"Imaginary Systems" - Computer Games, Media Comprehension, and the Systemic Organization of Human Experience

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ABSTRACT From a combined media studies and Systems Theoretical perspective, this paper proposes an expansion of the systems paradigm towards human experience and imagination by arguing that systemic thinking is an inherent and intuitive feature of human cognition. On the example of filmic montage, it is shown that the creation of basic 'imaginary systems' is necessary for the meaningful interpretation of media experiences, regardless of the systemic nature of the medium. Based on play experiences in computer games, aspects of imaginary systems are examined in detail: the distinction between interior and exterior through assumed boundaries; the interior organization of systemic elements and relations; the setting of goals and action strategies, enabling interaction and purposeful manipulation; and the ambiguity of imaginary systems, which distinguishes them from real systems and requires them to be approached differently. Possible implications and benefits for media studies, Systems Research and the teaching of Systems Thinking are discussed.

KEYWORDS Imaginary Systems; Systems Thinking; Radical Constructivism; Media Experiences; Video Games; Film Comprehension; Human Imagination

AUTHOR'S NOTE Core arguments of this paper stem from my doctoral thesis (Koenig 2012), in which a constructivist anthropology of computer games has led to the identification of systemic aspects of human cognition. The passages in question (esp. Chapters 2 and 3) have since been adapted to better reflect the commonalities and differences between real and imaginary systems, and the term 'imaginary systems' has substituted the earlier terms 'experiential systems' and 'System Experience'. An early version of this paper has been presented at the 22nd European Meetings on Cybernetics and Systems Research Conference in Vienna (Koenig 2014).

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1. Systems Everywhere?

The idea of systems as a productive concept to describe, assert and utilize a wide range of phenomena has not only become a formative paradigm in the natural sciences and technology, but has left its mark on sociological, psychological, economic, political and even cultural studies alike. While the roots of the systems movement can be traced to the inherently interdisciplinary, yet highly specialized efforts of early cybernetics (see Pias 2003, p. 10f.), the notion of systems gained wider attention when western society encountered increasing problems in coping with the implications of

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technological development, the performance of the natural sciences, the claim for global political perspectives and even the notion of social change experienced in terms of "revolutions". The demand for explanatory models that promised to account for this experience of increasing complexity was met with the suggestion that a systemic approach might be better suited to address these complexities than the more traditional analytical method. By arguing that an understanding of complex problems cannot rely on understanding the problems' parts in isolation, but must also take into account the relations and interactions between these parts (Bertalanffy 1971, p. 16f.), "General Systems Theory" shifts the focus from the experience of complexity as a problem to systems as a possible solution. While the systems method is not in itself a definitive (and far less a simple) answer, it promises better ways to pose questions in a complex world, and with this promise, the systems idea has quickly become a persuasive paradigm not only within academia, but - in the form of slogans like "the whole is more than a sum of its parts" (Bertalanffy 1971, p. 18) - also within everyday knowledge.

But even though the idea of systems seems to have pervaded our lives and our ways of thinking, the implications and even the premises of this idea are highly ambiguous. When Ludwig von Bertalanffy formulates the expansive claim of General Systems Theory as "Systems Everywhere" (Bertalanffy 1971, p. 1), this claim is neither simple nor self-explanatory: where do these systems come from? Are there "systems everywhere" in the world around us, which we need to identify and understand? Do we need to apply a systemic understanding to the world in order to better manage our perceptions by assuming "systems everywhere"? Or can we choose to see the world in systemic terms, and will therefore find "systems everywhere"? In the daily practice of systems research, these questions quickly retreat into the background, as it often seems preferable and even necessary "to proceed along functional lines, as opposed to being encumbered with philosophical, epistemological, or ontological issues" (Kay et al. 1999, p. 2). But these are also questions of great pragmatic significance, as any possible answer, once assumed, not only determines the added value we expect from applying the systems paradigm, but more importantly, also determines the range of possible objects that might deserve our systemic scrutiny.

One possible answer to these questions is that *systems exist in the real world*, and that a systemic approach is therefore simply an adequate way to identify, observe and describe these 'real systems'. This positivist answer relies on at least two conditions: (1) that an ontic reality ('the real world') exists independently of our imaginations and (2) that this reality is accessible to our experience in a way that makes a distinction between more and less adequate methods to identify, observe and describe this reality possible. As both these conditions can be no more than assumed, the positivist answer might be considered problematic from a metaphysical viewpoint. But the positivist answer is not necessarily a response to metaphysical questions, especially in those disciplines that are committed to the scientific method as their basic procedural tenet: when empirical data leads to the formulation of hypotheses which are again tested through more empirical evidence, the scientific process has to rely on the existence of a real world from which its data can be derived and against which its hypotheses can be tested. In other words, the empirical sciences direct their efforts toward the observation of real world phenomena, not toward the question whether this world is 'real' in a metaphysical sense. For the 'hard' natural sciences as well as the 'hardened' strands of the social sciences (cf. Steinmetz 2005, p. 111), the existence and accessibility of an ontic world is therefore a necessary premise rather than a conclusion, and within this premise, the continuing success of systemic explanatory models can be taken as evidence for a systemically organized world. From this perspective, the idea of *Systems Thinking*, which shifts the focus from the systemic nature of the real world to a more idealist notion of systems, might sometimes seem dubious or even deficient: "Systems thinking is coming to mean little more than thinking about systems, talking about systems, and acknowledging that systems are important. In other words, systems thinking implies a rather general and superficial awareness of systems" (Forrester 1994, p. 251).

But Systems Thinking is not merely thinking and talking 'about' systems and generally acknowledging their importance. While the term is sometimes used to describe the systems movement in general, "Systems Thinking" in a narrower sense means to apply a systemic perspective to the world rather than expecting the world to behave in a systemic way. On a pragmatic level, this is a necessary way of thinking when the goal is not only to describe, but to change or even create systems: when technological, economical or even social systems are deliberately transformed or designed, it is necessary to think 'in' systems (not only 'about' systems), or more specifically: the core ability of a systems designer is the ability to imagine systems rather than rely on the observation of systems in the outside world. This pragmatic understanding of systems thinking does not necessarily contradict the more positivist approach, as identifying real world systems and designing new, artificial systems often goes hand in hand. Within the field of media production, this duality is obvious in the process of digital game design: while game designers are certainly engaged in imagining and creating artificial "rule-based systems" (Juul 2005, p. 6), the process of creating digital games often begins with identifying a real world source system[1], parts of which are then translated into a simulated model (the game system) that shows some aspects of the original system's behavior, while others are deliberately changed or left aside (cf. Bogost 2014, p. 63). But even though the application of a systemic attitude is in principle reconcilable with the assumption of a systemically organized world, some systems thinkers go even further by stating not only that "Systems Thinking is a property of the thinker", but more specifically that "Systems exist as a mental picture in our minds. Saying this another way, systems thinking structures thinking about whatever entity or phenomenon we become aware of and assign meaning to" (Banathy 1996, p. 156). Here lies a second possible answer to the question where systems originate from: that they "exist as a mental picture in our minds", as a way to think about the world rather than as a feature of the world itself. This second answer - the idea *that we might have invented systems rather than discovered them* - does not mean that these inventions are merely arbitrary phantasms. As radical constructivists have been arguing for quite some time, it is precisely the uncertainty in regard to ontological questions (see Foerster 1991, p. 67) that suggests we judge our observations not as accurate depictions of an evasive ontic world, but in terms of their viability (see Glasersfeld 2001), i.e. their ability to provide solutions for whatever we perceive as a problem.

As a viable cognitive tool, the systems paradigm continues to provide such solutions, and it has become an obvious concern not only to elaborate and refine the paradigm itself in many different directions (cf. Hieronymi 2013), but also to find ways to promote and to educate on systems thinking - not simply in the sense of teaching 'about' systems, but to 'think in systems', to see the world in systemic terms (in order to identify problems) and to learn how to 'imagine' new and different systems (in order to find solutions). Attempts have therefore been made to include systems thinking in university as well as secondary school curricula (cf. Ossimitz, 2000), often evolving around System Dynamics oriented software applications like STELLA (Richmond 1985, cf. Doerr 1996). With the increasing success of the video game industry, the question has also been raised whether digital games might be used to teach systems thinking to an even broader audience (cf. Squire 2002). There is much in favor of this idea, as digital games engage their players in all kinds of systemic problems, and most importantly, players truly enjoy this kind of engagement. Much of this enjoyment can be tied to the fact that contrary to traditional scientific simulations (and most System Dynamics models), whose purpose is to create and modify a systemic model in order to then observe its behavior from the outside, game systems are by design missing at least one crucial element - the player. Experiencing the game requires players to immerse into the act of game-play by becoming a part of the system and interacting with its existing elements according to the system's rules. In order to make meaningful decisions and to experience a sense of "agency" (Murray 1997, p. 126), players are required to not simply take game events as granted, but to form ideas about the underlying system that gives rise to these events.

In the case of analogue games this underlying system is easily accessible, as players are usually made aware of the game's rules before they start the game. This allows to make a distinction between knowing the rules of the game and playing it, a distinction that has enabled (mathematical-economical) "Game Theory" (Rapoport 1966; 1970) to develop models of (rational) player decisions

[1] This is especially the case in the design of 'Serious Games', which employ "procedural rhetoric" (Bogost 2007, p. 29) to make the workings of certain areas of life accessible through the creation of digital game systems.

within an objectively determinable system: once the rules of the game are unequivocally known to all players (and once it has been determined how the payoffs tied to different outcomes of the game are appraised), it becomes possible to focus on the possible actions and interactions of players within an otherwise unambiguous rule-system, and to evaluate the utility of player strategies in mathematical terms (cf. von Neumann 1928; von Neumann and Morgenstern 1944). But when it comes to digital games, the activity of gameplay cannot be reduced to mathematical operations within the game system: contrary to analogue games, the rules of digital games are often not known beforehand, but need to be gradually uncovered by playing the game, and in many cases these rules are not even fixed and unambiguous, but evolve as the game progresses (cf. Juul 2005, p. 67). The activity of playing a digital game is therefore a constant shift between exploring a game system which can only be induced from the way it responds to specific actions taken within the system, and at the same time creating (and constantly re-creating) an imaginary system that helps players navigate within the game system in a meaningful way.

However, what stands out most about (digital) game-play experiences is the great ease with which players engage in this fundamentally systemic activity. While digital games most certainly require players to show a high degree of systemic awareness, players seem to have little trouble interacting with these systems from within, as long as they present themselves in an interactive, operational and functional way. When playing computer games, humans prove to be so adapt in dealing with interactive systems that it raises some crucial questions: is it possible that computer games are not simply training grounds to change the way we think, but that they are already inherently "[…] oriented toward human experience and ideas, much more so than other kinds of software?" (Bogost 2011). Does a systemic perspective need to be taught and trained in the first place? Or may the systems paradigm already be more familiar to us than we even seem to be aware of? From this point of view, the systemic nature of computer games does not generate new ways of thinking, but highlights new aspects of human cognition and experience that other media forms do not harness to the same degree. The ease of systemic interaction suggests a third possible answer to the 'origin of systems': that *human cognition is already deeply attuned to the logic of systems*, and that *the systems paradigm is already deeply rooted in human experience*.

2. Imaginary Systems & Meaningful Experiences

One obvious objection to this idea might be that computer games have been around for quite some time now, and that their players have had plenty of opportunity to get used to the kind of systemic interaction and comprehension they demand. So even if players of computer games show a high degree of systemic skill, and even if they seem adept at creating imaginary systems that help them navigate within their games, this might just indicate that computer games have already been successful at 'teaching' people to use systems thinking as a cognitive tool and that their players have grown accustomed to applying it. But the argument can be made that the assumption of imaginary systems is a necessary cognitive strategy to experience media events in a meaningful way, even if the medium itself works in neither a systemic nor an interactive manner. Long before the emergence of interactive media (and long before systems terminology could have made it explicit), the human tendency to assume imaginary systems shines through when Russian filmmaker and film theorist Lev Kuleshov set out to explore the possibilities of filmic meaning generation by conducting his famously simple experiment:

> In order to prove the impact of editing on the significance of shots, [Kuleshov] inserted one and the same shot of Mosjukhin's otherwise noncommittal face in different story contexts; the result was that the actor's face appeared to express grief on a sad occasion and smiling satisfaction in a pleasant environment (Kracauer 1997, p. 69).

More specifically, when put in the context of a shot of a baby, the actor would appear to express paternal joy; a shot of a bowl of soup would make him appear hungry, and in combination with a shot of a dead woman lying in a coffin, audiences would agree on an expression of sadness and grief (cf. Boorstin 1995, p. 65). This "Kuleshov effect" is not only a classic illustration of montage being a key feature of cinematic storytelling, it also shows how the act of interpreting the filmic sequence in a meaningful way falls upon the audience, and examined more closely, this activity is dependent on the assumption of imaginary systems that determine any possible meaning.

The first and most fundamental aspect of these imaginary systems is the assumption of related elements, i.e. elements that are distinct, but not separate, and which can therefore influence one another. In other words: these elements constitute the distinct *parts* of an imaginary system. Contrary to a computer game, the movie sequence creates an artificial assembly of elements (manifested in the 'shots') that are not actually related to each other; they simply present a set of different elements that may at the most seem to 'belong together' because they are presented one after the other. While the elements of a computer game (the 'parts' of the game system) are actually designed in such a way that one part can influence others, there is no such relation between elements within the movie sequence, and whatever relation the audience perceives, it is a result of cognitive computations, not a reflection of 'factual' relations.

The shot of the actor (Shot A) contains a possible element of an imaginary system (element a) which, if taken by itself, is simply a 'man' (or possibly a 'man with undefined emotions'). Shot A can be combined with either Shot I, Shot II, or Shot III, each referring to either element 1 (a child), element 2 (a bowl of soup) or element 3 (a dead woman). Element a (the man) can only be put in relation to the respective other element when an imaginary system is assumed (because the movie sequence does not contain any systemic relations but simply presents an assembly of otherwise unrelated shots). Only because of these assumed relations, the man and his emotions can appear as influenced by the other elements: the man is full of joy because he is watching his child (a_1), the man is staring at the bowl of soup because he is hungry (a_2), the man is sad because he mourns the dead woman (a_3). In any of these cases, the man's feelings (which Shot A does not convey) are perceived to be in a causal relation with the respective other element (child, soup or dead woman), and it is only because of this assumed causality that the single elements become meaningful. The most basic aspect in the creation of imaginary systems is therefore the application of cause and effect thinking, which Watzlawick (1984) has so strongly argued to be an inevitable, yet often deceiving principle of human cognition: if two or more significant things happen in close proximity to another, we can hardly help but intuitively assume hypotheses about how these elements are related, and which of these elements is the cause and which the consequence. But the ways in which elements can cause or influence each other must be guided by more fundamental rules and principles to allow for a meaningful relation.

In the Kuleshov sequence, the rules assumed to guide the elements' behavior and the effects they might have on each other are close to human experience; as the shots present either human beings (the man, the child and the dead woman), or a basic necessity of human existence (food), there is no reason to move beyond common human experience, needs and desires when assuming rules that may hint at and account for the man's emotions. One of the more obvious relations between an adult man and a little child being that of fatherhood, it is easy to assume that his emotions are guided by benevolence and (especially since there is no reason to assume that the child is not well) this results in the assumption of joy as an effect caused by a father watching his child (the rule applied being: 'If I see my child, then I feel joy'). The assumption that the man has positive feelings for the dead woman (and again, there is no reason provided to assume otherwise) might imply a desire to share a life with her as an unreachable goal, and it is the impossibility to fulfill this desire that leads to the assumption that he may be grieving (the rule applied being 'If a loved one dies, then I feel sad'). Likewise, his desire for the soup is only assumed, just as is the notion that the soup, while presenting a context for interpreting his emotions, is just outside his reach: he may see the soup, he does not engage in eating it. The emotion assumed could just as well be joy, if the assumption is made that a waiter is finally serving his food, but there are no elements which point in that direction: there is no waiter to be seen, and there's no hint at the fictional setting of a restaurant. The desire for the soup may lead to joy when he gets it, and to frustration if he doesn't; but in the simple setup of the two shots, it will first result in a more basic assumption of hunger (the rule applied being: 'If I am hungry, then I want food').

And finally, the question which rules and principles are assumed to determine possible causes and effects within an imaginary system is also a question of the system’s assumed boundaries: which elements are assumed to be part of the system, and which are not. The resulting imaginary system will depend on the setting of these boundaries, as the limitation of possible elements also determines the rules and principles that need to be applied to make sense of the experience. Even within the movie sequence, a shot of a waiter would alter the experience of the soup segment instantly, just as would an additional shot of a flask of poison or, in the case of the dead woman, the suggestion that the man is, in fact, a vampire hunter. And if the actor was wearing a doctor’s coat, then the counter shot of the child might lead to an assumption of worry or concern instead of joy. Each of these changes would suggest imagining another system, in which elements are related in a different way, and in which other rules would need to be applied to make sense of the movie sequence. But once again, the more fundamental setting of boundaries does not occur through the movie sequence itself, but is accomplished by the audience. If they limit the experience to what is shown on the screen, then they will only need to imagine a system whose rules account for the possible emotions of human beings. But if, for example, the projectionist is included as an element in this system, then they will also have to account for the rules of a broader system in which a new kind of medium is used to present them with images of an actor in emotionally significant situations. And if they include Kuleshov, who may be sitting next to them, watching their responses and possibly taking notes, then the system they imagine might need to account for the logic of an experiment whose elements contain the images on the screen as well as the screening of the film and the audience themselves. Any of these shifts of the imaginary system’s boundaries leads to the assumption of new and increasingly complex rules that are required to ‘make sense’ of events occurring within the system, while at the same time changing what this system is ‘about’. Depending on these inclusions and exclusions of elements, the resulting systems will allow for very different interpretations, and as Schaap, Renckstorf and Wester (2005) have shown, the range of what is included in the experience and the interpretations that result from this range are determined by the audience, not the medium itself.

The Kuleshov experiment suggests that the meaningful experience of even a simple movie sequence depends on the cognitive creation of imaginary systems which can be described as containing elements or parts whose behavior and interaction is assumed to be guided by rules and principles that apply within these systems’ boundaries. But there is another aspect to imaginary systems that the classic experiment reveals, not in its success, but in its shortcomings. In order to make this aspect tangible, it has to be pointed out that little documentation about the original experiment has been preserved; the film reels Kuleshov used no longer exist, and what documentation has survived is not only fragmentary, but possibly imprecise in essential aspects. A later recreation of the experiment - motivated by skepticism regarding methodological shortcomings and even possible ideological bias of the original experiment - has found that the reported effect did not occur when the purported setup of the original experiment was reproduced accurately. It was, however, suggested that the failure of the recreated experiment may be due to Kuleshov’s possibly imprecise phrasing of the actor’s ‘neutral’ expression. The recreated sequence did not call forth anything close to the expected Kuleshov effect when the shots of the actor’s face were perceived as expressionless. When these shots, however, were substituted with others which - by a control group, which was shown these shots without the context of the counter shots (soup, woman, child) - were rated as showing an ambiguous emotion rather than none at all, the test audience suddenly started to assume the expected relations:

> The ambiguous expression seemed to offer a stronger interpretative cue for the viewer than did the expressionless face. If Kuleshovian montage may not be capable of making an expressionless face emotive, it may very well do this with an ambiguous expression, since the objects (soup, coffin, child) provide a context for resolving the ambiguity (Prince, Hensley & Wayne 1992, p. 70).

This difference between the perceived absence of emotion and the perception that some kind of emotion is expressed, but cannot be distinctly determined, highlights that the cognitive process of creating imaginary systems to make sense of an experience needs a trigger which sets this process in motion. In the failed Kuleshov recreation, there is no reason to establish a relation between the counter shots and the actor's emotion, as there is no sign of emotion perceived, and therefore no reason to establish a system which accounts for an emotional response of the actor. When Alfred Hitchcock describes the Kuleshov effect, it is therefore not coincidental that there is no mention of an 'expressionless face'. Instead, Hitchcock makes use of a highly ambiguous expression - a smile:

> In the same way, let's take a close-up of [James] Stewart looking out of the window at a little dog that's being lowered in a basket. Back to Stewart, who has a kindly smile. But if in the place of the little dog you show a half-naked girl exercising in front of her open window, and you go back to a smiling Stewart again, this time he's seen as a dirty old man! (Truffaut 1983, p. 216).

The difference between a neutral expression and an ambiguous expression is far from a minor detail. Only when the perception is made that there actually is some kind of emotion (in Hitchcock's example, revealed by the smile), is there reason to ask: what emotion is it? As a smile is able to convey a wide range of emotions, the specific emotion cannot be deduced from the smile alone. In order to determine the underlying emotion more clearly, the obvious question becomes: what is the smile caused by? This question is, again, answered by assuming a causal relationship between the different shots: the emotion of the smiling man is now regarded as the effect of what he beholds: either the dog, or the young woman. While the shot of the dog may imply a state of fond amusement, the shot of the young woman will better provide a cause for his emotion when this emotion is interpreted as libidinal excitement. The different elements of the assumed system (a smiling man, and an object he seems to be watching) are dynamically arranged in order to relate them in a meaningful way, guided by cause-effect relations, leading to a conclusive interplay of these elements. This dynamic character of the process does not aim at establishing fixed interpretations of the single elements, but at the sketching of a conclusive system. When the counter shot is changed, the interpretation of the smile changes with it, simply because the prior interpretation of the smile does not make sense if experienced as a causal effect of the new shot, and would thereby threaten the conclusiveness of the imagined system: if the shot of the dog is taken as the cause for the man's libidinal excitement, there is clearly an element of the system not regarded for, which could establish a causal relation between the dog and what has before been determined as the man's lustful smile - and as this missing element cannot be determined, the interpretation of the emotion underlying the smile is intuitively changed. As Hitchcock's example shows, it is not the absence of significant perceptions that triggers the search for meaning. Instead, it is the friction between perceiving something as possibly significant, but not being able to determine this significance further that sets this process in motion and leads to the assumption of imaginary systems that can dissolve this friction. Consequently, these imaginary systems do not simply 'exist' in a static manner, they are dynamically created and re-created as a strategy to make sense of our experiences.

3. Imaginary Systems in Action

The Kuleshov experiment shows that even a medium such as film, which is neither systemic nor interactive, requires audiences to assume imaginary systems to interpret their media experiences in a meaningful way. But the dynamic creation of imaginary systems does not only serve to interpret our experiences, it is also essential to our active participation in shaping these experiences. It has been suggested earlier that the creation of imaginary systems as a cognitive strategy to make meaningful decisions and experience a sense of agency is especially evident in game-play experiences. It is therefore worthwhile to return the focus to the activity of playing games for an examination of imaginary systems *in action*. The interactive nature of this activity will not only allow for a more detailed discussion of how imaginary systems depend on distinctions between interior and exterior (*boundaries*) and how they are structured internally (*organization*), but also how they enable the setting of goals and interaction strategies (*manipulation*), and finally, how their subjective nature distinguishes them from real systems by abandoning the idea of functional completeness (*ambiguity*).

3.1. Boundaries.

Discussions of play and games have always been intertwined with questions of boundaries, as it has often seemed a quite serious matter to determine where play ends and where the 'seriousness of life' begins (cf. Sutton-Smith 1997). In today's game studies discourse, the idea of boundaries is a persisting concept in the form of Huizinga's "magic circle" (1955), which has become a common metaphor for the spatial and temporal boundaries of games and play. (Re-)introduced as a key concept especially for game design practice (cf. Zimmerman 2012), the metaphor is often used in a rather restrictive manner, aimed at providing a clear-cut formal distinction between what is considered part of a game and what is not:

> With a toy, it may be difficult to say exactly when the play begins and ends. But with a game, the activity is richly formalized. The game has a beginning, a middle, and a quantifiable outcome at the end. The game takes place in a precisely defined physical and temporal space of play. Either the children are playing Tic-Tac-Toe or they are not. There is no ambiguity concerning their action: they are clearly playing a game (Salen & Zimmerman 2004, p. 95).

From a game design perspective, this strict focus on spatial and temporal boundaries is certainly useful, as it provides a clear basis for game designers to think about the range of the game systems they create. But there are also problems with this restrictive understanding of the 'magic circle', and it has been put into question whether such a strict distinction can be made between game and non-game (see Consalvo 2007, p. 7) or between play and non-play (see Bogost 2006 p. 134). Am I only playing the game while I am actively moving the game pieces, or also when I study the game board or the screen, thinking about my next move? Am I still playing when I am sitting in the subway, considering strategies for the next round, or when I replay a finished game in my mind, trying to figure out what I might have done differently? Once the experiential aspects of play are taken into account it becomes obvious that a strict interpretation of the magic circle, limited to the physical and temporal boundaries of the game space, tells us little about the activity of play, and nothing about the imaginary systems that players create to manoeuvre the game system.

But contrary to this rather recent interpretation of the magic circle metaphor, its original use stems from a discussion that is already far more focused on the imaginary aspects of play than on the formal aspects of games: in Johan Huizinga's examinations of "the play element of culture" (1955, p. ix), he makes it clear that play is an experiential rather than a material activity, and that it emerges from the human capacity for imagination, comparable to the creation and use of language:

> In the making of speech and language the spirit is continually 'sparking' between matter and mind, as it were, playing with this wondrous nominative faculty. Behind every abstract expression there lie the boldest of metaphors, and every metaphor is a play upon words. Thus in giving expression to life man creates a second, poetic world alongside the world of nature (Huizinga 1955, p. 4).

Even though Huizinga does not explicitly describe this creation of a 'second world' in systemic terms, it shifts the idea of a magic circle from the physical world to the imaginary: for Huizinga, the act of play consists in a voluntary, yet strict adherence to rules, and it is central to his argument that the "sacred earnest" (p. 18) with which these rules are followed is not owed to a universal validity of these rules, but precisely to the fact that we are aware that these artificially created rules are only valid within the specific boundaries we create and uphold in our imagination (p.14).

This duality between the awareness that the boundaries and rules of play are only artificially created and therefore "can be deferred or suspended at any time" (p. 8) and the urge to still adhere to them as if they were absolute and binding reveals another important aspect of imaginary systems: the relative impermeability of their imagined boundaries. While the distinction between open and closed systems (cf. Bertalanffy 1950) is better suited for the description of 'real' systems, the cognitive and assumptive nature of imaginary systems suggests that these systems' imagined boundaries can at the same time be impervious *and* penetrable, or as Ian Bogost points out:

> [...] the magic circle of the game world ruptures into the material world, but yet it does not disappear entirely. Such an understanding of the magic circle disrupts the notion that play space possesses a stable interiority and exteriority (Bogost 2006, p. 134).

In the attempt to immerse into the game world, players need to accept the game world *as if it was real*, and therefore negate the 'real world' to a certain degree: players want to experience the fantasy world of the game rather than a world in which they are playing a game. But at the same time, the actions that take place within the game only become significant when they converge with the players' own interests, values, desires and skills; as Gregory Bateson has shown, play-actions need to be distinct from real actions, while at the same time relating to these real actions in order to become significant (Bateson 1955, p. 137). In other words: players are at the same time part of the game world *and* the world outside the game, and while some aspects of the 'real world' (the environment) are carried into the game, many other aspects are deliberately left behind.

With this *partial impermeability* of their assumed boundaries, imaginary systems resemble the idea of 'adiabatic systems' in thermodynamics, whose boundaries specifically prohibit the transfer of heat, while the transfer of other kinds of energy may or may not be possible (cf. Atkins 2007). In a similar way, the boundaries we imagine in order to "frame" our experiences (cf. Goffman 1974) not only determine what is and what is not part of the system, they define an imaginary system's 'universe' by setting the conditions under which this demarcation will take place; the nature of the boundary itself already constitutes a "first distinction" (Spencer-Brown 1979, p. 3) by defining the nature of the demarcation and therefore the nature of elements to be distinguished:

> This first distinction, as I have frequently said, is analogous to the one the artist makes with the first few lines on a sheet of paper, lines that determine what is going to be 'figure' and what 'ground''. For the point of view I have adopted, the most important thing about that distinction is not what is being distinguished, but that the artist makes the distinction within the sheet, the canvas, or whatever he happens to be drawing on. Both figure and ground are parts of one and the same sheet (Glasersfeld, 1991).

In Glasersfeld's example, the 'universe' within which the distinction between system and environment takes place is determined by two-dimensional, visual delineations - even before it is decided whether the distinctive lines to be drawn will form a line, a square or a circle, and whether they will be drawn in the middle of the sheet or in one of the corners. The decision to make a visual distinction by drawing on a sheet (maybe aimed at representing an abstract idea) already excludes the qualities of mechanical power, water pressure or heat transfer as defining characteristics of the distinction.

The specific nature of these boundaries is not arbitrary, but depends on the kind of experience that the resulting imaginary system must be able to accommodate; when players interact with, for example, a virtual city in a computer game, they need to imagine very different boundaries to navigate the experience of either *Sim City* (which requires fiscal and political aspects of city planning to be part of their experience), *GTA IV*'s Liberty City (which allows them to experience the consequences of either adhering to or breaking laws), or *World of Warcraft*'s Stormwind City (which primarily fosters an experience of the city as a hub for social interaction and trade). As the purpose of boundaries is the creation of a conclusive imaginary system that accommodates a specific experience, this purpose will also determine the nature of the boundaries that need to be drawn - some kinds of concepts and ideas will be unconditionally included in the system, while others can be incorporated at will.

3.2. Organization

The defining character of its boundaries pre-determines what kinds of experiences can emerge from an imaginary system by determining the nature of the *elements* it contains. For instance, it makes a huge difference whether the daily rising of the sun is assessed as a cosmological or a mythological event; while the assumption of a cosmological system will include planets which behave according to physical laws, the assumption of a mythological system will include very different elements: deities or mythological figures that are responsible for the sun’s perceived movement (cf. Byock 2005, p. 21f.), or maybe the sun itself is imagined as a deity, whose behaviour provides explanations for the otherwise bewildering observation of solar events (cf. Barber & Barber 2004, p. 179).

The system’s elements need to be *distinct* from each other; if there is only one single element contained within the border, the border does not contain a system, but exactly this single element. Digital games do not simply contain ‘digital entities’, but distinct avatars, Non-player Characters (’NPCs’), locations, and items with their specific abilities, functionalities and statistical values. A single computer game avatar, or a single game item, does not constitute a game system, but an allusion to a potential game at best. On the other hand, some elements of the system may indeed interact in such a way that they can be considered (sub-)systems within a greater system. This is especially obvious in Massive Multiplayer Online Roleplaying Games (MMORPGs), which are complex enough to regard them as systems consisting of various sub-systems: an MMORPG may contain sub-systems such as harvesting materials and crafting items, questing and fighting against monsters, or participating in a guild to efficiently manage complex tasks. In order to successfully manoeuvre the game, players need to be able to imagine each of these sub-systems as systems of their own, while at the same time being aware of how these subsystems might interact as parts of the game system as a whole - just as the graphics card within a personal computer is part of a larger computer system, while at the same time constituting a system in its own right. Any shift between these different levels of imagined systems requires making new distinctions, either to imagine boundaries within boundaries that delineate what has been part of a system as another smaller system, or to expand the boundaries of a system in order to imagine it as part of a new, larger system.

Once the elements of a system are imagined as distinct, it becomes possible to determine the effectiveness different elements have at a specific location within the system, i.e. at a specific point of the system’s operation. Just as the arrangement of wheels in a clockwork cannot be changed at will without altering (or even jeopardizing) the function of the clockwork, the different elements of an imaginary system are not in principle interchangeable.

This arrangement of elements is meticulously employed in the design of digital games: when players engage in an MMORPG, they quickly understand that the items they acquire at early points in the game, while being well suited to the challenges posed to new players, will gradually have to be substituted with higher-quality items to overcome more demanding obstacles; and while a certain virtual enemy may pose a challenging opponent at a certain character level, the same enemy may be unconquerable at an earlier stage, or trivial later in the game. The delicate functionality of the game is dependent on the appropriate arrangement of its elements.

This dependence of function and arrangement points to a hierarchical structure of the system’s elements, ‘hierarchical’ not in terms of absolute values, but in the sense of a *dynamical hierarchy*, in which a certain element may be integral at one point of the system’s operation, while being superfluous or even obstructive at another; conversely, at a certain point of a system one element may be vital for the functioning of the system, while another may be needless or impedimental.

Up to this point, the imaginations described might not fully deserve the label of ‘imaginary systems’, as the idea of delineated spaces containing distinct elements that are of varied significance at different locations within these spaces does not yet exhibit specific systemic qualities; it would still be possible to examine them in an analytical manner, as an understanding of each of these features individually would easily contribute to an understanding of the whole. But imaginations are more than ideas about *how things are*; even more importantly (and this is especially evident in gaming experiences), imaginations contain ideas about *how things work*: in order to make meaningful decisions and take actions within the world (or in a computer game), we need to form ideas about how the parts of this world interact, how they influence each other, and how we can take advantage of one element's behavior in order to purposefully influence other elements. In order to imagine a system whose parts interact in such a manner and to enable the system's functionality, it is necessary to first imagine these elements as being *related* to each other in some way.

In real, physical systems, the significance of these relations is quite obvious: the cogwheels of a clockwork must physically connect if movement is to be transmitted, and for the personal computer to function properly, the graphics card must be connected to the mainboard instead of just lying on top of the hard drive. But such relations are equally important to the creation of imaginary systems, as these systems need to account for the interaction between their parts in order to provide explanations for and hypotheses about how things 'work'.

In computer games, players must rely on the assumption of relations to evaluate the significance of elements they interact with, and to make meaningful decisions within the game world: while the significance of a new piece of armor or weaponry in an MMORPG depends on its statistical values (e.g. the amount of damage a weapon can do per second), these values, or 'stats', are only significant when related to the statistical values of other elements in the game (e.g. the hit points of challenging foes). The value and usefulness of an item cannot be imagined in absolute terms, but relative to the elements it can affect within the game, and the assumed nature and extent of these relations will guide the player in deciding which items will be used in which game-play situation. In other words: the application of cause and effect thinking, which has already been argued as crucial for the creation of imaginary systems, requires not only to assume the behavior of the system's separate parts, but also the consequences their behavior can have on other parts within the system - consequences which cannot be assumed if the parts are not imagined as being related.

This does not mean that the relation between elements must necessarily lead to perceivable action. Even though action is much more emphasized in digital games than inaction, it is often the assumption of elements being related that urges players to refrain from rather than take action. Instead of making obstacles and challenges that are too hard for players at a certain level inaccessible for those players, game designers often use a form of *deterrence through assumed relations* instead in order to enable a greater sense of player agency: when players encounter an enemy that is presented as near-invincible (be it through its visual appearance and size, a high number of hit points, or a special name-tag that indicates it as a 'raid mob' or 'epic encounter'), they will not feel prompted to attack this enemy on sight, especially without adequate support and equipment, but to flee or evade this enemy. The assumption of the enemy's strength and endurance suggests instant in-game death as a certainty, which is related to the inconvenience of losing time and to the damaging of player equipment, which is related to item repair costs and the spending of in-game money, which again is related to the efforts necessary to obtain this money in the first place. The assumed relations between the game's elements, which provide an immersive way to prevent players from taking certain actions, also highlight how player decisions are guided by assumed relations between an imagined system's elements.

3.3. Manipulation

As a system's behaviour is dependent on specific relations between specific elements at specific points within the system, the connections made between these elements can become of strategic importance. The assembly of a clockwork's elements is guided by strategic decisions: will the connection between cogwheel A and cogwheel B lead to a translation of mechanical power desirable for the clockwork's functionality, or is a connection between cogwheel A and cogwheel C more consistent with the system's desired functionality? This may seem trivial in the mechanical example, but this assumption of *strategic possibilities* is a crucial factor of imaginary systems.

Imaginary systems are not only attempts to envision and understand 'how things work', they also serve as cognitive tools in the attempt to purposefully manipulate these things towards a desired output, state or behavior. Based on ideas about the elements' functional relations, it becomes possible to develop strategies for interacting with these elements in a way that serves the desired purpose or 'goal'. Depending on the assumed system's complexity, the system's elements become *resources*, which may not themselves constitute the desired goals, but can be 'converted' into something else in order to make the goal more likely to be attained.

In digital games, strategies of converting resources determine the game-play possibilities per se, as the 'core experience' of a game may be seen in the efforts to convert available resources into those not yet available. In an MMORPG, the resource of time (the primary investment of players into the game) might be converted into completed quests, gathered materials or successful bargains in the auction house, which convert into the acquisition of money or items, resources which again may be converted into better chances to defeat enemies or craft better items. The different possibilities to convert one resource into another may be the most significant aspect of game-play decisions, determining or at least suggesting players' strategies of action.

In the attempt to identify and apply strategies that might serve to reach a desired goal or outcome, the *subjective character* of imaginary systems guiding actions and decisions becomes most obvious: while the assumed behavior and relation of a system's elements might still be a (more or less accurate) depiction of an actual system, these goals are subject to the individual interests and desires of whoever imagines the system, and while the strategies developed to influence the system might prove more or less viable, they are finally determined by their assumed ability to fulfill these subjective desires.

But the subjectivity of imaginary systems goes beyond setting the system's overarching goal or 'purpose'. Cognitively 'assembling' a system by relating its elements in a strategic way does not necessarily result in only one possible succession of strategies that will fulfill the desired purpose; there may be different ways to achieve the same overarching goal. Every time a strategy is employed to exploit an assumed relation between one element and another, manipulating the successive element is determined as a *partial goal* within the system. If alternate partial goals both comply with the desire of reaching the larger goal, the decision which strategy to follow cannot solely be guided by the demands determined by this overarching goal, but requires decisions within a contingent system.

This aspect of partial goals illustrates several notable characteristics of imaginary systems:

(i) The setting of specific strategies and the respective partial goals determines the nature of *emerging experiences*, even if the same larger goal is pursued. The setting of specific partial goals can be regarded as the main criterion in determining the character of the experience (robbing a bank is a very different experience from playing the lottery, even if both strategies intend to serve the purpose of acquiring money).

(ii) This leads to the relevance of *contingent strategies* for the experience of agency within an imagined system. If, for some reason, a certain strategy is regarded as the only way to achieve the larger goal, the possibilities to act within the system seem pre-determined and restricted and will therefore not foster an experience of agency (playing the lottery will feel less enjoyable if it is regarded as the only possible way to acquire money).

(iii) As the setting of different partial goals does not necessarily change the desired larger goal, the purpose of creating an imaginary system may seem alike even if the specific strategies employed lead to a different character of the system. Different people may share the same overarching goal and even imagine the system in which this goal can be reached in similar ways, while at the same time *experiencing the system in very different ways* depending on their decisions regarding its partial goals. It is this friction between shared and divergent goals and strategies that is subject to processes of negotiation, resulting in the social construction of meaning (is robbing a bank a better way to acquire money than playing the lottery?).

(iv) The difference between an imaginary system's overall goals and the partial goals within the system *cannot be ultimately determined*. The assessment of imaginary systems cannot assume a consistent nature of these systems. It must be taken into account that the distinction between overall and partial goals can sometimes be

> ambiguous or even erratic (do I play the lottery because I want to acquire money, or do I enjoy the thrill of playing the lottery, using the possible acquisition of money as a justification?).

This indeterminacy may not be obvious in the case of digital games, as the goal-oriented character of games is often regarded as self-evident, and the overarching goal of the game seems to consist of beating and, therefore, ending the game. This conception, however, does not account for the experiential aspects of the game, which are not sufficiently explained with the desire to 'get it over and done with'. The indeterminacy of a game's goals and the partial goals that constitute its course once again become apparent in the case of MMORPGs, in which a designated 'end' is not provided. While an external observation might content itself with the idea that these games' goal is reaching the highest possible character level, this notion is contradicted by the fact that even this highest level may only be a prerequisite to engage in the game's 'high level content', and therefore constitutes a partial goal required to explore its more challenging and exciting aspects. And while the acquisition of a specific item might be pointed out as a partial goal, enabling success against more demanding foes, this item might present itself as a larger goal for a player's efforts for long stretches of time, as the temporarily single aim of her efforts, until - through the item's acquisition - another goal will take its place and become the new motivator for the player's efforts.

With this ambivalent character of the indeterminacy of their goals, the discussion of imaginary systems comes almost full circle and returns to the setting of boundaries by making a first distinction. Just as this first distinction is the 'blind spot' of any experience and pre-determines the distinctive qualities of the imaginary system, the difference between the system's overall goals and the partial goals determining strategies of interaction is not necessarily deliberate, but is subject to the indeterminate character of imaginary systems. For the assessment of imaginary systems, this does not only mean that there is no way to ultimately single out a specific overall goal of these systems. It also means that imaginary systems can serve different overall goals or purposes simultaneously. But the indeterminacy of imaginary systems also challenges the idea of an ultimately delineated, closed system: if one system is experienced as an element in another, more encompassing system, the system's overall goal now serves as a partial goal in a larger system (the acquisition of money is only a partial goal, maybe serving the purpose of leading a good life and fulfilling one's material dreams).

3.4. Ambiguity

So far, the focus has been on the similarities between imaginary and real systems. Aspects like boundaries, related elements, and even the possibility to set goals within these systems and apply strategies to achieve these goals are equally viable for the description of real as well as imaginary systems. But there are also fundamental differences that a viable conception of imaginary systems cannot ignore. Most importantly, these are only assumed and therefore highly subjective systems, and as the problem of distinguishing between partial goals and overall purpose has indicated, they are of a highly ambiguous character.

Even though imaginary systems share many aspects with real systems, their ambiguity does not allow for them to be approached in the exact same way. Contrary to real systems, whose overall goal or purpose can only result from the system's composition and behavior, *the primary purpose of imaginary systems is to provide explanations for how things work*, and the cognitive assembly of these systems is a function of this purpose: imaginary systems are constantly adapted and recreated in the attempt to 'make sense' of our experiences, and to accommodate new or even contradictory perceptions by dynamically creating a "stable reality" (Foerster 1991, p. 67).

Due to this ambiguity, the main difference between real and imaginary systems can be tied to the idea of functional completeness: real systems need to be functionally complete to account for the system's behavior, and any description of a real system is flawed if it does not fully account for the functional behavior of the system.

In the case of imaginary systems, this idea of functional completeness has to be given up. As these are only assumed systems, they cannot be disregarded for their lack of functionality. The assumption that human cognition organizes perceptions by creating imaginary systems does in no way imply that these systems need to exist beyond the level of assumption, and much less can their functionality be an objective criterion for their assessment. Contrary to real systems, imaginary systems may not even constitute ‘complete’ systems at any given time, they may only consist in a single perception that is assumed to be part of a system - constituting the missing elements and features only by implication.

This ambiguity and indeterminacy is a common problem when dealing with the cognitive organization of human experience. When Erving Goffman proposes his aforementioned concept of ‘framing’, he emphasizes the ambiguous nature of cognitive organizing principles - and the ease with which humans deal with this ambiguity:

> Primary frameworks vary in degree of organization. Some are neatly presentable as a system of entities, postulates, and rules; others - indeed, most others - appear to have no apparent articulated shape, providing only a lore of understanding, an approach, a perspective. Whatever the degree of organization, however, each primary framework allows its user to locate, perceive, identify, and label a seemingly infinite number of concrete occurrences defined in its terms. He is likely to be unaware of such organized features as the framework has and unable to describe the framework with any completeness if asked, yet these handicaps are no bar to his easily and fully applying it (Goffman, 1974, p.21).

This ambiguity of human experience, in which incomplete and imprecise ideas are still applied with great ease, is an essential aspect of imaginary systems, and it may be considered an even greater issue in light of the fact that these are not static frameworks, but that they are dynamically adapted and recreated in order to make sense of changing and even contradictory perceptions. Contrary to real systems, imaginary systems can therefore not be assessed and described as ‘whole’, working systems and accordingly be tested and observed.

One way to picture how these ambiguous and incomplete ideas can still be applied with great ease is by envisioning a gardener building a garden-fence - continuously driving fence posts into the ground along a straight line. But instead of using a whole batch of fence posts, the gardener always uses the same one: every time she gets down to driving the ‘next’ post into the ground, she absent-mindedly reaches back, plugs the last post from the earth and drives it in the next designated spot. The gardener is at every given moment engaged in the act of building a fence, while never actually building it. There is no fence, only the act of building, and the assumption that the current post is the link between a previous post and the next one - but as long as the gardener holds on to this assumption, the act of ‘building the fence’ is still a meaningful activity. In order to understand the gardener’s actions, and the significance these actions have within the imaginary system she upholds, an observer will need to fill in the blanks the gardener might ignore; only by acknowledging that the gardener is acting within an imaginary system of ‘fence-building’ it will become tangible how this action ‘makes sense’ to her, even if for an outside observer, the action itself may appear to be an isolated occurrence with no actual consequence.

This ambiguity is a crucial aspect for the assessment of imaginary systems. While real systems can be subjected to strict and exhaustive scrutiny, imaginary systems must be approached in a much more tolerant manner: due to their assumptive nature, these systems cannot be rejected due to a lack of completeness or coherence. Instead, any single manifestation of such imaginations must be evaluated as if it was part of a functioning system, even if the other elements of this system are not precisely formulated or even disregarded within this imagination.

4. Implications

It has been the main proposition of this paper that systemic thinking might not necessarily be a skill to be applied at will, but that the creation of imaginary systems is an inherent part of human cognition and experience.

On the example of filmic montage, it has been argued how the assumption of systemic relations, fueled by basic causal thinking, is a necessary prerequisite for meaningful interpretations, and that these assumptions are triggered by the friction between perceiving something as significant and not being able to finally determine the nature of this significance. An examination of play experiences in digital games has further shown how these imaginary systems enable meaningful decisions and action by enabling the setting of goals and purposeful strategies, and how they are dynamically adapted and recreated to accommodate new and even contradictory perceptions.

The resulting conception of imaginary systems not only suggests a constructivist explanation for the persuasiveness of the systems paradigm in today’s academia and society. It is also suited to address a central concern of (radical) constructivist theory itself, which does not exhaust itself in the notion that all human experience is *just* a result of cognitive processes, but consequently leads to the question *how* humans shape their own experience, and under what terms and conditions the process of reality construction takes place. In Glasersfeld’s remarks on “the radical constructivist position” (1991), this venue of investigation is not only treated as an option, but as an obligation:

> If one adapts a constructivist orientation, one is obliged to go beyond the mere proclamation that the world we experience is a world we construct. At least one must try to show how what we call 'knowledge' - that is, our successful ways and means of managing our lives and conceptual structures - could be built up; and if one claims to be a radical constructivist, one must also show that this experiential world can be built up without reference to a supposedly 'existing' world (Glasersfeld 1991, p. 18).

With this obligation in mind, radical constructivism has brought forth a variety of conceptions that aim to account for the terms and conditions under which cognitive realities are constructed, ranging from Glasersfeld's own conception of viability and the favoring of the operative over the truthful to Watzlawick's aforementioned notion of the inevitability of cause and effect thinking, or Foerster’s (1984) discussion of the biological conditions enabling (and limiting) experiential ‘computation’. But while these considerations approach the functionality of the ‘human mind’ in an analytical manner by identifying a number of distinct principles that underlie the cognitive construction of realities, a more comprehensive ‘logic’ of the human mind (especially one that is consistent with the basic ideas of Systems theory) must also consider how these principles relate to each other by consolidating them into a more encompassing model of human cognition and experience.

The notion that human cognition is primed for the construction of “imaginary systems” can serve as a starting point for such a consolidation, as it provides a framework for evaluating separate aspects of human cognition (such as the distinction of elements and domains, the assumption of causal relations between these elements, the dynamic assignment of values to specific outcomes, or the perceived viability of actions and strategies for reaching or avoiding these outcomes) as interrelated principles that work together in the construction of a stable reality. And as the discussion of these imaginary systems’ indeterminacy and subjectivity has shown, such a framework can also take into account the ambiguous nature of human experience and cognition, thereby evading the risk of getting caught up in illusions of simplified measurability or even predictability (illusions that any attempt to devise a ‘logic of the human mind’ must be careful to avoid).

But what does this mean for the practical application of the systems paradigm to new domains? What is the ‘added value’ of considering the systemic nature of human imagination? As this paper has focused on combining Systems Theory with a media studies perspective, there are at least two immediate applications that can be suggested.

On the one hand, an application of the systems paradigm in the form of imaginary systems can be beneficial for the study of media experiences. In the age of media convergence (see Jenkins 2006), as people have become used to draw on a wide range of different media products and forms to shape their individual media experiences, it is no longer sufficient to ask how visual, textual, or interactive media enable meaningful experiences in their own medium-specific ways (cf. Hepp 2013, p. 122). Instead, media scholars are increasingly challenged to go beyond medium-specificity, and to ask how any of these media contribute to the construction of more encompassing individual or socio-cultural imaginations. However, this requires a viable conception of these imaginations, a conception that accommodates the great variety of possible medium-specific contributions, while at the same time unifying these individual contributions into a consistent model of human imagination. These requirements are easily fulfilled by the notion of imaginary systems, as ideas about how a system works can be fueled by visual representations, descriptive or narrative accounts, or through virtual models that aim to convey these ideas in an interactive manner.

On the other hand, an increased focus on the inherently systemic nature of human imagination can also provide a beneficial expansion for Systems Theory and the Systems Thinking discourse itself. It has been pointed out at the beginning of this paper that the success of the systems paradigm goes far beyond academia, but that a much broader audience has come to agree on the benefits of systemic ways of problem solving. However, while most people are quick to accept (and even demand) that problems must be addressed in a systemic manner, and systems researchers continue to come up with promising solutions for problems as complex as making sustainable use of ecological resources, equalizing economic imbalances or successfully managing organizational change and development, these solutions are often met with fierce resistance or even outright refusal when it comes to their real life implementation.

This reluctance does not necessarily result from a lack of systemic understanding that could be countered by increased efforts to teach systems thinking and to further promote systemic ideas. From a perspective of imaginary systems, it is much more likely that the models and solutions that systems theory is able to provide often collide with imaginary systems that are already in place, and whose significance for the parties involved hinders the implementation of even the most plausible and promising systemic solutions. Acknowledging and understanding these imaginary systems will be beneficial for the successful promotion of systems solutions, as it will not only enable more adequate communication strategies, but will also make it possible to adapt and expand systemic suggestions in order to consolidate their problem-solving potential with the requirements of the imaginary systems already in place.

But the implications of developing a better understanding of imaginary systems go far beyond the successful promotion of specific systemic ideas. With an increasing demand for direct democracy and more immediate participation in social and political processes, it will be necessary to develop more viable explanatory models for the public's behavior at the ballots, as a growing number of issues will not be decided by elected politicians, but by the outcome of public votes. But the behavior at the ballots cannot simply be explained by social, political or economic circumstances alone, but by how these circumstances are imagined by a voting public, and how they relate these imaginations to their own personal values and beliefs. While demagogues have always grasped and often skillfully exploited these imaginary systems, a growing understanding of how these imaginary systems are constructed and created will be crucial for more serious academic examinations and more responsible political communication.

As has been pointed out earlier, the notion that humans intuitively assume systemic relations and create imaginary systems implies that there is little need to teach and train people 'how to think in systemic terms'. However, this does in no way mean that efforts to teach systems thinking can be declared obsolete. What it does mean is that these efforts must aim at making us aware how we already imagine the world in systemic terms, and enable us to critically reflect the systemic nature of our imaginations, in order to uncover their shortcomings and contradictions and to find ways to create more viable imaginary systems - and thereby live up to the central promise the systems paradigm holds: to find better solutions for whatever we perceive as problems in a complex world.

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