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Games Versus Reality? How Game Designers Deal with Current Topics of Geography Education

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Abstract: Digital entertainment games frequently address current societal issues that are also dealt with in geography education, such as climate change or sustainable city development, and give various opportunities for learning. However, in order to be fully able to determine the games' educational potential and to instruct meaningful reflection on them in class, the designers' approaches to realism regarding these topics need to be understood. Therefore, we have developed a model of realism in games and conducted 9 interviews with 10 experts from the entertainment game industry about their understanding of and dealing with realism concerning the represented geographical topics. In many cases, the interviewees' approach to incorporating real-world issues can be regarded as beneficial for their games' educational potential, and some designers even pursued learning goals. However, we also identified approaches that can result in questionable presentations of real societal issues. We found the most problematic one to be the prioritization of player expectations for the sake of perceived realism. This approach may lead to the depiction of stereotypes and common misconceptions. The results presented in our study may help teachers to prepare reflection on such misrepresentations in class, or designers to become more aware of the educational implications of different forms of game realism.

Keywords: game-based learning; digital games in geography education; game design approaches; socio-ecological challenges; game design expert interviews

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1. Introduction

Current socio-ecological and socio-political challenges and phenomena, such as climate change, sustainable city development, migration and resource conflicts, are topics that pose relevant challenges to our society as a whole. These topics should therefore be integral in the education of the generations who will be responsible for developing solutions within them. The drivers of these are both natural and anthropogenic factors and, as such, geography is the most relevant school subject in which to explore these issues. Geography is regarded as the subject that provides the link between natural and social science education, with human-environment-interaction being the major focus of the subject [1].

Commercial digital games also address these issues. For example, urban development is at the core of games such as Cities: Skylines and SimCity, climate change affects the game world in Civilization VI, and in political simulation games such as Tropico and Democracy the player governs migration, amongst other things. Such games are very popular (see an overview on sales in [2], p. 10), and a large proportion of adolescents engage in digital gaming frequently in their free time—around 68% of 12- to 19-year-olds in Germany do so daily or several times a week, with only 8% not engaging with digital games at all [3]. This widespread engagement with these games illustrates the large influence they may have. Additionally, such games hold potential in the areas of motivation [4,5], representation of geography-relevant knowledge and the need for its application [6], contextual learning [7],

and systemic thinking [2,8]. Consequently, there are a number of reasons to incorporate games into informal and formal geography learning. Some studies already indicate the effectiveness of using games in educational applications (for a general overview on all kinds of games see [9]), also specifically in the context of geography education (e.g., [5]). However, in order to explore the potentials and limitations of the medium for geography education thoroughly to enable meaningful teaching applications, not only the games themselves and their players should be taken into account when studying the medium, but also the developers. Their approach to incorporating the named real-life issues in particular should be investigated, for a variety of reasons.

Firstly, the promotion of media literacy is now an integral part of the educational mission in almost all school subjects (see [10] for an example from Germany, and [11] for a summary on media education in the U.S.), including geography education [1]. Media literacy is a key skill for students to develop for responsible use of media to which they are exposed on a daily basis. Particularly the ability to critically examine and handle media can only be developed if the medium in question is understood as thoroughly as possible. In the case of games this includes the intentions of the developers and limitations within the design process, which influence how real societal topics are depicted in games. It may therefore be helpful to understand how deviations from realistic representations (worked out e.g., by [6,8,12,13]) arise in order to be able to reflect on them in an informed way in class.

Secondly, learning about the views and approaches of entertainment game developers who deal with geographical topics could also be valuable for the educational game industry. Current educational games are still, to a large extent, less motivating and attractive to players than their commercial relatives [14,15], despite both depicting real-life topics. However, pleasure and learning are deeply intertwined as for each situation that demands action a human's brain checks whether the action promises pleasure [16]. This assessment determines how willing a person is to perform the action, which also applies to learning situations (ibid.). Research in neuroscience also found that the degree of interest or enthusiasm of a learner correlates positively with the memorization performance [16]. Insights into the design of entertainment games regarding the realism of educationally relevant topics, or knowledge of where and why developers deviate from a realistic portrayal, could thus help to improve the design process of future games for learning.

Lastly, it should be recognized that somewhat 'realistic' games can influence concepts, perceptions and attitudes of their players, whether intentional or not, which makes it vital to understand the design of games and the thoughts behind it. Reyes and Adams [17] claim that games which model real life systems are "an educative and ideological force" (p. 161). As an example, they cite how a game about football changed the players' understanding of the sport, resulting in new tactics being integrated into real-life football and subsequently extending the game's influence even beyond their players ([17] referring to Suellentrop 2010). However, even fictional content in narrative media can have an impact on the beliefs and attitudes towards real-world topics when fantastic and realistic elements are mixed (e.g., [18], regarding written stories). In the context of games, this means that even games that only borrow some elements from reality can be perceived as realistic, causing confusion between fantasy and reality, and making players take in the designers' ideas and messages hidden in the video game space [19]. Digital games are even considered to have a stronger 'persuasive power' than other media, as they are interactive and immerse players in their virtual world [20]. These persuasive powers of games suggest that, in the context of real societal topics, games can have both positive, educational effects as well as problematic impacts. This makes the understanding of the way real-life topics are handled in the design process valuable for a beneficial reflection on the game content, particularly for teachers who are to guide such a reflection in class. An investigation that aims at this understanding has, to our knowledge, not been carried out before. Generally, studies on games that involve the designers are scarce, particularly in the context of education—the limited examples include the study of Czauderna and Budke [21] on game designers as

actors of political education (from our project group), and of Hall et al. [22] on games for health education.

To address this research gap, we interviewed 10 experts from the commercial game industry about the development of games that include geographical issues, specifically the socio-political/socio-ecological topics of climate change, migration, city development or resource use. Thereby we aimed at answering the following questions:

- What is the designers' understanding of 'realism', and how important is it to them when they design games on current societal topics?
- In which areas do developers attempt to portray socio-ecological issues realistically by their definition, and in which areas do they deviate? In particular: Why do they do so? Which design criteria, intentions or obstacles might stand in the way of a realistic representation of such topics?

To be able to answer these questions, a general understanding of 'realism' in the context of digital games needs to be established. Therefore, we first group the concepts of realism found in the literature and create a model of the different realism types relevant to digital game design. This model will serve as a basis from which to understand and interpret the results of our interview study, which we subsequently present. Ultimately, we discuss the implications of our results for the games' educational potential concerning societal issues and for future game design on these topics. Main aim is to derive reflection impulses for school lessons with games, and to contribute to the understanding of why games are developed in the way they currently are and whether it would be purposeful (or even possible) to design them differently for learning purposes.

2. Forms of Realism in Games

The basis for investigating the design concepts of game developers, with regard to the realism of societal topics in their products, is to first understand what is meant by 'realism' in the context of digital games. The following section aims to clarify the different notions that exist in this area in game studies. It was found that the term 'realism' is used to describe a plethora of different design principles in published literature and is defined differently in each study. For a general overview of these concepts we created a model of the types of realism relevant to digital game design (see. Figure 1). Our model consists of three layers; the internal, external and perceived realism, and extends to four dimensions; the narrative, the system, the action, and the sensory aspects found within games. These terms and the concepts that went into this model are explained subsequently.

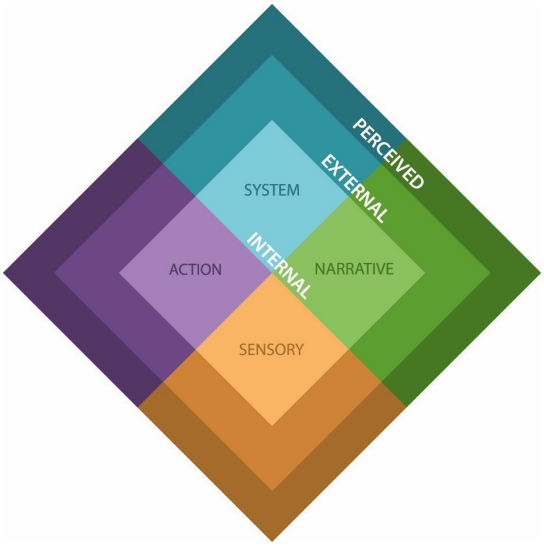

Figure 1. Model of the types of realism associated with digital games (inner square: internal realism; second square: external realism; outer square: perceived realism; dimensions: system, narrative, action, sensory).

The most basic differentiation made in game studies is between a type of realism that refers to consistent logic and the general coherence within the game, and one that draws on the world outside of the game. The first type of realism is solely concerned with consistency and logic of the virtual world (see e.g. [23], p. 32) with the aim of creating a game world that makes inherent sense. This kind of realism can apply to completely fictional worlds—the depicted events, characters, environments etc. just have to be appropriate for and consistent within the fictional setting. An example of this is when the lighting is called realistic if it fits the light source in the gameworld [24] (pp. 10–11), which can be without a (known) real world equivalent, such as a second sun. This type of realism is not termed consistent throughout the literature. The majority of previous studies have dealt with different partial aspects of this type of realism, for example concerning graphics [24] or narration [25], without defining the overarching type of realism. We apply the term game-internal or internal realism to this type of realism (as in [23]), which is represented in Figure 1 by the inner square.

The second type of realism refers to when what is depicted in the game (i.e., the events, characters, environment, etc.) represents the world outside the game, so is similar to or plausible in real life (e.g., [20,23,25,26]). This type of realism is hence about the depiction of socially agreed concepts of reality and the state of science—this means that research, in the form of information gathering, about the depicted aspects of the real world is needed to incorporate this kind of realism into games. This type of realism is termed 'external realism' by a range of authors (e.g., [25] for any type of media; [23,26]). This term is adopted in our model, where it is represented in the second square in Figure 1.

Both external and internal realism can be split into further subcategories, as the inconsistent naming throughout the literature already suggests. It was found that most of the types or concepts of external or internal realism described in game studies can be grouped into four categories or dimensions: realism concerning the narrative, the simulated system, the actions and the sensory aspects. These categories or dimensions are represented by the four different colors in our model.

The 'realism of the narrative' (green/right-hand tiles in Figure 1) is a subcategory frequently addressed in game and general media studies. External realism in the narration is described by Breuer et al. [20] as their definition of 'narrative realism', which is about the comparability of all narrative elements, such as the conflict, the story's characters or the setting, to the real world—similar to Lombard and Ditton [27], who have defined 'social realism' as depicting events that happen(ed) or could happen in reality. Taking an example from geographical themes, this could be a narration about a real war, the resulting migration movements and the events on the migration routes, as depicted in Bury Me, My Love. Galloway [28] takes 'social realism' a step further, stating that for him this type of realism applies to "games that reflect critically on the minutiae of everyday life, replete as it is with struggle, personal drama, and injustice" (p. 75). If these concepts are taken together, external narrative realism is concerned with presenting real issues in their complexity and controversy within the games' story. Internal narrative realism is also covered in the literature. In this context, a concept by Busselle and Bilandzic [25] can be applied to games: They define, for narrative media in general, a type of realism they also call 'narrative realism', which addresses the "plausibility and coherence within the narrative" (p. 256), which is in contrast to their definition of 'external realism' that compares the games to real life. Hence, internally realistic game narratives can be defined as those with a consistent logic, no matter how close to or far from reality their general theme may be. For instance, the characters in a story can be internally realistic when they act consistently and in line with their introduced character traits throughout the narrative, even if they are not humanoid.

Another aspect addressed in the context of realism is the games' simulation, referring to a realism in the game's system (blue/upper tiles in Figure 1). To Reyes and Adams [17] (pp. 160–161), "[w]hat matters for simulative realism is the way rules model real life systems. A realistic game, from a simulative standpoint, would be one with rules abstracted

from real life systems". As an example, they name the modeling of multinational conflicts, which involve more than a backstory, namely also modeling different actors and their impacts on the system. This means that real-world topics are included beyond the narrative, in the games' rules, which implies that the game mirrors the systemic connections of the real world. This external type of simulative realism is therefore relevant to the depiction of complex systems (on this topic see [2]). As an example, for a climate system to count as externally realistic in the game, changes to the virtual system, such as the release of greenhouse gases, would have to lead to other systemic changes within the game world, such as alterations of temperature patterns, as is simulated in Civilization VI—Gathering Storm or Democracy 3. In the context of internal realism, the coherence of the game again needs to be considered; concerning the simulation this could be the coherence of space and function ([29], referring to Poole, 2000). This coherence presents as logically connected spaces, functions of objects that stay the same throughout the game, and the avoidance of inexplicable barriers and restrictions (such as 'you cannot go there/use this item here') [29]. Additionally, behavioral realism, as defined by Slater et al. [24] and adopted by Cheng and Cairns [30], could be counted as internal system realism as well. For example, virtual people and objects in the game world may physically react in a way fitting to their properties, such as large, heavy-looking objects being hard to move even though they might appear otherwise unrealistic. This is similarly described by Low [29], whose understanding of this action realism includes the surrounding in a game generally interacting with the player as expected, such as material properties or responses when handling machines. In the study by Cheng and Cairns [30] the consistency of this behavior plays a major role in this type of realism as well, meaning that the behavior or material property does not change throughout the game.

As video games are an interactive medium, the actions performed within a game (the actual gameplay) can also be designed to be externally or internally realistic. We term this 'realism in the action' (purple/left-hand tiles in Figure 1). *External* realism in this category is matched by the main design principle applied by Couture [31] to a laboratory simulation, which the author calls 'formal and functional realism', where the actions that can be performed in the simulation are the same as in the real-world counterpart, in this case a range of experiments that can also be carried out in the represented real-world laboratory. The principle of 'historical accuracy', pursued in the conception of Versailles 1685, is also deemed to be external realism in actions (and applicable to disciplines other than history). In this case this form of realism predominantly applied to giving players a role appropriate for the (historical) context whose range of actions do not exceed the limited power of this role [32]. External realism in that subcategory is therefore about designing players' roles and actions comparable to roles and actions in reality, including typical social relationships and power structures. For example, the players' role in Versailles 1685 is the head of security, a Blue Guard, who has access to everywhere in Versailles, such as in the real one at that time, except the chambers of the King and the Court—so the player is given "limited but legitimate agency" [32] (p. 70). A breach with this type of realism would be the god-like roles found in many strategy and simulation games, such as Cities: Skylines, in which players control almost all aspects of the gameworld on their own. On the game-*internal* side, the coherence of causality described by Low ([29], referring to Poole, 2000), which is about consistent outcomes of the same actions, could be included in the model: When players perform an action, this action should have the same result at any time in the game, as long as the conditions do not change. The internal realism in action would then be about the consistency of player agency. This type of realism can again apply to completely fantastic settings as even in a fictional world, such as a science-fiction setting in another universe, outcomes of players' actions can be persistent and thus internally realistic.

When it comes to realism in the sensory aspects (orange/bottom tiles in Figure 1), which involves predominantly visuals and sounds, many authors focus on a realism in the sense of a high resolution of textures and polygon count (e.g., [33]), also called photorealism (e.g., [34]) or geometric realism (e.g., [24,35]). We categorize this kind of

realism into the game-internal category as it can again be applied to fantasy game worlds. For example, although a dragon is an imaginary creature its skin can look 'realistic'. Reyes and Adams [17] add that visual realism is also about "how a game constructs a sense of place and time" (p. 160), which can be regarded as crucial for an internally coherent gameworld, or a 'persistent environment' (Taylor, 2006, cited in [17], p. 160). Another way to look at sensory aspects in a game is to compare them with their real-world reference (e.g., the so-called 'realist' games addressed in [36], pp. 85–86). This kind of external visual or sensory realism would then be concerned with whether and how real places, architectures, sounds and similar features are represented. For example, we would talk about external visual realism when in-game cities and environments are visually designed to represent a real-world counterpart, such as the buildings in Anno 1800 depicting European architecture around that time.

However, realism in games is not only a design principle, it is also of importance in what way each of the described realism types are registered and assessed by those who deal with the medium. In this context, the concept of 'perceived realism' is commonly referred to in the literature, which can be seen as an overarching type of realism, as all realism types only become relevant by being perceived by someone. In particular, the players' judgment of realism in the game is most crucial for the persuasive potentials of a video game [23]. Studies have shown that the players' perception of realism does not always coincide with the designed realism. For example, a study by Dittrich [37] on perceived external simulational realism (although not named as such) of serious business games found that the most complex games, despite being designed as the most realistic with respect to the complex simulated system, were perceived as less realistic than those with medium simulative complexity, with the author assuming excessive mental demand as a reason for why this was the case. Thus, the players' perceived realism seems worth studying in addition to the design principles and is therefore depicted as an outer layer in our model (Figure 1). More recently, a range of authors in the field of game studies are approaching game realism directly from the player's perspective, such as perceived (external) simulational and social realism by Ribbens [23] or perceived (internal) graphic realism, inter alia, by Lin and Peng [26].

We also repeatedly find notions of realism that concern the integration of the game into the real world. For example, Reyes and Adams [17] argue that games can influence everyday life and mix with reality, such as when games make people perform certain actions in real life, which they term 'inverse realism'. Another example is the perceived enactive realism as mentioned by Lin and Peng [26], which concerns how much players feel as if they are undertaking real action in the game world due to the interaction with the game, e.g., via the controller. As those types describe phenomena outside the game rather than (perceptions of) in-game design, although they are connected to them, and we aim to investigate the design process of the games, such types of realism are left out of this model.

By developing our model, we aim to shed some light on the terms used in the context of game realism, and how they can be related to each other. However, neither internal and external realism, nor the subcategories, are free of overlap or strictly separable concepts, and it is often difficult to tell whether one is talking about perceived realism or the underlying design concept (particularly as there can be no such thing as an "objective" view on realism, speaking in a constructivist sense). We also do not claim this model to be exhaustive. Yet all these forms of realism included in the model affect the learning potential of games in some way, although games do not need to be perfectly realistic in all aspects to be suitable for learning, as no simulation is [38]. Busselle and Bilandzic [25] explain that the recipients of any narrative medium compare all new information received within the storytelling with the previously received information and place it into a mental model. Inconsistencies in any type of realism, i.e., when incoming information cannot be fitted into the mental model that has been built, may cause lack of understanding, and, as a consequence, loss of enjoyment and a reduction in the desired learning effect (ibid.). In addition, as stated previously, making any game content appear realistic may influence players, which makes every type

of realism relevant for reflection, also for the promotion of media literacy. Thus, the model introduced in this study can be an aid in future studies on (the effects of) different forms of game realism and serve as orientation for game development and for guided reflection. For our research, this model served mainly as a basis for structuring and interpreting the results of our interview study.

3. Materials and Methods

3.1. Data Collection

We conducted nine guided interviews with members of the entertainment game industry (for simplicity in the following: game designers/developers) as part of the DiSpielGeo project, concerning a total of 10 different games. All games discussed in these interviews featured current societal topics, particularly the exemplary topics of migration, climate change, city development and/or use of resources/resource conflicts. These topics were chosen as they are key societal challenges or phenomena that are at the core of public discourse and also current topics of geography education. All of the discussed games are presumably well-received by players, as they have sold over 50,000 copies each on the respective platforms and have earned mostly positive user ratings. Thus, the interviewees can be regarded as experts in the development of successful entertainment games that cover geographical topics, which gives a certain strength to their statements on game design. We thereby classify the game developers as 'experts' in their understanding as persons with specific, practical knowledge, who have a significant impact on the practice in their respective fields of action, in accordance with the definition developed by Bogner and Menz [39]. With the help of the interviewed members of the game industry we were therefore able to gain insight into a practical field that is otherwise difficult to access by outsiders, which is one of the major advantages of expert interviews [40]. We assume that the interviewees speak for the whole development team, as most of the games are designed collaboratively.

Of the nine arranged interviews, seven were conducted and recorded with the help of a video conference software and the other two were completed through the medium of a questionnaire by the participants as they were not available for an oral interview. All recorded interviews were transcribed verbatim. An overview of the discussed games and the roles of the interview partners in their development process is given in Table 1.

Table 1. This is a table. Overview of the conducted developer interviews (* in German, translated for this study).

Game	Development Studio	Role of Interview Partner(s)	Oral or Written Interview
Age of Empires II	Ensemble Studios (Dallas, Texas, USA)	Designer	Interview
Anno 1800	Blue Byte (Düsseldorf, Germany)	Designers (two interviewees)	Interview
Anno 2070	Blue Byte (Düsseldorf, Germany)	Designer	Interview *
Bury Me, My Love	The Pixel Hunt (Paris, France)	Designer	Interview
Cities: Skylines and Cities in Motion 2	Colossal Order (Tampere, Finland)	Producer	Written
Democracy 3	Positech (London, UK)	Designer	Interview
ECO	Strangeloopgames (Seattle, WA, USA)	Community Manager	Interview *
Rise of Industry	Dapper Penguin Studios (Spain)	Designer	Interview
Tropico 6	Limbic (Langen, Germany)	Producer	Written *

Our interview guidelines consisted of open-ended questions that allowed the participants to share their experiences and views as freely as possible, as suggested by Meuser and

Nagel [41] (pp. 31–32). Most important for our geographical perspective on game realism in this study, and thus for our guidelines, was external realism, as this kind of realism is needed to depict geographical content, specifically the socio-ecological challenges we focus on in this paper, and it needs to be based on researched information. Therefore, we predominantly addressed external realism and the deviations from it in our interview questions. However, since we only asked open-ended questions and gave the interviewees as much time as they wanted to talk about their design process, they could, starting from questions about external realism or deviations from it, address all relevant aspects and forms of realism that might influence the (un)realistic representation of geographical subjects. In addition, we did not explicitly name the elaborated terms concerning game realism in our interview questions to find out if and how the designers themselves distinguish between different concepts of realism.

The first set of questions addressed the topic of realism directly, specifically the developers' impression of their games' realism, and the general importance of selfsame to them. Some specific questions regarding external realism were concerned with the representation of geographical topics in their games, the way the developers informed themselves about these topics, their interest in them and the challenges they faced when integrating them. Other questions were more indirectly aimed at game realism, where we asked about the importance of complexity, the developers' understanding of the players' roles and decision-making in the games. For example, we asked: "How do you see the role of the player?", "Which relevance does complexity have for your game?", or "What makes decisions in your game interesting?" The final part of the guidelines was concerned with a possible educational use of the games, where we asked whether the designers have thought about an educational potential during or after development. The guidelines facilitated comparability, as the topics for each interview were almost identical, but we adapted the questions slightly depending on the game discussed. These topic-guided interviews enabled us to capture the game developers' subjective perception of the implementation of realism in the game design process, as well as their reasons for introducing or deviating from different forms of realism, and how they incorporated these into their game in order to create a compelling gaming experience. In conclusion, our methodical approach was most closely related to the method of the theory-generating expert interview described by Meuser and Nagel ([41] and earlier works), termed by Bogner and Menz [39], in which "subjective action orientations and implicit decision making maxims of experts from a particular specialist field" (p. 48) are captured to gain specific, yet subjective and interpretative knowledge on the respective area and to ultimately either deduce theories or work out common thought patterns among experts in the specific field.

3.2. Data Analysis

We analyzed the interviews using the qualitative content analysis approach outlined by Mayring [42,43], also mostly aligning with the procedure for expert interview analysis recommended by Meuser and Nagel [41]. Initially, we developed inductive categories from the interview material. For ensuring intercoder-reliability, as a first step two researchers paraphrased part of the interviews independently and derived one coding system each. The resulting categories were compared and a joint coding system was established. All text passages were then assigned to these inductive categories using the analysis tool MAXQDA. As proposed by Mayring and Fenzl [43], we made sure that the main coder would agree with themselves when assigning the text passages, a second time (intracoder-reliability) and that the other involved researcher agreed with the assignment, as a second step towards intercoder-reliability.

Subsequently, we brought in our model of realism in games as a second, deductive category system to link our interview results with the theory and to determine the forms of game realism that the developers did and did not talk about. As Table 2 illustrates, the inductively formed categories described above were therefor assigned to the four realism

dimensions from our model—realism in the narrative, the system, the action and the sensory aspects.

Table 2. Linking of deductive and inductive categories in our interview analysis.

Deductive Categories	Inductive Categories	Examples from the Interviews
Concerning realism in the narrative	Real-world topics and contexts	"you can see already the good things about industrialization and the bad things that are still existing today within all city development" (Anno 1800)
	Real individual experiences/emotions	"we had to find someone that could actually explain to us what it feels like to be, for instance, in a smuggler's boat with 50 or 80 other people and fearing that the boat would sink" (Bury Me, My Love)
	Positivity/reduction of controversy	"On Tropico there are no ethnic or social conflicts worth mentioning or deep entanglements in world politics" (Tropico 6)
	Incorrect concepts	"it's a little bit out of date, because when we first—when we did Democracy 3, one of the things that goes in there is hybrid cars" (Democracy 3)
Concerning realism in the system	Logic of system relations	"It is important that players can understand the mechanics and needs of the city based on real life" (Cities: Skylines & Cities in Motion 2)
	Reduction of complexity	"What we have to do then, we have to actually condense the whole thing to some essential factors that can be understood and handled" (Anno 2070)
	Real polytelic decisions/trade-offs	"Our real economic decisions that were made throughout history, how you made decisions about, whether do I invest in technology and advancing technology or advancing military and satisfying short-term or long-term goals" (Age of Empires (AoE) II)
Concerning realism in the action	Restricted power of individuals	"basically they don't have a full grasp over their destinies. And that's one of the things we wanted to stress with the game" (Bury Me, My Love)
	Overpowered roles of players	"The player is the mayor, the city council, and essentially the god looking over all aspects of the city" (Cities: Skylines & Cities in Motion 2)
Concerning realism in the sensory aspects	Visual representation of real places, objects and sounds	"So the artists take a lot of visual inspiration and made a big mood board of textures and colours and things from the era" (AoE II)
	Optical differences	„some of the details we got right, some we got wrong, so we had to use some elements that failed cultural inspection" (AoE II)
	Fictional places and surroundings	"what we never include are for example real dates, places and character names for example, so we always distance ourselves from reality, so that we still have the freedom to do what we want" (Anno 2070)

We then connected the passages from different interviews assigned to the same category and compared the answers of the interviewees (as described by [41]) to find commonalities and differences in the design approaches in each category. The identified commonalities indicated typical perceptions and common practices of the game designers, which are presented in the results section with the help of representative quotes. Our primary focus in each category was the reason(s) for the particular form of realism chosen, and for deviations from them. Finally, we interpreted the results with regard to our research questions.

3.3. Methodical Limitations

Guided expert interviews may be criticized as being too restrictive for allowing a true expression of the interviewees' thoughts, while also lacking standardization and thus mostly resulting in mere impressions on a topic (find these and several other points of criticism in [39], p. 44). We still regarded semi-structured expert interviews as the most suitable method to gain valuable information on the game development process, as we

could bring up the relevant issues for answering our research questions and could at least partly ensure comparability while at the same time allowing for adaptations and some freedom in the answers of the interviewees. However, we encountered some methodical challenges in the process of data collection. For one, the 'written interviews' produced less extensive and rich results than the oral ones, though we designed the questionnaire to resemble the open-ended questions posed in the other interviews. Due "to the procedural nature and the non-explicitness of considerable parts of expert knowledge" [41] (p. 31), this has to be expected when using a questionnaire, which requires participants to explicitly formulate their knowledge. Naturally, there was also no possibility to ask for further examples or to react to the answers with follow-up questions in the written interviews. Nevertheless, they provided us with valuable information. In addition, as we encountered difficulties in gaining access to the rather reserved game industry, and thus in arranging interviews with respective experts, we were thankful for each reply. We also have to assume that the interviewees may have answered in accordance with the publishers of the respective games, as the latter control and restrict the communication about the products, especially the most renowned ones. This may have caused the interviewees to shed an overly positive light on the development process and may have prevented them to give their fully honest opinion on certain aspects of the games. We need to take that assumption into consideration when interpreting the results.

4. Results

The following section presents the results of the qualitative content analysis, starting with a section on the developers' general understanding of realism, including their approaches to gathering information on their real-world inspirations. Afterwards, the results are structured according to our model, as illustrated in Table 2.

4.1. Developers' Understanding of Realism

In the interviews conducted, it became apparent that the distinction between different forms of realism was not actively made by the game designers. They did address the four areas of realism distinguished in the model (see Figure 1)—narration, system, actions, and visuals/sensory aspects—and talked about external, internal and perceived realism, but without making any separation between these or other categories. An example of this is apparent in the following statement, in which different forms of realism are referred to:

> "So actually, we are praised for our research and the themes we put in, that it is very well interwoven and that it feels good, that the players dive into the world, feel comfortable there and have fun and are not torn out. And if you can immerse yourself and lose yourself in the world, then I think we've done everything right, and although we do have some players who complain that we're not one hundred percent correct as far as reality is concerned- I remember we once had a discussion in the forum about it, where two users argued about how many masts a frigate had [. . .]". (Anno 2070)

In this statement, the interviewee initially addresses external realism in the narrative and in the system where they talk about the topics and how they are interwoven into the game system. The designer then indirectly addresses players' perceived realism, but with a focus on internal forms, in particular the coherence of the story and game system which ensures that players are "not torn out" (ibid.) of the game world. At the end the focus shifts to external realism in the visuals, here the representation of a ship type. This exemplary statement could indicate that the different forms of realism are hard to separate in practice, and partly build on each other.

It is notable that the interviewees generally talked little about aspects that we would categorize as internal realism. Although we mainly targeted discussion on external realism through our questions, as we were particularly interested in the geography-relevant societal topics in the games, we also asked questions that were open to the inclusion of other realism forms. Developers also mainly talked about external realism in these open questions. When

the interviewees did occasionally address internal realism, they predominantly mentioned it indirectly in the context of deviances from external realism. For example, to implement infinite resources in Anno 2070, which was clearly pointed out as a deviance from external realism, the designers created a space underwater which provides resource supplies: "We have researched that there are geysers under water, so-called black smokers, and then created the image that we have said from this black smoker all the time infinite resources are pouring from the earth's core [. . .]" (Anno 2070). The deviation from external realism is coherently integrated into the game world by means of the resource-providing 'black smokers', which are fictional but meant to make sense to the players, thus creating a game-internal realism in the narrative and the game system. Examples such as this suggest that internal realism is used to embed deviations from external realism into the game world in an understandable way.

There was also agreement between the interviewed designers that information gathering is important as a basis of the different forms of game realism, as is expressed in this exemplary statement: "[. . .] every time we create something new then we always need to research it, to make sure it's coherent [. . .]" (Anno 1800). Research to gather information seems to be not only relevant for representing real-world topics but also for facilitating internal realism (game-internal coherence), both designed and perceived. This is presumably because it is easier to establish a concept on something that already exists and is also easier for players to understand. However, the extent to which the interviewees informed themselves about the topics depicted in their games and their sources varied. Often, the developers used a mixture of different popular sources on the internet and non-fictional literature, and a little less often movies and fictional literature, in addition to their own knowledge, as a basis for their model of reality. More rarely, external professionals in a specific topic or witnesses were consulted: For Rise of Industry, economic experts were enquired about resource use and production in specific industries, and Bury Me, My Love (BMML) was first inspired by a newspaper article on a Syrian migrant who was then involved in the creation of the game's story. Scientific experts seem to be even more rarely involved, with scientists only consulted in the development of the human-environment-system in ECO for the games considered here. One of the reasons for the lack of consultation of external experts is thought to be the confidentiality of the game content during the majority of the development phase, which makes it difficult to involve outside parties. As the designer of Anno 2070 reports: "For example the project which is announced today—until it is announced I am not allowed to talk about it and therefore—that is always classified information, and expert opinions come in fact mostly afterwards, that is when it is officially announced, when everyone is actually talking about it anyway" (Anno 2070). It is likely that another reason for favoring popular media is that commercial games are regarded as more obliged to the players, in terms of their expectations and concepts, than to the faithful representation of reality: "In the first place it is often not about depicting reality, but about fulfilling a player expectation" (Tropico 6). This is due to the fact that "you have to pay more attention to what most players want, because they pay the game" (ECO). Players are commonly used as 'fact-checkers' in the early publishing phase of a game instead of professional experts, which clearly stresses the importance of their perception of a game's realism to the game designers, in addition to a presumed cost-effectiveness of this approach.

In some cases, additional knowledge is gained from other games. One reason mentioned in this regard was to 'benchmark' the gameplay, as a game is more accessible when it is similar to other games, at least for experienced players. Another reason seems to be a practical one, namely that not all topics within games can be researched thoroughly. For example the designer of Age of Empires (AoE) II discloses that while the background on historical cultures and historic city development was researched using various sources, the economy and the connected resource management was based on the presumably fictional logics of board games: "I think that there wasn't as much research into how to make the economy work, because it was much more game abstraction, so we did play a lot of

board games, so Age of Empires the video game is much closer to board game resource management than real worlds inspiration" (AoE II). Approaches that take other games as additional inspiration result in a mixture of well-researched (though mostly not in scientific sources) topics and systems, i.e., those that are in the focus of the games, and those whose presentation is based on other games and which therefore may possibly (intentionally or unintentionally) reproduce deviances from external realism. The mixture of approaches to research also shows that even during the research phase a selection is made in terms of which aspects could be interesting game-mechanically and story-wise, and it is only for those aspects that further information gathering is carried out.

Several interviewees mentioned that the development team's own ideas were mixed with researched information within the game. For example, in the development of Democracy 3, when the topic was too complex to be fully researched or implemented, the designer decided to depict what felt right to themselves. The illustration of Earth's future after a severe climate change in Anno 2070 is based on a mixture of research and the designers' imagination, with part of the future technologies for climate protection depicted in the game based on research to make sure "that these technologies exist, that they are somehow tangible", but mostly the designers stated that "this is our idea of what the future could look like", of "how future humanity would deal with this issue [of climate change]" (Anno 2070).

The different research approaches uncovered the varying extent to which external realism is considered important for (different parts of) a game. When it comes to integrating the research insights into games the developers spoke of various reasons for the implementation of or deviation from the different types of realism. Although the interviewees themselves did not explicitly distinguish between realism in the narrative, the simulated system, actions and visuals/sensory aspects, they did address these forms in the interviews. The insights concerning these four areas of realism are presented in the following sections.

4.2. Realism in the Narrative

When talking about realism in their games, especially when considering the included geographical topics of climate change, resource use, migration and/or city development, a lot of the developers' statements can be assigned to the category of external narrative realism, meaning there were references to reality in the game's story and general context. As they chose to depict real social or socio-ecological topics in their games, they therefore needed to draw from the game-external reality, which was also why these designers were chosen as interview partners. In the interviews conducted, the designers named various reasons for featuring these societal topics in their narration.

One of the most frequently mentioned reasons was the provision of interesting context. An example is the topic of migration in Bury Me, My Love (BMML):

> "[. . .] we know that if you want to make a game or a movie or a novel that is gripping and interesting you have to have conflict. And sadly for migrants, every route they can take is dangerous, so it's a potent source of conflict, hence it's easy to fit all those routes into the game because they are all potentially filled with tension." (Bury Me, My Love)

According to this interviewee, real-life topics such as migration are incorporated to build up the arc of tension in the story, and to evoke a feeling of pressure on the player. Another emotional reaction is provoked by climate change in Anno 2070, the designer of which stated that one of the reasons this topic was integrated into the game was "because we had the feeling 'okay, the topic is touching'" (Anno 2070). Thereby the emotional involvement stems from many people being affected by the issue and having their own opinions on it. Furthermore, the 'conflict' mentioned by the designer of BMML promises challenges for the players, and all of the social or socio-ecological topics considered here are suitable subjects to depict different kinds of conflict. In Cities: Skylines, the topic of sustainable resource use and sustainable city development is even the main content of an add-on to the game, called Green Cities, because "[i]t creates a new challenge to the

game, gives the player a whole new perspective" (Cities: Skylines and Cities in Motion 2). With sustainability coming into play, new decisions regarding city development have to be made: For example, the cost, efficiency and environmental impact of different energy sources need to be considered. The challenge created by real-life topics thus results from polytelic situations that arise in the realistic contexts, i.e., situations in which conflicting interests have to be weighed up against each other. Another example is that in AoE the player needs to decide "do I invest in technology and advancing technology or advancing military and satisfying short-term or long-term goals" (AoE II), which is a polytelic decision because the available resources do not allow both. These types of decisions are regarded as being particularly interesting for the players. Overall, designers see the integration of real-world topics, amongst those social or socio-ecological issues that are also part of geography education, as a contribution to gaming fun.

Another reason repeatedly mentioned for bringing external realism into the narrative is the creation of so-called immersion, i.e., the players' involvement in the game's narration. For example, the developer of Anno 2070 reports that due to the real-world topics in the game, players give the feedback that they "immerse themselves in the world, feel comfortable and have fun and are not dragged out of it" (Anno 2070). Another key word in that context is 'credibility', where the designer stated they made references to reality because "whatever world we create, it should be credible, it should function" (ibid.). References to reality enhance the perceived realism, so even when the designers create fictional worlds those references can make the game seem less 'made up'. In addition, apparently a 'functioning' game world, as in game-internal realism in the sense of coherence in the game context, can be created more easily on this basis. At the same time, the credibility also sets a limit for the external realism in the game: "Games are often fictional and therefore have no realism requirement, similar to literature and film. Therefore, reality is usually only used to the extent that it serves the creation of a credible world" (Tropico 6). The limit for external realism is therefore reached when credibility has, presumably, been achieved. The players' perceived external realism thus seems to play a major role in game design, or at least the developers' assumptions of it.

Closely connected to both credibility and gaming fun are the player expectations, which further restrict external realism in the games' narration. For example, in Anno 1800, the choice of topics depends on "what players expect realistically from the era that we represent" (Anno 1800). Statements such as this reveal that mainly those topics are chosen that are well-known and topical for a certain time and place. This makes the popularity of real-world topics a decisive factor when deciding to incorporate them into games, which is probably also one reason why developers predominantly use popular media sources for their research. As one designer expressed: "Well, we actually thought about what we wanted to do next when we started the project, at that time the issue of climate change was—it started to become more and more popular" (Anno 2070). Similarly, the Tropico 6 developer mentioned that only societal topics that are expected to still be relevant in the future were integrated into the game. Apparently, part of the interviewed designers expect to increase the long-term marketability of their games by bringing up popular socio-ecological, geographical issues in the narration.

However, the interviewees did not only see the attraction to players when they included real-world geographical issues into a game. The developers also acknowledged the educational value—all of the interviewees saw such a value to some extent in their games. Some of the designers regarded education as a mere positive side effect that was not intended during development, whilst some purposely pursued educational goals. The community manager of ECO even shared that their game was initially intended for schools before it became an entertainment product; other designers have pursued entertainment and educational goals in parallel. Interestingly, those designers did not see a conflict or even a difference between educational and entertainment goals. Rather, as the developer of AoE II puts it, "deeply engaging with any of the educational aspects of the game I think is a fulfilling and rewarding part of it" (AoE II). Pleasure and learning are seen as being

intertwined—thus the AoE-designer referred to games as "enriching entertainment", the Democracy-designer called theirs a "stealth teaching tool". The educational goal or effect most frequently mentioned in connection with a realism in the narrative was the generation of an interest in the depicted real-world topics that may stimulate an engagement with them outside the game. As one of the developers of Anno 1800 expresses: "So like with everything, a game is a window to way more than what it just presents, and for us, by presenting contents in a box that player[s] find interesting, then it maybe just open[s] them to a new area of knowledge they didn't tackle before" (Anno 1800). From the perspective of the designers, gaming fun and learning can thus be regarded as prerequisites for the other, as interest is sparked by engaging with real-world topics in an entertaining way, and deeper engagement with these in turn enhance the entertainment experience.

Another educational goal that was pursued by creating an externally realistic narration was the broadening of perceptions in the context of the depicted topic, most explicitly referred to by the developer of Bury Me, My Love:

> "So you tend to have a rudimental model of what a Syrian migrant is [. . .]. So that's what we tried to render in the game, we wanted to show that you might consider Syrian migrants in a way that is completely fantasized and very far away from who they actually are, at least who Dana, the person who is the main inspiration, is. And that's something that we wanted to be able to have people understand while playing the game." (Bury Me, My Love)

In BMML the story is of a young migrant on her flight to Europe, with the player in the role of her husband back in Syria. The game shall bridge the gap between players and migrants by offering another perspective on migrants that is designed to be realistic. Later, the designer also states: "[. . .] if I can help people to have a more diverse representation of this question of migrations, it's something that I can bring to the table" (Bury Me, My Love). This conveys the impression that the game developer even sees some sort of responsibility to shed light on current social topics such as migration. The Democracy designer expressed a similar sentiment:

> "And to be honest, again, when that [climate change] was put in the game, that wasn't as big an issue as it is now, that was mostly put in the game because I care about it enormously, now obviously it's more of an issue because the situation is worse and we need to reflect that." (Democracy 3)

In this case, the designer expressed a need to reflect the issue of climate change in current game content because it is gaining impact on the real world. In addition, the interviewee claimed to have brought in the topic in their game despite it not being popular at the time of the game's development, which is in contrast to the abovementioned selection strategy that was applied by the majority of the interviewed designers. Yet the statement also uncovers that aside from the educational aspect, a reason for bringing in such topics seems to be personal interest, as well as political attitude, of developers.

How the designers approach the presentation of the societal issues also varies between the interview partners. A number of the interviewees, particularly those that were pursuing educational goals, stressed the controversial aspects about these topics. For example, the designer of BMML saw "no need to always hide behind metaphors or symbols, for instance having characters that would be looking like animals or like fantasy creatures, you want to discuss racism but your story is going to be set in space because you don't want to be true, too full-frontal in the way that you tackle the topic" (Bury Me, My Love). The Democracy designer even risked deterring potential buyers with how climate change is depicted: "And people who say that's a hoax or that's not true, they will just be angry and they will refund the game, I don't care. Because I think it would be ridiculous to not take that point of view" (Democracy 3). Again, the influence of personal attitudes becomes apparent, and it is even prioritized over player expectations. On the contrary, many of the other interviewees held back on personal attitudes and clearly stressed the leisurely purpose of their media, such as the designer of Rise of Industry:

> "I also didn't want to go too deep into this aspect [of human influence on the climate] because especially a couple of years ago, all the world was very sensitive about this subject [here: climate change], so if I were to put it [in] I would be kinda like making a political propaganda, I've been accused of this by adding the pollution mechanic, and I really just want people to enjoy a management game without looking at messages that I put [there] for political purposes, I'm just making a game." (Rise of Industry)

Consequently, the designer has chosen a setting in the 1930s, "so there would be this complete disconnection, like no talking about the current climate" (ibid.). As well as the use of fictional places, setting a game in the past, or simply leaving out certain aspects of topics, another strategy applied to avoid controversy is humor. For example, Tropico 6 uses a humorous presentation to disguise the controversial nature of real dictatorships. Yet, avoiding taking a political stance is not the only reason for toning down controversy; in Anno 1800 the issue of slavery in the context of resource gathering has been left out because, according to the designers, "it would be very stupid because then it is just super easy to exploit slaves, and that is just not fun, and you also don't want to express it as something being fun and something that helps and that actually makes things easier" (Anno 1800). The designers saw a moral conflict with making the topic of slavery an element of gameplay because the game mechanics would only convey that exploitation is easy and, worse, helpful, without being able to reflect the controversy of the topic within the game mechanics. Additionally, the target group has been mentioned as a reason for an overly positive game context, as some games are intended to be family-friendly. Overall, with few exceptions, the reasons for downplaying the controversial nature of topics can again be traced back to the designers' conceptions of player expectations, their own preferences and the marketability of the entertainment product.

4.3. Realism in the System

Another form of realism frequently addressed by the interviewees was the external realism of the in-game system, meaning realism in the simulated connection between the variables that players can (indirectly) control. This means that based on the already mentioned real-world topics that are included in the games, the system relations within these topics are often meant to follow the causalities and logic in the real world. For example, in Democracy 3, parameters connected to climate change, such as the average temperature on the virtual Earth, are simulated to react to system changes, such as the emission of greenhouse gases, similar to the system outside the game world. As the designer states: "the basic principle of it [climate change] is still the same [as in reality], we have it modeled in the game that it affects average temperature and it affects food crisis over the long term" (Democracy 3). Thus, geographical issues do not only occur in the narrative, as background story for example, but also in the simulated system. Human-environment systems such as this are often incorporated in games; most frequently the developers mentioned a negative influence of players' choices, for example in city development or resource management, on the virtual environment. Additionally, the economic processes in the games and their connection with the geographical topic of resource use were regarded as being close to reality by the developers.

One of the reasons why developers intend to simulate real-life system relations is that game systems which are based on reality are said to offer enough complexity to challenge the players. For example, Tropico draws from the complexity of real urban systems: "[City development] results from the interaction of the sub-systems (e.g., the collocation of hospitals, shopping facilities, church, public transport, keeping polluting industries out of residential areas)" and "[t]he complexity of Tropico results from the interactions of the sub-systems by decisions of the player" (Tropico 6). In the genre of strategy games and city builders, complexity is an essential part of the gameplay and something the players seem to enjoy:

> "I think Anno is one of the most complex games I know, because you have to consider many factors. And I mean our players love us for this variety and possibilities and that everything is somehow elegantly interwoven and that everything makes sense somehow, but you can also really get lost in it. There's always something to do, and everything is interwoven and often you start with one thing and when you want to accomplish that, there are three other things that are more urgent [. . .] and for Anno we have a target group where we say they want complexity, they want that everything is somehow connected and they also have fun to work into these topics and deal with them, but it's not everybody's thing." (Anno 2070)

This suggests that a slightly excessive demand is a contributor to gaming fun, at least for a certain group of players. The above statement also implies that mimicking real-life systems ensures that the game system "makes sense" to the players. Similarly, the designer mentioned that topics are drawn from reality "in order to also have a stronger relation to it [here: the game content]" (Anno 2070), and the designer of Age of Empires II found "that much younger kids could make good strategic decision-making if they had a context for 'what should I be doing at any situation?'" (AoE II). Thus, real-life systems not only offer complexity, but at the same time the designers believe that a relation to reality in the game makes it easier for players to understand this complexity. External realism in the systemic context is thought to help players to assess the possible consequences of actions in the games' systems, and thus make more reflective decisions in the polytelic situations mentioned in Section 4.2 and further described in Section 4.4.

Furthermore, in addition to the educational goals connected to the realism in the narrative context, some interviewees also mention educational goals pursued by simulating real-life system relations. For instance, the designer of Anno 2070 stated that "what makes 2070 so special is this effect on the environment, which we have in it for the first time, that all decisions concerning production always have an impact on the world, this is obviously new and has a different educational aspect" (Anno 2070). According to the interviewee, an externally realistic representation of system logics can educate players about the depicted real-life systems.

However, the majority of interviewees also mentioned different forms of simplifications, and thus deviances from external realism, when it comes to the system. The main reason mentioned is to avoid cognitive overload. Whilst the 'slight overstraining' is appealing to many players, external realism in the system can also be overly complex. The designers therefore try to find a balance between over- and understraining players:

> "There was always a goal to be, you know- if there is a little bit more that you wanted to do than you could actually do, that was interesting. [. . .] And keeping it just at that edge where it's not over—if there were ten things that I couldn't do that would be overwhelming and sort of an overload, but if there's just a few things that felt like 'Oh, if I had just done this a little bit differently or had I just spent a little more on my economy earlier by narrowing that set of things', I think it added a lot to the replay abilities." (AoE II)

A reportedly common way to achieve this balance is to involve potential buyers in play testing, and to simplify the system accordingly. A simplification frequently made was to make the system relationships clearer in the game than in reality, as the designer of Tropico 6 shared:

> "Cause and effect are usually highly complex in economy and society. In addition, the consequences of actions can be absent or only occur with a long delay so that they can no longer be easily attributed to the cause. In games, it is important that the player can overlook and evaluate the consequences of their actions. Therefore, games often simplify contexts considerably and establish a clear cause-effect relationship." (Tropico 6)

The main aim of this form of simplification seems to be the traceability of cause-effect relations. This suggests that, apart from the familiarity of the game system because it is based on the real world, it is these simplifications that ensure a balanced cognitive load and the comprehensibility of the consequences of players' choices. This comprehensibility or traceability is considered necessary for learning processes, in terms of learning about the game, meaning understanding the game system and being able to adapt one's own actions for gaming success, but also in the context of the aforementioned educational goals, not least learning about the geographical topics:

> "The goal of ECO was in the sense, what you don't notice in real life—you can't really see your own fingerprint. So you don't immediately know: Okay, what I have done now will have this and that effect. But in ECO on a smaller world, you notice it very well [. . .], because everything is packed up—you get it—okay now we have a problem here, the CO2 levels are rising, now I have to do something. Or I have to live with the consequences." (ECO)

The above statement suggests that deviances from external realism through enhanced comprehensibility can help to understand the real-life issues depicted in the game, which is, in the above example, the effects of human action on climate. Ways in which this comprehensibility can be ensured are clearer cause-and-effect-relations, a speeding up of time and a resulting greater visibility of decisions' effects on the game system. The Tropico 6 designer even mentions a "satirical exaggeration", which further enhances the visibility of actions' consequences, and a direct communication of the latter to the player.

There seems to be a source of friction between efforts to create external realism in the simulation and apparent necessities for game-internal modifications of the systems. This friction is not only due to the aim to balance cognitive load and to facilitate learning, but also due to player preferences and game mechanics, as the following statement suggests:

> "Hey I fulfilled the victory conditions, but now I have my own goals, [. . .] I want a million inhabitants, I want to settle all the islands, I want to exploit all the resources', these are all goals that the users set themselves and for that it is important that we have infinite resources in the game, and this clearly distinguishes us from the reality, where we realize that we are slowly reaching the limit and have to think three times about which resources we mine and which we don't. In Anno we used a trick, [. . .] all the mines we have in the game for example have a predefined amount of how much you can pull out of that mine before it is exhausted, and the trick is that [. . .] everything underwater is infinite." (Anno 2070)

In this example, systems that work in an externally realistic way—here: resource systems that take into account the finiteness of natural resources such as coal—are simulated next to systems that follow a fantastic logic, with the aim to allow players to pursue their own goals in an endless gameplay. To ensure game-internal realism in the simulation, so there is a coherent system that still feels logical to the player, these two systems are separated by the barrier between land and water. Such a coexistence of external realism and internal logics in the simulation is mentioned by several interviewees, and partly the two are even mixed. For example, in Anno 1800 players "can upgrade the residents to the next level, to the higher developed person" (Anno 1800); here the valorization logic of material things is transferred to a person. Our interviews revealed that designers are aware not only of the benefits of such fictional amendments, modifications and simplifications of systems based on a real-world inspirations, but also of possible negative effects on players, such as that the coexistence of external realism and in-game aspects that are logically embedded in the game through internal realism could produce misconceptions. For example, one designer mentioned that due to fictional solutions to climate change in Anno 2070 "the idea might be there that solutions are simple although they are not" (Anno 2070).

In addition to such intentional breaches of external realism in the simulation, the developers also disclosed causes for deviances that are not based on conscious decisions,

namely their own subjectivity and the bias of information sources, too little research, and concepts that have turned out to be wrong or outdated. Frequently, the interviewees also stated that real systems are too complex to be represented completely, which forced them to make compromises in the simulation. One example is the migration system of Democracy 3:

> "[. . .] if we have high immigration does that push down wages? And I can see—I know lots of data says it doesn't, but a lot of people think that it does, and it really depends [on] who those people are, and we don't model it in enough detail to do it justice. So, we cannot, for example, say—we don't model wages separately for skilled and unskilled, and we don't model immigration of skilled and unskilled people separately, so already it's a complete mess and we just have to pick a side" (Democracy 3).

The above statement shows that when reality is too complex to be simulated and the system needs to be simplified for the game, again the intention to fulfill player expectations and the prioritization of perceived realism ("a lot of people think that it does") determines the path the game system takes. As the designer of Tropico 6 said: "[. . .] each aspect is only simulated as far as it is necessary for a credible world and gaming fun [. . .]" (Tropico 6). The majority of our interviewees share the view that the game system has drawn enough inspiration from real-world systems as soon as it is perceived as being realistic and interesting for the players. This is understandable for commercial games that need to sell. Overall, perceived external realism, or even 'perceived external realism' (what the designers think that the players think), therefore seems to be a decisive factor for the degree of external realism implemented in a game's system.

4.4. Realism in Action

In accordance with the integration of real-life topics, many actions that players can undertake in the games are designed to resemble realistic decisions. As already mentioned in Section 4.2, polytelic decisions within real-life topics, such as conflicts of interest between economy and environmental protection, are regarded as being particularly interesting for players because they enhance complexity.

Aside from the polytelic nature of these games, an aspect that all of the decision-making situations described by the interviewees have in common is that they are decisions that the players would not be able to make in the real world, although they are taken from realistic contexts. Such decisions could not be made by an individual in the real world due to being in a much less powerful position outside of the game, due to taking over a different perspective and being in a distinct situation in the virtual world, or due to the game being set in the past or the future. For example, in AoE, the players are allowed to make "high-level decisions about how I build my empire", and the game shall "give a sense of making those trade-offs" (AoE II), such as polytelic decisions about the deployment of the scarce resources. This distinctiveness from the player's everyday situations and the opportunity to decide on topics that have a relation to the real world but are usually beyond the player's control are presumed to contribute substantially to the appeal of the decision-making aspect of those games.

Strongly connected to this distinctiveness in possible actions are the player roles, which also do not adhere to external realism due to several aspects. One deviation from external realism frequently mentioned in the context of embodied roles is that players take over tasks of a variety of professions at once. For example, the players' tasks in Rise of Industry involve "pretty much everything from market search, market studies, to civil engineering and even, what's it called... prospector, as well, locating all the resources and getting the best out of them", and the designer stated that "there's no way that in real life one person could do that all, it would be like five different PhDs that you would need to do it" (Rise of Industry). Another designer explained the implications of this mixed player role:

> "So I'd say the player probably takes a kind of hybrid role out of these areas [here: economy, politics and religion], and thus has the chance to actually influence the world, because you don't have to be so considerate of the other areas, but you can follow your vision relatively straight forward." (Anno 2070)

Taking over several roles at the same time, merged into a 'hybrid role' typical for strategy games, increases the freedom of action for the players, as well as the impact on the game's system and hence subsequently on geographical issues. For this purpose, aspects of real roles are mixed with a game-internal logic. The designer of Anno 2070 added that "the position of the player is definitely not legitimized due to the democratic deficit" (Anno 2070). Such a lack of negotiation, as brought up by several interviewees, allows the players to impose their decisions without the need for legitimacy. There was only one game in our sample, the multiplayer-title ECO, which includes democratic processes such as votes on climate protection measures. Leaving out negotiation processes adds to the freedom of action and the direct impact of players' decisions on the virtual world. As the designer of Cities: Skylines and Cities in Motion 2 summarized: "The player is [. . .] essentially the god looking over all aspects of the city. In the real world there are several layers of decision making needed for what the player is able to decide in an instant in the games" (Cities: Skylines and Cities in Motion 2).

This exaggerated power seems to align with player expectations and perceived realism, which once again have an impact on the game design: "[. . .] I don't think many people fantasize about 'if I was Prime Minister, I wouldn't get anything done because I would be arguing with people and they wouldn't let me do things'" (Democracy 3). The designer of Democracy assumed that players imagine the represented role to be more powerful than it is in reality, so this idea was transferred into the game. The modified role also enables a faster game pace, which was considered to be favored by players. The players' preference for powerful roles was explained by several of our interviewees with a feeling of importance:

> "If you give less it will feel too restrictive, there's a few games that give you very few of these roles and it feels like 'oh that's it? I'm going to do this for forty hours?', it's not enough. So the more roles you give and maintain them at high-level without low-level mundane decisions, the more important the player will feel, and in a way, is going to enjoy it even more." (Rise of Industry)

As this statement suggests, the power to make a strong impact on the development of the game by being able to make significant decisions by oneself creates a feeling of importance that adds to gaming fun. The designers of Cities: Skylines and Cities in Motion also assumed that their players want to act out their creativity, which they tried to enable with the overpowered roles. The constant (mostly polytelic) decision-making also creates an ongoing challenge that keeps the game interesting for a long time, and presumably makes it more valuable for potential buyers. Although it can be argued that leaving out or minimizing negotiation reduces the complexity of the game, it may also increase the complexity in other aspects, as players need to make decisions for several areas of expertise on their own, including how to deal with the social and socio-ecological challenges. The powerful role also allows players to explore these real geographical contexts interactively: "Cities are familiar, complex, unique and there are multiple factors that affect how a city has grown to a certain state. The most interesting questions are why did they develop as they did. Location? Natural resources? Politics? We have given all the power to the player to make decisions and see how they affect the city they are building." (Cities: Skylines and Cities in Motion 2)

According to this designer, the powerful player's role enables explorative learning. As with the simplifications in the simulated system, here again a deviance from external realism is assumed to bring benefits for learning. The AoE-designer even saw another positive educational effect stemming from the powerful roles, that "in the end you would learn more about [. . .] yourself as a leader" (AoE II). The roles in the games and a connected freedom in the decision-making thus enables players to discover their preferences, and

experiment with different social or political currents. In this context, the designer of Anno 2070 stressed that "whether decisions are good or bad is something you have to decide for yourself" (Anno 2070).

Yet, although the games are not intended to decide which decisions are right or wrong for the players, as stated by many of the interviewees, the game system nevertheless needs to set limits for this freedom of choice. There have to be different ways to win, but also different ways to fail. In some cases realism sets these limits. For example, in Democracy 3, the external realism that has been interwoven into the system subtly defines the limits to the decisional freedom: "[. . .] the game seems to kind of naturally tilt people towards compromise because most extremist strategies tend to fall apart for either political or economic reasons. And it's not coded to do that, it's just coded to be realistic [. . .]" (Democracy 3). Hence the realism in other parts of the game sets boundaries for the overpowered player roles, and vice versa.

There was only one interviewee, the developer of BMML, who stated to have purposely given the players a role with strongly restricted power from the start:

> "But us putting you in the shoes of Majd [context: the husband of a migrant woman named Nour, who is fleeing to Europe], you are way less in control, you basically control almost nothing because all you can do is try to cheer Nour up, and sometimes give her advice, but as she's a free agent, she won't even always listen to you. [. . .] So [. . .] it's a way for us to stress that this situation is a very complicated one, and there's a ton of things that are completely out of [those people's] control and basically they don't have a full grasp over their destinies." (Bury Me, My Love)

Here, the externally realistic player's role as an individual with clearly limited room for action and little control over events is intended to convey the helplessness of all involved in forced migration. The realism in that aspect is yet another means to transport the message of the game. The appeal of the game seems to rather stem from the tension in the narration and from the unexpected nature of decisions' outcomes than from the decision-making itself.

4.5. Realism in the Visuals/Sensory Aspects

The realism in the visuals and other sensory aspects, which involves, on the external side, the representation of existing surroundings, objects, sounds etc., and on the internal side the resolution, lighting, textures and similar, is the category least addressed in the interviews conducted. When the interviewed developers did address sensory aspects of the games they predominantly talked about external realism. For example, the designer of AoE II reported that the development team has researched architecture, items, sounds and languages of the represented era to be integrated into the game.

Some of our interviewees stated that such a form of realism is expected and appreciated in games with externally realistic settings, while deviations from it are criticized: "We have such experts in the forum from time to time, who then say 'listen, the ship does not look like that in reality, it must be 10 m longer or so'" (Anno 2070). In these cases, player expectations again determine the extent of external realism; in this example, a more faithful representation is favored. Often this form of external realism is also meant to support the other forms of realism in the game, not least within the geographical topics. For example, a represented chat interface in Bury Me, My Love is intended to support the narration about migration:

> "That's one of the reasons why we went with a very direct style, we used this framing of a chat application, and we wrote our scripts in very spoken language with lots of very short sentences and jokes and humor, because what we saw in this piece from Le Monde [note: an article about a Syrian migrant] is the main thing we wanted people to learn about, how nowadays migrants from Syria actually are, and to compare that with the clichés that they might have in their head when they think about Syrian migrants." (Bury Me, My Love)

Together the colloquial style of the narration and the representative realism in the visualization are supposed to make the simulated conversations feel real, by creating authenticity and reference to everyday life, with the aim of ultimately adopting the presented image of Syrian migrants. Hence, an external realism in sensory aspects such as visuals is used to enhance immersion and perceived realism, in the end also to facilitate conveying a game's learning goals.

In a few cases the developers talked about game-internal visual realism. Internal realism in the visuals was also considered to aid players to immerse themselves in the game. For example, one of the Anno 1800 developers reported that a simulated liveliness in their virtual cities can draw the attention of the players: "[. . .] in city builders it also should be fun to just watch for a couple of minutes, to just see your people going around. We have this good German word, the 'Wuselfaktor', when your people are 'wuseling' around, and that is also very important for city builders [. . .]" (Anno 1800). This form of internal realism also visually demonstrates to the players what effects their decisions in urban development have on life in the virtual city.

Yet even with the visuals, there were some restraints to realism, particularly external realism, reported by the interviewees. One reason to deviate from external realism is orientation for the players, for instance the developers of Anno 1800 stated that players need to be able to differentiate between objects in the landscape. Therefore, the crops that can be grown in an area were not only chosen based on research, but also by their color scheme, so they have differing visuals that can be distinguished from a distance. In addition, the vastness of reality makes it impossible to be fully externally realistic, even in the visuals. This is why once more designers "need to make a choice for what is the most obvious of the time period" (Anno 1800). In addition, not every detail can be researched, so that, for example, in Age of Empires they "had to use some elements that failed cultural inspection" (AoE II). However, one interviewee also reported that it was a conscious preference of the designers to deviate from external representative realism: "what we never include are, for example, real dates, places and character names, so we always distance ourselves from reality, so that we still have the freedom to do what we want" (Anno 2070). The interviewee saw this form of realism as a restriction of creativity, which is why semi-fictional settings were chosen—on a representation of Earth, but in locations only inspired by real existing places. Overall, similar reasons are given for both the use of external realism in visuals/sensory aspects and for deviations from it as for the narrative, systemic, and action realism: Player expectations, immersion and credibility, comprehensibility, difficulties with the sheer extent of reality, as well as preferences of the designers.

5. Discussion and Conclusions

This interview study with game design experts investigated the designers' approaches to game realism when it comes to geographical topics. Main aim was to further explore the educational potentials and limitations of commercial games, and to derive incentives for reflection, whilst the educational perspective on their strengths and weaknesses may also help improve the development of future games for geography education.

5.1. Insights on Realism and its Constraints in Entertainment Games

Generally, the topic of realism seems to be of high importance in the theory and research revolving around digital games, which is reflected in the extensive literature on realism in the game studies [20,23,26,30] (for more see Section 2). As the interviews conducted suggest, realism is similarly important in practical game development. Although the interviewees did not actively distinguish between the different forms of realism identified in the game studies and presented in our model, their statements indicate that they nonetheless pay attention to all of them during development.

The type of realism most frequently addressed by the interviewees was external realism, i.e., a design concept that is meant to represent parts of the world outside the game.

As this realism type is particularly relevant from our educational perspective, it may be that our background had an influence on the direction that the developers' answers took. It is also possible that 'external realism' is simply the interviewed developers' common understanding of 'realism', particularly as the different realism terms are mainly referred to by scholars, and not by the gaming industry.

The interviews indicate that external realism is implemented by the designers for various reasons. For one, real-world societal topics are used to create tension and an emotional response in the narration and a general interest in the game content, as they are often conflict-prone and currently highly debated. The games' system and action design builds on these conflictual topics, which are utilized to enhance challenge and complexity, making use of the complex systems underlying topics such as climate change or city development (also see [2]) and of the polytelic situations that arise from these topics (also see [44]). Ultimately, the increased challenge and complexity add to the enjoyment of the gaming experience. As game theorists frequently state: "It is the challenge that is sought, one of the basic motivations of play" [45] (p. 170). Challenge and complexity as a fun factor can be explained with the theory of mastering, as players feel a moment of mastery that is highly satisfactory when figuring out how complex systems in a game work and how to solve complex problems [45,46]. However, in addition, external realism is used to give players a familiar context. This is meant to let them handle the increased complexity more easily, as system relations based on the real world are more accessible. In addition, game-internal coherence (internal realism), and the closely connected immersion [47], are reportedly easier to establish on the basis of familiar contexts—here external realism supports the internal realism. Furthermore, 'credibility' was often mentioned, which is strongly connected to perceived realism, and is one of the major aims of making references to the real world. Surprisingly, several of our interviewees also disclosed to pursue educational goals with external realism in the context of societal topics, such as informing about these topics, triggering an interest in them or helping to understand their underlying complex systems. Partly this is due to the interests or political attitude of the designers—they apparently want to depict topics they are interested in themselves, or even consider themselves responsible for informing people about them. Yet some of the interviewees also saw the educational aspects of their games as a contributor to gaming fun. Even if the designers wanted to present themselves to us in a particularly positive light by indicating educational objectives, they agreed on the spreading understanding that enjoyment often comes from learning [46,48,49]. In addition, the mentioned 'mastery moment' is the rewarding result of learning about the logics of the game [46]. In this respect, the basic motivation of entertainment games and learning games become intertwined.

Nonetheless, there are also factors that limit external realism concerning real-world topics in the games. For one, ensuring comprehensibility and balancing cognitive load forces designers to constrain the complexity that arises from socio-ecological topics to a certain degree. This is not necessarily detrimental to the games' educational potential, as long as the simplifications do not lead to misrepresentations and thereby to the conveyance of misconceptions. Understanding the system in which the player operates in and comprehending which action (indirectly) caused which effect is even essential for learning. Here, parallels can be drawn to the practice of didactic reduction through the way of mediation, which is to narrow educational content to the core aspects and to mediate it in a simplified way in order to make a subject matter comprehensible and appropriate for a specific target group of learners [50]. Other reported reasons for breaches of external realism include a need to produce enjoyable, motivational game mechanics. For example, the common overpowered player roles, which were identified as a deviance from real world inspirations by several authors [8,12,13], enhance player agency and therefore evoke feelings of control, self-efficacy and achievement, which are core factors of motivation in engaging with media [51]. Such deviances that increase player agency within the geographical topics may also be beneficial from an educational perspective, as they allow for relatively free exploration of realistic contexts and the testing of formerly abstract, theoretical solutions,

which is considered a unique advantage of such games [5]. The stimulated self-determined thinking through of these contexts is crucial for learning, as it is for any subject matter [16].

However, the interviews also disclose deviances and reasons for these that may be more problematic from an educational standpoint. It was found that designers' interests and political attitudes, while contributing positively to the incorporation of some geographic issues on the one hand, caused topics of lower personal interest to be represented in a less complex way on the other. For example, while climate change is strongly present in Democracy due to the designer's personal interest, migration is only treated superficially, and its cause-effect relationships are much simplified. The avoidance of controversy when depicting the topics (such as leaving out most environmental impacts of resource use in Rise of Industry) partly stems from preferences of the designers, too. Yet the interviews revealed that the most decisive reasons for deviations from external realism are player expectations and perceived realism. Perceived external realism is easier to establish than a more faithful external realism. For example, medium complexity seems to appear more realistic than a more true-to-life high complexity [37]. When a game reaches the point where it is (presumably) perceived as realistic by the player, designers reportedly choose not to go into further detail on that represented aspect of reality. In addition, when selective decisions have to be made, e.g., due to an inability to represent reality in all its complexity, preference is often given to common player perceptions. This practice can result in the perpetuation of prevalent clichés and misconceptions within the games' design and a lack of new information, such as the under-complex and stereotypical representation of migration impacts in a range of simulation games [6] (p. 29).

Prioritizing perceived external realism based on player expectations over external realism seems to be the biggest shortcoming in the design process for the educational potential of games. While the mixture of external and internal logics may also cause confusion [18], as our interviewees also recognize, many game-internal logics are easier to be unmasked as fiction, even if they are logically embedded in the game by internal realism (such as the infinite underwater resource deposits in Anno 2070 or a resource management that follows board game logic in AoE II). Yet something perceived as externally realistic is presumably not questioned at all by players [25] (p. 268). From an entertainment industry perspective, this approach works well, as it keeps players in their comfort zone. However, from an educational viewpoint it may be problematic: Since games can influence players' concepts of the represented topics [17,19] and players feel confirmed in their own views through playing the games, the presented stereotypes and misconceptions may further consolidate their potential misinformed knowledge.

5.2. Utilizing the Insights in Education and Game Development

The solidification of clichés and misconceptions can be counteracted through reflection that develops critical thinking towards the medium, for example in geography classes. To sensitize teachers for the critical design aspects and to enable them to guide purposeful reflection, the insights of this study could be used in teacher training at universities. Our model on realism in games could be used as a starting point to raise awareness with regard to problematic approaches to perceived realism. Teachers that were prepared in this way could then lead the discussion into the classrooms. For instance, the educationally valuable comparison between virtual world and real world (effectively performed in a geographical context regarding SimCity by Kim and Shin [5], for example), could be complemented with a reflection on which concept of realism predominantly underlies the part of the game in consideration. In addition, an assessment of which (political) message resonates with the game system, or elaboration on designers' strategies for dealing with real-world issues, could sharpen the awareness that game content is subject to the choice of its designers. Thereby, a contribution could be made to the promotion of media literacy, as is required in school education [10,11]. Once the necessary critical view on the medium is given, the advantages of the games, such as complexity, freedom of action or their ability to generate emotions, could be utilized for facilitating contextual, exploratory learning [5,7,48],

fostering systemic thinking [2,8], and sparking an interest in geographical topics that extends beyond the game (as reported by several interviewees) and, consequentially, the classroom.

Additionally, the insights gained from this study can be utilized to improve the design of serious games and, as the educational aspect reportedly does play a role in commercial game design, of entertainment games suitable for geography education. As discussed previously, some deviations from external realism are necessary for creating enjoyable and comprehensible gaming experiences, which should also be considered for learning games. Pleasure does not only come from learning, as argued above, but vice versa, enjoyment is also an important prerequisite for learning, considering the findings of neuroscience that pleasure contributes substantially to a readiness to learn and ultimately to learning success [16]. For example, the common overpowered player roles could relieve the criticism regarding many serious games that players are given too little freedom of action [15]. Internal realism, in terms of the coherence/a logical composition of the game world, in its designed and perceived form, is also important for both entertainment and educational games. This is because inconsistencies, such as non-embedded learning tasks and assessment attempts, lead to a disruption of engagement [25,49]. However, for the given reasons, perceived external realism based on player expectations should not play such a prominent role in educational game design. Making a game appear realistic is still highly profitable for its persuasive and educational potential [37], but the player's perspective should not be prioritized if the perception deviates from reality to such an extent that it leads to considerable over-simplification and misconception of represented real-life content. Such conceptions could, at most, be incorporated to disprove them in the game. Educational game designers have the advantage of not needing to focus so much on the marketability of their games. Nevertheless, commercial game developers should also be more aware of the implications of prioritizing player expectations over more truthful representations of real-world issues. Simplifications are necessary, but the reduction of complexity should be made in an informed and conscious way rather than by simply choosing common beliefs. Our model could be a cornerstone for an increased awareness of the different realism forms, possibly through an application in the training of future game designers. A practical approach that could also help to avoid depicting only general knowledge and clichés is the consultation of up-to-date authentic sources in the information gathering phase, following the example of Bury Me, My Love, and incorporating (scientific) experts into the team, such as for the development of ECO. Since this study focused on the creators of games and can therefore only assume the games' positive and negative influence on players concerning geographic topics, it would also be useful to conduct studies with young players of these same sort of games, for example to investigate their reflective ability regarding the topics presented.

As other authors have already postulated (e.g., [48,49]), it seems that both the educational and the entertainment perspective can learn from each other. In the near future, a close collaboration between educators and both branches of the game industry may help to create games that students love to learn with and to facilitate fruitful education with one of the most popular forms of digital media.

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