept and are increasingly sponsored by the digital games industry (<http://jayisgames.com/cgdc9/>).

Similarly, by creating modifications of commercial games, mostly using a game’s internal set of tools, users arguably ‘analyze’ a game and explore its internal mechanisms by systematically overstraining the rule system. For example, the toolkit provided with the game *Star Craft 2* has been used to create a Tetris game, a twin-stick shooter, a racing game, a vertically scrolling shooter and a first-person shooter. [22] Thus, users illustrate points of contact between established game genres by tweaking the original rule system.

On a similar note, independent games such as *The Linear RPG* by Sophie Houlden can, understood as a prototype, potentially provide insights into the notion of spatiality in role-playing games in a different form than texts. While the genre mechanics conventionally revolve around the exploration and commodification of space (i.e. an unexplored topography), the game reduces the play space to a single path that the player can traverse. While the game by itself rather represents a parody, complemented by other, slightly modified instantiations of the same concepts, it produces valuable insights into topics such as the relationship between

exploration of space and character development (both psychologically and in terms of their capabilities) which most commercial RPGs handle in more or less the same manner. At the very least, it can provide insights into “which units [of the topic of spatiality in RPGs] matter” as Bogost notes in his aforementioned talk. [1]

Franchise mash-ups such as Super Mario Bros. Crossover and genre mash-ups such as Mamono Sweeper or Centipong, which constitute a common genre within independent game production, can also be understood as prototypes, not because they have been designed with that goal in mind but because they often inadvertently gravitate towards remixing the same popular franchises, identify key gameplay mechanisms and allow for exploring potential overlaps between game genres by testing multiple rule changes required to effectively remix these elements. Through forums discussions, these rule changes are later discussed and the feasible ones are perpetuated in follow-up projects.

In some cases, techniques ‘prototyped’ within the independent games community are already being taken up and, thus, introduced into mainstream discourse by commercial games. For example, one such gameplay element that has been adopted, albeit less prominently, in recent multiplayer shooters is the notion of moving via weapon recoil, which had previously been explored in experimental games such as Ammo Roar or OSpace. Also other similar mechanisms such as the sliding tackle which characterized the high-budget shooter Vanquish have previously been implemented, albeit on a 2D plane, in independent games. Again, this process appears plausible with regard to film where syntagms that used to be considered avantgarde such as Kuleshov’s montage techniques or the split-screen and multiple frame experiments in films by Peter Greenaway [23] have similarly been adopted in mainstream films.

V. Findings from Testing the Concept in a Student Workshop

To test the concept and determine factors that influence its successful applicability, we have applied it in the first of a series of workshops at the university of Bayreuth. For this session, the students did not program actual prototypes but described their concept in a pre-structured form as to facilitate comparison and allow for some benefits of actually implemented prototypes. Even using ready-made libraries and accessible authoring tools, teaching actual prototyping in a on-semester course requires a clear, goal-oriented structure; in order to proceed in that direction, Chaffin and Barnes [24] provide useful points of orientation taken from an experimental course.

We chose the very basic topic of symbolic encoding in digital games, i.e. the translating of a narrative function (in the Barthesian sense) into a rule system, because it represents a similar level of abstraction as the question of montage that Kuleshov, Pudovkin and others explored with their cinematographic experiments.

However, only few articles in games studies literature actually offer close-readings of games and identify actual mechanisms of signification. Most of these, such as Jan van Looy’s analysis of Head over Heels [25] as an ‘interactive

metaphor’ on the conditions of friendship, both date back to the early years of digital games research and work with older games that receive less mainstream media attention but, due to their ‘imperfections’, allow for analyzing technological constraints and gameplay mechanisms much more easily.

In order to ensure comparability of the prototypes, we focused on the immensely popular genre of block-matching games such as Bejeweled or Puzzle Quest. The core gameplay element in these games involves repositioning tokens on a game board to create sets of three or more adjacent tokens sharing the same color or other property. Due to the sheer quantity of games produced, the main elements (rules manipulating tokens, a grid-based game board, matching conditions etc.) crystallized over time through innovation, imitation and constant feedback in the form of sales figures. Jesper Juul describes the mechanics of the genre in more detail and also hints at the functions of online distribution for the spread of its “clones”. [26]

Through discussions during the workshop, we identified several requirements for effectively using prototypes to advance theory formation and discussed methods of incorporating this approach into a games research curriculum. Before summarizing the findings, a few sample concepts that were developed during the workshop shall be briefly sketched below.

A. Sample concepts developed within the workshop

The micro narratives explored using block-matching rules in existing games like Puzzle Quest usually have a very limited narrative scope such as bashing a door or casting a spell. Thus, the goal was to extend the concept to reflect more elaborate micro narratives, drawing loosely on structuralist typologies such as Vladimir Propp’s morphology of the Russian fairy tale or Joseph Campbell’s The Hero with a Thousand Faces, which offer a more or less exhaustive inventory of narrative archetypes.

The workshop concepts were not yet implemented using prototyping tools but rather sketched on paper as well as with paper prototyping methods [27] in order to give students time to familiarize themselves with this rather uncommon approach. Since, as Schrage and others point out, prototyping media are an integral aspect of the respective “cultures of prototyping” (e.g. in company workflows), in order to implement prototyping into a game studies methodology, they would have to be standardized and their implications on the theory formation process would have to be critically reflected. Thus, the concepts outlined below shall be briefly summarized with regard to their core gameplay mechanics.

The first concept students tackled was to convince an adversary in a discussion. In this case, no direct opponent is present but colored ‘argument blocks’ occupy the playing field and more come into play at random positions in real time, representing the need to think quickly in a discussion.

These blocks cannot be moved directly (i.e. the player cannot directly ‘change someone’s mind’) but instead they need to be matched with each other (i.e. to bring the opponent’s arguments into a contradiction) or with player blocks of the complementary color (i.e. weakening the opponent’s arguments through a counterargument). Thus, a red argument block could be combined into a match with green player blocks.

The longer the game takes, the more frequently new

argument blocks come into play. This both makes it harder for the player (signifying that the opponent has already ‘made up his mind’) but also creates more opportunities for combining the argument blocks with each other.

Once a set number of argument blocks have been eliminated, the round and, thus, the argument is ‘won’. There might be a ‘perfect win’ scenario with a corresponding bonus if the player can eliminate all argument blocks in play at a given time.

The second micro narrative involved courting another character and should be played against an AI ‘opponent’ or a second player. The playing field is made up of more blocks than usual, thus making it much more difficult to create combinations than in a regular game. The game is turn-based and both the player and the target of her courtship are making their moves at the same time but unaware of what the other is doing; both moves are played out simultaneously in each turn.

While games like Puzzle Quest require the player to strike at the opponent by making matches while preventing the opponent from creating useful combinations (i.e. from ‘retaliating’) at the same time, this objective is inverted for the game at hand. That is, the player tries not to make matches himself but to complement the other player’s anticipated combos, enabling him or her to create at least a x4 combo. Thereby, players need to try and understand their target’s intentions and act accordingly for a successful courtship.

A third concept dealt with the notion of remembering a person or an object. Underneath the blocks, a picture of the object to be remembered is displayed. By creating x4 combos or two subsequent x3 combos, players create ‘remembrance blocks’. Matching these blocks deletes them, thus revealing the corresponding part of the picture underneath. Matching four remembrance blocks deletes a 4x4 square around the blocks; this specific effort signifies focusing very much on a particular aspect of the topic to be remembered. The number of turns is limited and differs by difficulty level.

There is no way of failing the game but instead, the object is more or less completely revealed, thus helping the user’s pattern recognition more or less. This allows for an element of chance if the player only uncovers very few squares but if the picture underneath still allows for identifying the object to be remembered. Thus, player can apply strategies that transcend the block-matching gameplay; for example, if the picture recognizable depicts a person, they can concentrate their matches on the area where they expect the person’s face to appear.

Finally, taking the concept to the extreme in a tongue-in-cheek manner, the students discussed how syntagms reminiscent of particular films such as ‘dodging a bullet’ could be implemented using block-matching mechanics. In this case, the game would be limited to only a few seconds of play time (similar to the Wario Ware franchise) and players would be presented with predefined constellations that can be completely solved in one or two turns utilizing chain reactions.

B. Observations from applying the concept within a curricular activity

Applying at least the fundamentals of prototyping within a workshop lead to a number of observations on how integrate the process with existing theoretical approaches and how to utilize it to advance theory formation rather than running the risk of supplanting it.

First, existing theoretical frames need to be referenced in order to identify pending research topics with regard to the given genre or game type; for instance, for the workshop, we used the family trees of block matching games sketched by Juul [26] and the implied biological metaphor for game design history which coincides with the evolutionary approach towards software development [28] that characterized the early years of the mainstream software industry but still basically appears applicable today. In a concluding discussion, the participants should determine whether how aspects of the theory are applicable with reference to their own experiments and whether their prototypes provided connectable insights.

Another method that proved fertile was to directly correlate opposing pairs of prototype in order to identify key discrepancies as ‘working hypotheses’ that can later be juxtaposed again with other examples and narrowed down recursively to identify consensual theses, which might be applicable to other genres or narrative purposes. This technique follows the very fundamental notion of basic oppositions in cultural and literary studies [29].

The workshop was directed at students without previous knowledge of scripting languages or authoring tools; however, having a common set of tools and a consistent level of competence offers new possibilities. For instance, the impact that competitive forms such as game jams recently have on software development [30] could be leveraged in this context as well by using game-like mechanisms to further optimize the process. The fixed deadlines and the level of face-to-face communication at a game jam would, with some necessary adaptations, provide a fertile ground for utilizing prototyping as a means of digital games research.

Finally, the aforementioned examples from the independent game design context point to the fact that prototypes, in order to generate knowledge, need a broader platform for discussion so that their explanatory potential can unfold within discourse through productive dissonance between the individual users’ interpretations. This discussion can take place on blogs and forums where participants map their previous knowledge and assumptions onto the model. One potential problem is the fact that, in a rather loosely defined and open community, opinions often gravitate towards an emerging mainstream, which leads to a homogenization of concurrent perspectives and can decrease communicative activity. The concept of the media biotope proposed by Suto [31] could be a constructive way of modeling and avoiding this pitfall. Moreover, as hinted at above, the process is playful in the sense of paidia according to Roger Caillois, i.e. it encourages experimental recombination, which works best in a larger group or community.

VI. Expanding the notion of prototypes

While the aforementioned examples referred specifically to quasi-prototypical forms of games, the notion of prototype should be broadened further to expand its usefulness and to gain insights that might be adaptable to digital games.

For instance, Scott McCloud’s *Understanding Comics: The Invisible Art*, one of the defining works on storytelling in comic books, is presented in the form of an actual comic book, [32] which already hints at how game prototypes could be used for analytical purposes as well. The book can be read as a

collection of prototypes; however, the examples given in the book very closely tie into the central ‘narrative’ which slightly limits their associative richness in favor of a coherent account that fits its printed form.

Via an in-comic character, McCloud often directly points to the shared aspects between different varieties of a representation technique he deems most important rather than leaving that task to the reader. However, he still often provides multiple versions of a technique or stylistic device such as the often quoted adaptations of Magritte’s painting *The Treachery of Images* which is used to explain the principle of layering levels of representation in a comic book.

By comparing the examples, the reader can infer the distinctive elements. Moreover, *Understanding Comics* enables and encourages the reader to construct any number of alternative examples in his mind via extrapolation, which may lead to insights that the author had not even planned for.

This basic form of ‘cognitive simulation’ represent an important first step and can be seen in relation to computer-supported simulation as, for example, Keith Oatley argues, referring to Shakespearean theatre as a “simulation that runs on minds”. [33] Since the characters are created as to represent specific character traits or emotions in a particularly clear-cut way, the manifold interactions between these characters and the concepts they represent produce a consistent spectrum of potential outcomes which allows for the viewer to construct their own model of the human mind in a form of simulation. Since dialogue and action are necessarily deterministic (except for local forms of improvisation), the simulation “runs on” the viewers which process it both according to established interpretive schemes and their own experience and expectations, leading to divergent versions but based on a common ground.

This understanding of theatre as a “model of the world” is mostly consistent with other, later attempts that apply it also to other media genres. For example, the notion of literary anthropology proposed by Wolfgang Iser and Winfried Fluck avoids terms like simulation but similarly regards literature as a ‘laboratory’ for both individual and societal developments that are incompatible with the current situation but can be read as ‘prototypes’ for future societies.

For the purpose described in this paper, however, to cultivate this collective cognitive simulation process a platform for discussion – similar to the Shakespearean theatre as a catalyzing environment – would be necessary to both generate ideas and to condense them into a number of consensual arguments.

With regard to the current recent media landscape, the increasingly widespread text type of the tutorial meets these requirements and, therefore, can also be considered ‘prototypical’, i.e. as a means of analyzing media by creating additional layers of content. Within a tutorial, users attempt to reconstruct a given topic, often a genre or iconic design, by technical means, i.e. they create a working prototype that is fed into a social network, conceptually dissected, discussed by the community, and then tweaked until a mutually consensual version is achieved. For example, rather than describing the camera work in games such as *Resident Evil* (<http://www.ogre3d.org/wiki/wiki/tiki-index.php?page=3rd%20person%20camera%20system%20tutorial>) or *Final Fantasy* (<http://forums.create.msdn.com/forums/p/56655/345470.aspx>), authors of tutorials ‘reverse-engineer’ its constitutive mechanisms and express them via a scripting language. This

practice has the added benefit of implicitly illustrating how gameplay concepts are often tied to characteristic programming techniques and occasionally even stem from exploiting a given algorithm. For instance, the acclaimed game designer Geoff Crammond describes how the concept of his groundbreaking game *The Sentinel* (1986) was derived from an optimized algorithm for displaying and scrolling a complex 3D environment as well as a procedural level generation algorithm on the BBC Micro and the Commodore C64. [34]

VII. Concluding Remarks

The notion of generating positively ‘fuzzy’ knowledge on digital games via interlocking prototypes rather than producing a stringent argument in the form of a text might still appear uncommon and its value remains to be ascertained via concrete examples. These should ideally be designed to tie into an ongoing theoretical debate so that they can be read against existing, text-based findings.

Moreover, integrating game prototypes with traditional text-based research on digital games is a problem that would need to be tackled.

The source code of the prototypes needs to be shared to allow for replicating and modifying the chosen approach. A useful model of sharing knowledge within small research groups, which appears to be applicable for that purpose, is described in [35]. One potential issue will be the prototyping tool or language since, ideally, the barriers towards exchanging and extending prototypes should be minimal. For that purpose, an open standard such processing (<http://www.processing.org/>) with a large number of third-party libraries as well as an activity community would likely represent a good comprise.

As suggested above, the prototypes need to be augmented by layers of commentary that should ideally be presented in a separate frame while using the prototypes, similar to the manifold means of annotating videos on youtube and related platforms that have been added over the past few years. [36] As in the case of video tutorials above, these functions notably facilitated the social sharing of videos for quasi-prototypical purposes, for example - tying in with the previous paragraph - in the prominent case of video tutorials.

For topics that involve digital game reception, prototypes could be used with focus groups to produce more controllable and fine-grained empirical findings than if the participants were exposed to a given commercial game. In the context of in-game advertising, several promising metrics including focus group set-ups, usability techniques such as retina scanning as well as scripts, which directly evaluate player input have already been tested and could prove valuable for that purpose. Pursuing the idea even further, suitable forms of citing prototypes and other bibliographical aspects would need to be addressed as well.

The approach sketched within this paper is obviously not equally suitable for all types of theoretical problems. Examples of recent topic areas in game studies research, which could feasibly be tackled via prototyping, are the functions of metrics and quantification on the work-play balance ([37] goes a step in this direction by consciously focusing on a non-standard game example), location-based games affecting the players’ experience of spatiality or cultural performance in MMOGs. More application-oriented

topics such as motivational aspects in serious games [38] already tentatively utilize prototypes – albeit still mostly describing rather than sharing them – as a proof-of-concept and can thereby provide further methodological insights.

Another constitutive aspect of “cultures of prototyping” according to Michael Schrage are that the types and quantities of questions that can be answered via prototypes. [39] While in film studies, a ‘culture of prototyping’, i.e. a somewhat stable and conscious relation between theory and practice, has tentatively developed over time, it remains to be seen whether and how the same will occur within the game studies discourse.

To determine the conditions for integrating prototyping into games research methodology, more actual applications – i.e. prototypes – are necessary rather than resorting solely to theories of learning. At any rate, as a complement to purely theoretical perspectives on digital games, prototyping appears to be a feasible and potentially valuable proposition, not least as a means of analyzing games as program code on a level of abstraction at which it is meaningfully observable

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