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Proceedings of the
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Edited by
Dr Maja Pivec and Dr Josef Gründler
FH JOANNEUM University of Applied Sciences

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A Process Full of Challenges: A Serious Game About the German Energy Transition

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Abstract: The implementation of the german energy transition (*Energiewende*) is unclear in its configuration and timeframe. The future of the transition depends on more than factors such as technological development, economic feasibility and political framing. Rather, maintaining a positive attitude by society and its understanding is significant. Therefore, effectively communicating the complex process of energy transition is essential. For preserving the variety of aspects and the multitude of perspectives in this open process we choose the format of a serious game. We explain why we think developing serious games can be an appropriate tool for that purpose. Contrary to existing games on that topic, we focused on motives, attitudes and their implications in a world full of contradictions and caprices in everyday life. We created an innovative Adventure, which focusses on the energy transition. This topic represents a challenge because it bears complex interrelations (technical, political, social) and strong polarization in debate. In order to achieve a compelling game experience as well as a learning outcome, we use a set of characters to represent different attitudes. While dealing with job-related and day-to-day tasks, the characters run into the dilemma of foiling their commitment to sustainability. In the quest of a balance between consumption and happiness, they have to make energy-aware decisions and cooperate with each other.

1. Introduction

For developing a game about the energy transition it is important to keep in mind the essential relevance of energy in our life. Energy is a momentous, global topic. On the one hand, having energy is crucial for production, heating, to power electronic equipment, or for mobility. Lack of energy and the efforts to supply more energy to more people is on the agenda, especially in developing countries. On the other hand, switching energy resources or even saving energy is a worldwide challenge – especially against the background of climate change and energy security. Many countries are now transitioning their energy systems by building new renewable power plants and introducing innovative mobility concepts, including the use of electric vehicles.

The german energy transition is a fundamental and rapid process to change the country's energy system. The goal is to transform the energy system from producing energy from thermal capacities, such as coal, gas and oil, to renewable and sustainable resources, such as wind, solar and biomass. Renewable energies had a one-third share of german electricity consumption in 2016, whereas the share was 3.4 % in 1990 (FMEE 2016a and 2016b). Additionally, the Federal Government of Germany is committed to reducing gross electricity consumption by 10 % by 2020 compared to 2008 consumption, but by 2015 it had achieved only 4 % of its goal (FMEE 2016a). The energy demand within the transport sector is an even greater challenge. While its demand increased by 1.3 % between 2005 and 2015, the goal is to reduce demand by 10 % by 2020. Therefore, the transformation is far more ambitious than changing the electricity system, but needs to address issues of heating and mobility as well. The energy transformation does affect the daily lives of the public. Subsequently, energy is a topic in media, picking out uprising conflicts such as changing business models, in distribution of costs and installing new infrastructure. Such conflicts are a practical starting point for game design.

Although more than approximately three quarters of german society support the energy transition (Renewable Energy Agency 2013, 2016), we conclude that the public needs to actively facilitate and understand the process. However, we see important challenges in that case (Kreuz 2017). One main challenge for bringing the topic to a non-expert audience is the transition's complexity. This complexity derives from technical, economic, social and time-related constraints as well as relationships. For an in-depth understanding, technical and economic knowledge is needed. Furthermore, certain aspects are not always "right" or "wrong", but are dependent on

specific perspectives or opinions. This might trigger conflicts between stakeholders. Furthermore, Grunwald (2014) argues that the *Energiewende* 'is a social transformation including technological change but going far beyond' which 'includes a complex set of human actors such as […] citizens affected by side effects of energy technologies and infrastructures and also citizens in their role as the democratic sovereign' (p. 11).

Based on these complex and social aspects regarding the path to a future energy system, adequate description of the related complex topics is vital for understanding. The process needs to be communicated objectively to the public, whose understanding, acceptance and public support is crucial. Already, the coalition agreement between the three parties currently forming the german government includes the politically motivated demand for serious games: 'Digital games shape the everyday life of many, especially young people in our country. We honour the diversity of high-quality supply of computer games, especially with educational value […]. We further want to support that' (Federal Government 2013). Therefore, serious games might be a proper tool for the given purpose of communication in this context because players can dive into aspects on their own paths. Based on this understanding, the game format can be considered as a communication tool. As a structured container for information, it enables the user to follow elaborate stories. With an information format in mind, the gaming approach may lead to interactive systems such as the hypertext structure in the project "Der Kontext" (www.derkontext.com), database driven information tools, or our more artistic approach with interactive narrations.

2. Complexity, design and serious games

As Luhmann (1986) states, functional systems reduce complexity by establishing their own binary codes, in this case the availability of energy. While these systems tend to self-preservation and to establishing their own conditions, essential aspects are put aside. The reduction of complexity endows us with efficiency. However, we ignored negative consequences such as risks affecting individuals, and ecological harm. The conventional energy system separated production and consumption of energy. Whereas centrally managed plants incorporated professional expert knowledge, the consumer could just plug in and use their devices. The consumer was set free and disengaged from responsibility. The energy transition fundamentally shifts this arrangement. Complexity comes back with new and unimproved proceedings and unreasonable demands (Müller 2014a). The energy system, before managed in a proven workflow and negotiated political arrangements, now heads towards a tangled constellation of factors, which the design theorists Rittel and Webber (1973) would call a "wicked" problem. Such situations revoke any definition. Precedence, particularity and manifold independencies complicate problem solving (Conklin 2009). Systematic correlations, uncertainties and conflicting stakeholder prospects lead to inconsistent approaches (Lazarus 2010). In the context of a more demanding time-critical background of climate change and the near-sightedness of interests, the problem becomes "super wicked" (Levin 2012). The problem of climate change continues to worsen as we attempt to regulate it, thus there are fewer opportunities to find a solution. In addition, new stakeholders and even new categories of stakeholders like next generations (Jonas 1984) and non-human stakeholders (Singer 1984) are recognised. Stakeholders are both cause and are capable of solving climate change problems. They have both tangible local demands and face and wish to prevent abstract, global risks. Within this, they face trade-offs (e.g. renewable energy plants vs. wildlife conservation). For these situations, the solving process can only provide tentative approaches (Roberts 2000) and an erratic iteration (Mitchell 2008). Any solution comes at the risk of irreversible consequences that limit future operations (lock-in effect) while the goal must be to preserve a wide scope for action, to sustain the value of options (Hubig 2006).

When dealing with a wicked or super wicked problem, hierarchal top-down methods and case-based reasoning are insufficient. Instead, an experimental and constructive approach that maintains innovation and collaboration is needed. This directs to strategies used by authors, artists and designers to create new artefacts. These processes derive their power from a deep insight into the communication processes of the stakeholders. From a semiotic point of view, it can be argued that pragmatic relations are the key for understanding design (Van den Boom 1994). Recent trends like design thinking (e.g. Branzaglia 2017) and gamification (Deterding et al. 2011, Müller 2014b) are deploying the inherent knowledge of designing for general usage. Rather than a toolset for shaping footage to a useful form, design becomes a service for rethinking a situation and defining workflows (Müller 2015). Thus, design is an open, creative and experimental process in putting different methods into effect to achieve not foreseen results.

For representing a complex reality as we described, the principles of game design are valuable for motivation and understanding. But games are diverse. Describing game design has to take in account all sorts of games and contradictory categorising systems. Thinking of the differences between an adventure and a puzzle game reveals that certain aspects such as narration and characters will have a different impact on playing. Apperley (2006) described seven categories of game genres used today: action, adventure, arcade, role-play, strategy, simulation (sim games) and casual games. While sim games form their own category, serious games can be found in any of the seven aforementioned categories. Aldrich (2009) defines serious games as the new media of learning how to know while sim games are defined as the new media of learning how to do. Thus, using serious games we can improve our understanding, and using sim games we can improve our specific skills. Serious games and sim games always depict a specific part of reality. Thus they form an abstract and operable model. Using these operable models, the player is able to influence certain parameters, to change initial states and to profit from building different future scenarios. While specific simulations today are widely used in industry and economics, serious games do not yet carry this importance. Simulations show their strength especially in complex situations. Illustrating the energy transition in a fictional small neighbourhood of an urban quarter within an adventure game might improve the understanding of these complex issues and will benefit users. The game format preserves complexity by dealing with uncertainty (Costikyan 2013) and, instead of a straightforward reduction to a known approach, it sprouts new narrations.

Gameplay, a term coined for the special user experience, could be used as a key to game design. Four areas of game design can be identified in compelling games (Rouse 2004, Rogers 2010, Schell 2012) and they also can be mapped to the four player types of Bartle (1996, see also Yee 2006 and Kallio et al. 2011).

First, game design (and of course design in general) starts by establishing a structured communication process. It has to take in account the shifting interests of heterogeneous stakeholder assemblies and give them a platform for self-discovery and room for identity. Games might be used as an occasion for communication through the incorporation of chat rooms and forums. The social-oriented player may find herself also comfortable with sophisticated and well-funded characters (Ibister 2006) and a branched dialog system. Animated characters used in games are adopted from ritual role-playing, theatre and film. In games, characters can become more intimate agents of tentative exploration. Through characters, a game can implement different views and related communication strategies. They open windows to unfamiliar concepts and guide players as an interface (Lessard and Arsenaut 2016). They are defining a social sphere of interoperability. By this means, world-building always is an act of considering reality (McGonigal 2012). The ability of characters to opt for transformation is the key to the dramatic evolvement of stories (Lotmann 1973). Thus characters are access points into complexity, as memorable human-centred figuration of confusing issues or as guides through complexity and embroilment. Consequently, characters are as well a central concept in our e-transform game.

Second there is the opportunity to dive into an immersive world. Game worlds refer to both, social reality and media, our second and often more influential reality. The game world may expand to deep diversity and enfold meaningful situations (Darvasi 2016). Games refer to the user's abilities of understanding by levels, which are a framework for the acting of the player and her quests. Portioning the quests into manageable missions is a core task of game development. Quests may prepare the players for problem solving and raising awareness to the extent of their attention. Missions inherit pedagogical thinking in appropriate assignments and as active lenses to what matters. Reducing complexity by level design means to create a rich and compelling structure for interaction.

Third, games have to be fun and provide a constant feedback and reaction while feeling safe. Interactivity establishes a field of resonance for the player's actions and decisions without harsh consequences. Playing is a sandboxed experience which allows users to discover limits without harm. The gameplay may challenge sensorimotor skills or the power of deduction. Developing games is tied to the need of balancing out the gameplay between challenge and relief not to cause neither fear, ennui nor frustration by exhaustion. Its goal is to provide a feeling of flow (Csíkszentmihályi 2008). Reasonable feedback invites the player to stay tuned and remain motivated and active. The challenge is to strengthen engagement in the gaming. The rules of play form a procedural rhetoric (Bogost 2007) that guides and persuades the player to reduce contingency (or complexity) by reasonable actions.

Fourth, the feedback system makes it easy to invoke achievements. Game design is able to count the player's success by trailing his efforts. This has a social side of never leaving the player alone in the situation. Well-designed gratification systems combine a point system to reward actions with transparent progress to unlock motivation. Achievements are tied to values, thus offering a guide through complexity and orienting the player on serious issues.

3. The e-transform game

In the context of the aforementioned complex transformation processes, such as the current energy transition, we cannot use unidimensional choices for action within a serious game. Rather, we need to construct scenarios which reflect the diversity of opinions and attitudes of stakeholders of the energy transition (e.g. the different preferences for goals of the transition process, see e.g. Kreuz 2016, 2017 and Joas et al. 2016). In particular, the social dimension of the energy transition is multifaceted because of different perspectives and appreciations. Consequently, the characters within the e-transform game constitute a team, which includes diverse backgrounds. This team helps the user draw links with the various needs and desires in society. It helps to understand contradictory views by following the characters' expectations and requirements. Individual biographies with distinct experiences, knowledge and attitudes give insights into iconic facets of the transition.

To connect facts and fiction in our game environment in a constructive way, we based our game development on our social research into the energy transition. In particular, the stakeholder interviews by Claus Kaelber, a researcher in the generic e-transform research project (with the support of Eugenia Umerkajew and Sebastian Kreuz), gave revealing insights into different stakeholders(see e.g. Hipp et al. 2016). These outcomes had been categorised and classified according to the media user type model (Öhmischen and Schröter 2011). Claus Kaelber and other team members (Katharina Kasarinow, Joachim Sommer) sketched out five types of actors which are open-minded towards the energy transition. These ideal types were then envisioned as personas (Adlin and Pruitt 2010) in an intertwined narration.

The e-transform serious game – concept and supervising by Jens Müller (Müller et al. 2017), energy-related content by Sebastian Kreuz and Felix Müsgens (Müsgens and Kreuz 2014, Kreuz 2016, 2017) – is based on a modular concept. The idea is to show 24 hours in the life of a character. We started with five personas developed by Claus Kaelber (2014). After we liaised with a Munich based communal planning team which planned a future creative quarter, we adopted this created quarter – a modern urban place – as the setting of our game. Although the quarter has not been built yet, it gave us a foundation for shaping the characters and their behaviour with some authentic grounding. The game world could be linked to a believable community in a typical urban environment with local shops and attractive places to work and relax. This setting deploys a sophisticated urban view onto the world, with the sometimes neurotic behaviour of close neighbourhood, with individuality and self-expression and the hopes and expectations of dwellers from different milieus. In our game, we focused on typical locations which are closely connected to the individual characters, distinguishing and explaining their whims and habits.

The nucleus of the e-transform game is eight characters interacting in the neighbourhood. The quarter proclaims to have a high standard of sustainability, energy saving and usage of renewable energies, furthermore claiming a high integration of social services, cultural places and spaces for creativity, hence the name "creative quarter". Here, particularly engaged and open-minded people come to live. This is the perfect niche for the five transition-friendly types which evolved from the theoretical survey. Two of such types made it into our game, the journalist named Julie and the IT specialist named Max. We completed the set for our episode with other typical inhabitants of the urban quarter to add variety and contrast to their mind-sets and backgrounds. During character design (graphics by Florian Pömmerl, animation by Mike Zauner), in addition to the foundation of the media user types by Öhmischen and Schröter (2011) we used other concepts for defining character sets. We considered the new humans (Lepp 1999), the sins and virtues (Ernst 2014), the temperaments (Adler 2007), the depth psychological types (Riemann 2007), the social characters (Fromm 1932), the archetypes (Propp 1986, Campbell 2011, Vogler 1998), the OCEAN model (Asendorpf and Neyer 1996) and the team roles (Belbin 2010). Due to mostly related origins, the different models could be considered as complimentary ways to sharpen a character's non-diegetic background and its appearance in the game (Müller 2016). While these theories focus on the human actors, they complementarily reflect individuals' living conditions. The dynamic conflict between characters, their coexistence and paths taken throughout the game facilitates change.
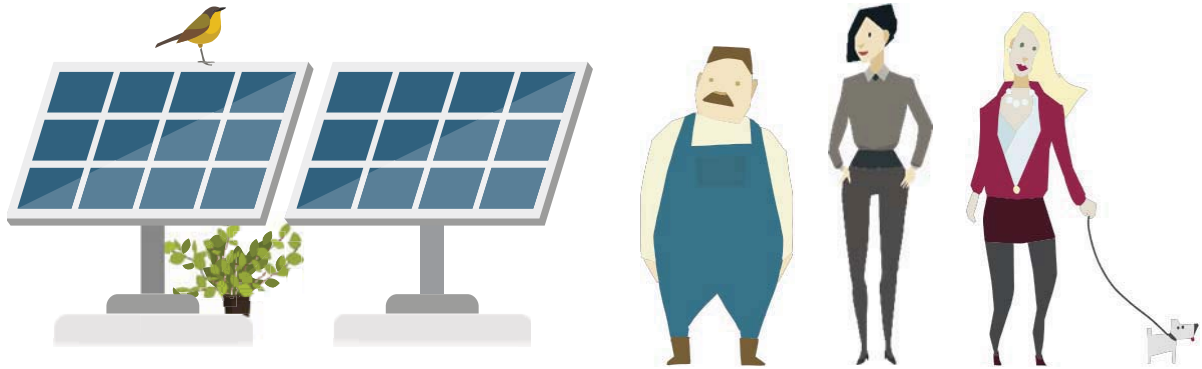
Figure 1: Screenshot of the serious game

The fictional player character Julie is drawn as a French correspondent. She discovers an illegal manipulation to the solar installation at her apartment building. Her perspective on the german *Energiewende* is driven by admiration of political empowerment. She perceives the transformation as a democratic process towards self-determination in the paradigm of enlightenment and emancipation. She tries to stay in contact with all her clients and family. Her international travel conflicts with her goal to save energy. She is always on the run, feeling freedom from the boring routines of fixed employment contracts. On the other hand, she is kept busy by parallel jobs. Indeed, Julie is a ubiquitous voyager, in her restlessness, feeling at home everywhere and nowhere, but her actual place to rest is her flat in the quarter, where she retreats to concentrate on writing up her investigations.

Her neighbour Max is a successful IT expert. Max is also one of the five types from our preliminary research. He supports the energy transition not only as an expert but also because he believes in smart technical solutions for all challenges. In his opinion, the energy transition is a necessary step away from old-fashioned techniques. His optimism towards the blessings of digital technology fascinates Julie. But in his rational thinking, even life is a puzzle of choices and relationships. He already has a job, a new apartment, and now he is looking for a partner but finds women difficult to understand. However, he does furnish his new apartment in preparation for future family living.

The waitress Semira contrasts the intellectual forwardness of Julie and Max. She is trying to manage the day. Getting her things done does not leave her time to deal with the energy debate. Instead, she feels dedicated to the small steps in her immediate surrounding. Her thoughts do not reach the lofty goals of mankind. Instead she recognises all the obvious troubles with the people and situations around her. Someone has to fix things and she feels responsible. Semira's place is her cafe, which she manages and which is unique in connecting the guests and characters of the game.

Another practical talented character is Dieter. He lives a frugal live, disliking extravagance and waste and, as facility manager, he has the power to reduce wastage and suppress changes. In addition to his influential role in the underground control centre and his subtle management of services, he is able and willing to make a local but substantial contribution to the *Energiewende.* In his view, the energy transition is all about energy saving. Dieter's base is his janitor's office but he also has access to otherwise hidden places like the roof. All the building's services - water, electricity and the lifts - are dependent on his maintenance. He is aware of the impact of neglecting his duties and the power he has.

For the activist Hartmut, the energy transition is a political issue, fitting in with his fight against centralism towards decentralised and democratic structures. He makes people aware of the need for increased global solidarity and to stand up for their rights. He believes in the power of arguments, distributed by paper. In the game episode, he tries to involve everyone else in contributing to his district magazine. Hartmut's base camp for action is his copy shop, where he invites fellow campaigners for editorial meetings.

A more stylish character is travel agent Victoria, who loves shopping and entertaining. Nevertheless, she is convinced by the energy transition, because it promises a cleaner and healthier world. She loves change but it should not truncate her consumer-orientated lifestyle. Her conflict, driven by her profession selling holiday flights, is to maintain luxury while compensating for the side effects. She rejects requests for abstinence and restrictions.

For her, economic prosperity is the key to a good life. Her travel agency is a place to spawn dreams of luxury and consumption, a hub for ecologically problematic desires.

Student Fabian rejects the optimistic view of the aforementioned characters and disbelieves in the energy transition. He thinks it is all too late for a turn around, there is no hope because the moral plea from efforts like Hartmut's engagement will lead to nothing and trail away without any resonance. He believes that the reality is too cumbersome to change and feels that he has no power to make an impact. Fabian, thrown out of his girlfriend's home, is looking where to stay, a status describing his actual phase of life.

Finally, the homeless Josha is wondering about the other characters. As most of the others, he is convinced by certain aspects of rethinking the energy sector but he has given up and lost all influence in causing change. Regardless, he intends to challenge society's convictions in a fundamental way. With his radically different living situation compared to all other characters, he casts doubt on the certainty and conventions of modern sustainable life, measuring it against a fundamental humanity. He is homeless, his habitat is the street, where all characters' game paths cross. The outcast, who plays no role anymore, stays in the spatial centre.

In accordance with our findings, the characters' motivations are very different, causing conflicts when they meet in locations of their neighbourhood and try to collaborate. To exemplify this, Berlin-based playwright Volker Lüdecke (2017) created a rich story for the game. In alternative branches, the story outlines the characters' daily life. They became entangled in intricate, "wicked" contradictions. It was an interesting challenge to transform the story from its original stage version, employing all the standards and tricks of dramatics to the possibilities of a user-driven gameplay. This was managed in a collaborative workshop, a format necessary to bring together all the special knowledge in dramatics and game development into a creative artistic production process. Every sentence has its stage direction, which is coded directly as a game script. While the stage version is a readable story, the game version is encoded as a computer readable CSV-file. This allows the author to easily change the story by editing it inside a spreadsheet application. After a technical revision by the programmer, this script drives the characters in the game. The chat-like dialogue system animates the player as they make situational decisions. Good life and/or environmental concerns are a key to develop the story from the players' perspective. The underlying achievement system demands weighing "happiness" against "CO_2-stock", the latter as an indicator for the aspect of energy and climate protection. Therefore, the user has the challenge to increase happiness while paying attention to her individual CO_2-stock. Furthermore, users have to successfully fulfil missions. In this respect, establishing a good relationship between all the characters helps to accomplish the tasks. The gameplay (programming by Faruq Suriaganda) makes it easier to finish with success by cooperating with each other. The sound (concept and realization by Benedikt Möller) and music by (Danijel Zambo) bolsters the immersive atmosphere of the game. A dedicated musical theme accompanies every character.

4. Conclusion

With the big challenges regarding the energy transition in mind, such as complexity and required public understanding, we established a serious game related to the energy transition process from a german perspective. The game shows the difficulty of heterogeneous stakeholders with different interests and goals. While a heterogeneous box of communication tools can be used like homepages, infographics, movies etc., formats that also had been produced by the e-transform team (www.e-transform.org), serious games are one of the most difficult formats to produce. Serious games are a proper tool to express different individual viewpoints concerning complex transition processes like the energy transition, which need to be communicated and understood.

Further research might focus on the improvement and continuing development of tools to relay knowledge to lay people without conveying opinions, but showing openly the wide range of preferences, trade-offs and contradictions in comparable processes. In bringing together a team of researchers (communication scientists, social scientists and economists), artists (animation, game design, music and writing) and software engineers, there was an on-going discussion of methods and roles. It worked best in our joint workshops, when we worked on defined challenges of the game like the dialog system and were forced to explain ourselves the disciplinary mode of operation. We established tools for collaboration that work intuitively for all participants, e.g. a table of dialog lines, fed by the game author, complemented with instructions by the level designer and implemented into the engine by the programmer. Overall, the convergence of research and visualization/narration in the demanding format of a serious game seems to be an appropriate way for preserving complexity while establishing

awareness and sensitivity for a momentous subject – and give hints through engaging missions for alternative actions.

References

Adler, A. (2007, orig. 1927) *Menschenkenntnis*, Vandenhoeck & Ruprecht, Göttingen.

Adlin, T. and Pruitt, J. (2006) *The Persona Lifecycle – Keeping People in Mind Throughout Product Design*, Morgan Kaufmann, San Francisco.

Aldrich, C. (2009) *The Complete Guide to Simulations & Serious Games*, Pfeiffer, San Francisco

Apperley, T.B. (2006) "Genre and Game Studies – Toward a critical approach to video game genres", in: *Simulation and Gaming*, March 2006, pp 6-23.

Asendorpf, J. B. and Neyer, F.J. (1996) *Psychologie der Persönlichkeit*, Springer, Berlin and Heidelberg.

Bartle, R. (1996) "Heart, clubs, diamonds, spades: Players who suit MUDs", *Journal of MUD Research*, http://www.mud.co.uk/richard/hcds.htm.

Belbin, R.M. (2010, orig. 1981) *Management Teams. Why They Succeed or Fail*, Third Edition, Butterworth-Heinemann, Oxford.

Bogost, I. (2007) *Persuasive games – The Expressive Power of Videogames*, MIT Press, Cambridge/Massachusetts.

Branzaglia, C. (2017) *Fare progetti. Una ipotesi di metodologia per tutti, Fausto Lupetti Editore*, Bologna.

Campbell, J. (2011, orig. 1949) *Der Heros in tausend Gestalten*, Insel Verlag, Berlin.

Conklin, J. (2009) "Building shared understanding of wicked problems", *Rotman Magazine*, Winter 2009, pp 16-20.

Costikyan, G. (2013) *Uncertainty in Games*, the MIT Press, Cambridge/Massachusetts.

Csíkszentmihály, M. (1996) *Flow*, Klett-Cotta, Stuttgart.

Darvasi, P. (2016): "Empathy, Perspective and complicity – How Digital Games can Support Peace Education and Conflict Resolution", Working Paper 03, Mahatma Gandhi Institute of Education for Peace and Sustainable Development & United Nations Educational, Scientific and Cultural Organization.

Deterding, S., Dixon, D. Khaled, R. and Nacke, L. (2011) "From game design elements to gamefulness – defining ‚gamification'", in: *Proceedings of the 15th International Academic MindTrek Conference – Envisioning Future Media* Environments (MindTrek '11), ACM, New York, pp 9-15, http://doi.acm.org/10.1145/2181037.2181040.

Ernst, H. (2014) „Die Sieben Todsünden: Heute noch relevant?", *Aus Politik und Zeitgeschichte* 52/2014, pp 3-7.

Federal Government (2013) *Deutschlands Zukunft gestalten – Koalitionsvertrag zwischen CDU, CSU und SPD*, https://www.bundesregierung.de/Content/DE/_Anlagen/2013/2013-12-17-koalitionsvertrag.pdf.

Federal Ministry for Economic Affairs and Energy (FMEE 2016a) *The Energy of the Future – 5th Monitoring Report of the Energy Transition* (long version), http://www.bmwi.de/DE/Themen/Energie/Energiewende/monitoring-prozess.html.

Federal Ministry for Economic Affairs and Energy (FMEE 2016b) *Time Series about the Development of Renewable Energies in Germany*, http://www.erneuerbare-energien.de/EE/Navigation/DE/Service/Erneuerbare_Energien_in_Zahlen/Zeitreihen/zeitreihen.html.

Fromm, E. (1932) „Die psychoanalytische Charakterologie und ihre Bedeutung für die Sozialpsychologie", *Zeitschrift für Sozialforschung* 1/1932.

Grunwald, A. (2014) "Sustainability research as inter- and trans-disciplinary activity: the case of German Energiewende", *Problemy Ekorozwoju – Problems of Sustainable Development* 2014, vol. 9, no 1, pp 11-20.

Hipp, C, Kaelber, C. and Müller, J. (ed.) (2016) *Leitbilder für eine erneuerbare Energieversorgung*, e-transform issue 2, University of Applied Sciences Augsburg and Brandenburg Technical University in Cottbus, Augsburg and Cottbus.

Hubig, C. (2006) *Die Kunst des Möglichen I – Technikphilosophie als Reflexion der Medialität*, Transcript, Bielefeld.

Ibister, C. (2006) *Better Game Characters by Design: A Psychological Approach*, Morgan Kaufmann, San Francisco.

Joas, F., Pahle, M., Flachsland, C. and Joas, A. (2016) "Which goals are driving the Energiewende? Making sense of the German Energy Transformation", *Energy Policy* 95, pp 42–51.

Jonas, H. (1984, orig. 1979) *Das Prinzip Verantwortung – Versuch einer Ethik für die technologische Zivilisation, S*uhrkamp, Frankfurt am Main.

Kaelber, C. (2014) *Kurz, schnell, gut? Orientierung und Sensibilisierung im mediatisierten Alltag,* in: Hipp, C., Kaelber C. and Müller, J. (ed.) *Kommunikation erneuerbarer Energieversorgung,* e-transform issue 1, University of Applied Sciences Augsburg and Brandenburg Technical University in Cottbus, Augsburg and Cottbus, pp 38-52, www.e-transform.org.

Kallio, K.P., Mäyrä, F. and Kaipainen, K. (2011) "At least nine ways to play: approaching gamer mentalities", *Games & Culture* 6:4, pp 327–353, DOI 10.1177/1555412010391089.

Kreuz, S. (2016) *Ziele und Erwartungen zur Energiewende*, in: Hipp, C, Kaelber, C. and Müller, J. (ed.) *Leitbilder für eine erneuerbare Energieversorgung,* e-transform issue 2, University of Applied Sciences Augsburg and Brandenburg Technical University in Cottbus, Augsburg and Cottbus, pp 30-39, www.e-transform.org.

Kreuz, S. (2017) *Die Energiewende verständlich vermitteln – Herausforderungen und Umsetzungskonzepte*, in: Hipp, C, Kaelber, C. and Müller, J. (ed.) *Medien für eine erneuerbare Energieversorgung,* e-transform issue 3, University of Applied Sciences Augsburg and Brandenburg Technical University in Cottbus, Augsburg and Cottbus, pp 30-41, www.e-transform.org.

Lazarus, R.R. (2010) "Super wicked problems and climate change – restraining the present to liberate the future", *ELR* 40/8, pp 1153-1234.

Lepp, N., Roth, M. and Vogel, K. (1999) *Der Neue Mensch – Obsessionen des 20. Jahrhunderts*, Katalog zur Ausstellung des Deutschen Hygiene-Museum Dresden, Cantz, Ostfildern.

Lessard, J. and Arsenault, D. (2016) *The Character as Subjective Interface*, in: Nack, F. and Gorden, A.S. (ed) *Interactive Storytelling,* Springer, Los Angeles, pp 317-324.

Levin, K., Cashore, B., Bernstein and S., Auld, G. (2012) "Overcoming the tragedy of super wicked problems – constraining our future selves to ameliorate global climate change", *Policy Science* 45/2012, pp 123–152.

Lotman J.M. (1973) *Die Struktur des künstlerischen Textes.* Edition Suhrkamp, Frankfurt am Main.

Lüdecke, V. (2017) *Bonjour Energiewende*, in: Hipp, C., Kaelber and C., Müller, J. (ed.) *Medien für eine erneuerbare Energieversorgung*, e-transform issue 3, University of Applied Sciences Augsburg and Brandenburg Technical University in Cottbus, Augsburg and Cottbus, pp 48-61, www.e-transform.org.

Luhmann, N. (1986) *Ökologische Kommunikation – Kann die moderne Gesellschaft sich auf ökologische Gefährdungen einstellen?* VS Verlag, Wiesbaden.

McGonigal, J. (2012) *Besser als die Wirklichkeit. Warum wir von Computerspielen profitieren und wie sie die Welt verändern*, Heyne, München.

Mitchell, S. (2008) *Komplexitäten – Warum wir erst anfangen, die Welt zu verstehen*, Suhrkamp, Frankfurt am Main.

Müller, J. (2014a) *Energie, Klima und Design,* in: Hipp, C, Kaelber, C. and Müller, J. (ed.) *Kommunikation erneuerbarer Energieversorgung*, e-transform issue 1, University of Applied Sciences Augsburg and Universität Cottbus-Senftenberg in Cottbus, Augsburg and Cottbus, pp 70-89, www.e-transform.org.

Müller, J. (2014b) *Weltrettung durch Zocken*, in: Kaiser, M. (ed.): *Ringvorlesung Games, Retro-Gaming – Gamification – Augmented Reality,* Verlag Dr. Gabriele Hooffacker, Edition Medien Campus Bayern, München, pp 61 –79.

Müller, J. (2015) *Die Werkzeuge des Design*, in: Bauer, C., Nolte, G. and Schweppenhäuser, G. (ed.) *Ethik und Moral in Kommunikation und Gestaltung,* Verlag Königshausen & Neumann, Würzburg, pp 105-119.

Müller, J. (2016) *Charakterdesign für Serious Games. Anmerkungen zur Darstellung komplexer Sachverhalte in Computerspielen,* in: Hipp, C, Kaelber, C. and Müller, J. (ed.) *Leitbilder für eine erneuerbare Energieversorgung,* e-transform issue 2, University of Applied Sciences Augsburg and Brandenburg Technical University in Cottbus, Augsburg and Cottbus, pp 66-89, www.e-transform.org.

Müller, J. Pömmerl, F., Suriaganda, F., Zauner, M. and Zambo, D. (2017) *Perspektiven der Energiewende – Entwicklung eines Serious Games*, in: Hipp, C, Kaelber, C. and Müller, J. (ed.) *Leitbilder für eine erneuerbare Energieversorgung,* e-transform issue 2, University of Applied Sciences Augsburg and Brandenburg Technical University in Cottbus, Augsburg and Cottbus, pp 78-89, www.e-transform.org.

Müsgens, F. and Kreuz, S. (2014) *Energiewirtschaft – Veränderung und Wandel,* in: Hipp, C, Kaelber, C. and Müller, J. (ed.) *Kommunikation erneuerbarer Energieversorgung*, e-transform issue 1, Hochschule Augsburg and Universität Cottbus-Senftenberg, Augsburg and Cottbus, pp 30-37, www.e-transform.org.

Öhmischen, E. and Schröter, C. (2010) „Alltagswirklichkeit der Onlinenutzung", in: *Mediaperspektiven* 10/2010, pp 457 – 470.

Propp, W. (1986, orig. 1928) *Morphologie des Märchens.* Suhrkamp Taschenbuch Wissenschaft, Frankfurt am Main.

Renewable Energy Agency (2013) „Erneuerbare Energiewende ist bei Deutschen weiterhin hoch im Kurs", *Renews Kompakt*, September 2013.

Renewable Energy Agency (2016) „Die Akzeptanz für Erneuerbare Energien im Spiegel von Umfragen", *Renews Kompakt*, March 2016.

Riemann, F. (2007, orig. 1961) *Grundformen der Angst und die Antinomien des Lebens,* Verlag Ernst Reinhardt, München.

Rittel, H.W. and Webber, M.M. (1973) *Dilemmas in a General Theory of Planning. Amsterdam,* Elsevier, Policy Sciences 4/1973, pp 155-169.

Roberts, N. (2000) "Wicked problems and network approaches to resolution", *International Public Management Review*, volume 1, issue 1, pp 1-19.

Rogers, S. (2010) *Level Up! The Guide to Great Video Game Design,* Wiley, Chichester.

Rouse, R. (2004) *Game Design: Theory and Practice*, Wordware Publishing, Plano.

Schell, J. (2012, orig. 2008) *Die Kunst des Game Designs – Bessere Games konzipieren und entwickeln*, mitp-Verlag, Heidelberg.

Singer, P. (1984) *Praktische Ethik,* Reclam, Stuttgart.

Van den Boom, H. (1994) *Betrifft Design – Unterwegs zur Designwissenschaft in fünf Gedankengängen*. VDG, Alfter.

Vogler, C. (1998) *Die Odyssee des Drehbuchschreibers,* Zweitausendeins, Frankfurt am Main.

Yee, N. (2006) "Motivations for play in online games", *CyberPsychology & Behavior*, 9(6), pp 772–775.