Requirements for a General Game Mechanics Framework

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In this article I will apply a meta-theoretical approach to the question of how a game mechanics framework has to be designed in order to fulfil its task of adequately depicting or modeling the reality of game mechanics. I had two aims in mind when starting my research. I studied existing game theories and three game mechanics theories in particular in order to evaluate the state of the art of game mechanics theory. (Descriptive aim) The second aim followed on from these studies. With the results of my research I wanted to define the attributes a comprehensive and general game mechanics theory might or – rather – needed to have. What are the general properties that such a theory should display? (Normative aim)

In my opinion the underlying mechanics of a game may be regarded in some way as its centerpiece. The reasons for this shall become clear over the course of this article.

To begin with, I would like to make two terminological clarifications. First, I am not going to examine different game mechanics and typologies or categories of game mechanics. Instead, I will take a theoretical step backwards, so to speak, on the meta-level by analyzing and comparing different theories of game mechanics (which themselves suggest categories and typologies). Secondly, I will use the expressions "game mechanics theory" "(game mechanics) framework" and "(game mechanics) model" synonymously.

In my research I focused mainly on the following three key theories of game mechanics:

1. Carlo Fabricatore's *Gameplay and Game Mechanics Design* (2007)
2. Miguel Sicart's *Defining Game Mechanics* (2008)
3. Ernest Adams' and Joris Dormans' *Game Mechanics. Advanced Game Design* (2012)

Before I undertook my study – in 2015 – these had the reputation of being the most elaborate theories of game mechanics.

As a first finding of this comparison it became evident that all three frameworks share the idea that the mechanics of a game cybernetically organize the changes of a game's states through rule-based interaction and causal relationships. This means that all games are rule-based and that these rules organize the causal relationships between the interactions of the different agents in a game. On this level of formal abstraction all games are comparable with each other.

Apart from this common ground, however, the different frameworks vary widely. Because of their considerable differences I needed to identify further general criteria and requirements such a framework would have to meet in order for it to be comprehensive. Therefore, at an early stage of my research the normative considerations became a key factor. To obtain such a broader understanding of what a game mechanics framework should accomplish, I was mostly reflecting on conceptual and terminological distinctions. This is why my argument follows a pure top-down approach which could almost be considered a case of apriori reasoning.[1] This essay will therefore be based on the following structure:

1. I will start with an examination of technical terms.
2. After that I will draw conclusions about the normative requirements of game mechanics frameworks.
3. Then I will compare the three theories mentioned above.
4. Finally, I will present further conclusions with regard to future research goals.

THREE CONCEPTS DISTINGUISHED: GAME EXPERIENCE, GAMEPLAY AND GAME MECHANICS

There are three crucial terms which closely correlate with one another, but in my opinion need to be distinguished more clearly:

1. Game experience
2. Gameplay
3. Game mechanics

1 I suppose that it would be worth considering complementing this approach with a bottom-up study examining existing and tried and tested categorical differentiations used by bigger game studios in there production process.

All of these terms are often used in discussions of game mechanics theory. I would argue that if they are not sharply distinguished, the project of designing a general conceptual game mechanics framework is doomed to failure by definition. On the other hand, I believe that by using and defining these terms boldly some fundamental conceptual decisions can be reached which will improve the theoretical discourse around game mechanics and its framework.

So what do these terms actually mean? Or: How should they be defined so as to avoid confusion?

I consider "game experience" and "game mechanics" to be the two conceptual cornerstones that define the field of game mechanics: on one side, "game experience" stands for the *subjective experience* ("I feel excited playing this."), whereas on the other side, "game mechanics" stands for the *objective mechanics of a game* ("The inner, causal architecture of this game looks like that.").

The subjective perspective: game experience

What is game experience? I define "game experience" as the mental and therefore subjective experience that is created by a particular game. This premise has far-reaching implications. As game experience is a mental and subjective process ("first-person perspective/accessibility") it is not methodologically directly observable with the third-person perspective of science. (Psychological) science achieves no immediate access to it but has to interview the player. Despite its subjective ontological nature, game experience can be described as an epistemologically objective property of a game (e.g. "The game experience of this game is more exciting than the experience of that other game.") Why is game experience relevant in the discussion about game mechanics? The main reason is that the experience is the purpose of playing or developing games. This becomes obvious when we look at the vocabulary that belongs to the game experience. It contains all the motivational words that explain why we play ("fun", "immersion", "flow", "thrill", etc.) and why we consider some games as good and others as bad. But while a (good) game experience is the ultimate goal of a game and what game designers aim at, it can only be accomplished indirectly. As this cannot be immediately observed scientifically there is no immediate control of the game experience by the game designer.

Scientists and producers must therefore focus on what is at their disposal. For game designers it is the game itself that creates the game experience. And I would suggest that of the many different factors that influence game experience, game mechanics is one of the most important ones.

I would argue that game mechanics is one, if not the central *objective cause* of game experience (others might be the semantic-narrative layer and the aesthetic-atmospheric layer). For game designers it is therefore crucial to understand how specific mechanics evoke specific experiences. Game mechanics and game experience are two very different things: the latter can only be perceived subjectively; the former can be observed and produced objectively. But they causally correlate with each other.

The objective perspective: game mechanics

So what do I mean by game mechanics? Let us start with the afore-mentioned shared common ground of the different frameworks and loosely define "game mechanics" as "the objective structures and properties of a game that cybernetically organize the changes of a game's states through rule-based interaction and causal relationships." The catch in this definition is that it is by far too abstract and formal. One would expect that game mechanics contain properties that contribute to a distinctive definition of games. But the definition of game mechanics given above could also describe nearly any (computer) program (if "game" is replaced with "program"). So, while this definition might be helpful as a starting point it will need to be narrowed down in order to become a sound foundation for a theoretical reflection. As a first step towards such a more precise definition, I will clarify the issue of rules or actions.

Rules or actions?

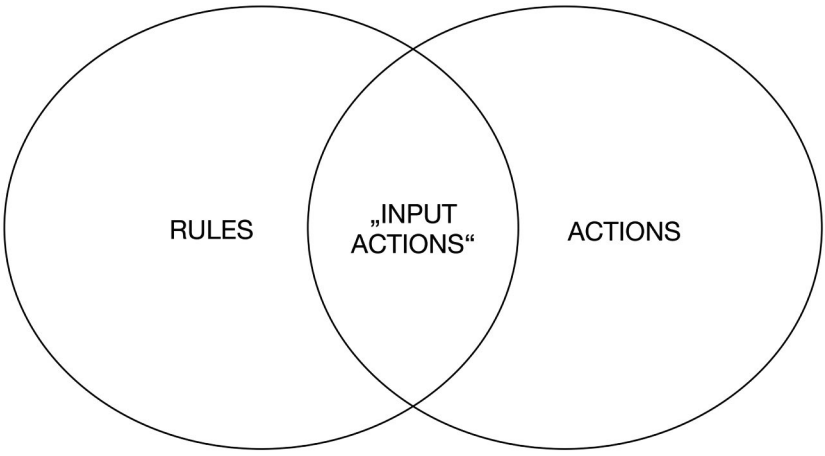
There seems to be some disagreement regarding the question of whether game mechanics encompass the formal rules and structures of the game or "the actions afforded to players by those rules" (Sicart 2008), or indeed both. I would argue that the former must be the case: since game mechanics should describe the cybernetic system as a comprehensive whole it cannot exclude but must contain the rules. Any description that limits the scope of examination to the actions "afforded to players" neglects essential properties of the game and therefore results in a reduced perception of its mechanics. I would further argue that the restriction of the field of game mechanics to the actions of the players is the consequence of a misguided conceptualization that takes its starting point from gameplay and its player focus[2]. I would counter such an approach by emphasiz-

2 I will use the term "focus" here instead of "perspective" in order to distinguish it from the use of "perspective" denoting the ontological difference between "subjective" ver-

ing that when talking about game mechanics one should start from the game as such and therefore maintain a holistic focus. It also raises the question of what term we should then use for the other elements underlying the game if we restrict the mechanics to the actions.

As illustrated by the following diagram (figure 1), I would suggest that some rules are identical with actions. These are the rules that define what I call "input actions". Input actions (such as "press button") are actions that are observable on the input-level of the game whereas other actions of a more complex scale, such as strategies, cannot be observed (but only derived) from the game. Therefore, I would suggest to exclude holistic long- term activities from a game mechanics framework and to consider small-scale "input activities" as part of the rule set of a game.

Figure 1: "Input actions" are also rules



Source: Hofmann

The interface: gameplay

How do game mechanics create game experience? They need an interface: gameplay. All of the authors mentioned in this article talk about "gameplay" rather than "game experience". A common phrase might sound like this: "Game mechanics create gameplay" (Adams and Dormans 2012: xi).

sus "objective" perspective. The term "focus" might also be more accurate insofar as it is concerned with the object and not with the subject of observation.

The term "gameplay" seems to be some kind of a hybrid: Fabricatore defines it as "the set of activities that can be performed by the player during the ludic experience […]". (Fabricatore 2007: 4)

So, according to this definition, gameplay is on the one hand concerned with activities (which are factual and objective properties of the game), but on the other hand only player-related activities are considered. This player relatedness is not exactly the same as the subjectivity of the experience mentioned above; it is rather a form of perspectivity. Gameplay is player-focused in its perspective. If we consider gameplay as "the set of activities that can be performed by the player during the ludic experience […]" (ibid), gameplay can be defined as a player-focused subset of all possible interactions in a game.[3] Some authors add to this the aspect of challenge(s) posed by the game.[4] The available actions serve to master these challenges.

We have now made the necessary terminological differentiations that allow us to distinguish between the notion of gameplay and the notion of game mechanics. And if we distinguish "between the rules of the game and the actions afforded to players by those rules" (Sicart 2008) we then can call the former "game mechanics" whereas the latter could be labeled "gameplay". Gameplay therefore is the tangible interface between player experience and game mechanics. This causal connection is illustrated in figure 2:

3 Likewise Craig Lindley: "[…] gameplay gestalt, understood as a pattern of interaction with the game system." ("A gestalt may be understood as a configuration or pattern of elements so unified as a whole that it cannot be described merely as a sum of its parts."); "[…] In general, [game play gestalt] is a particular way of thinking about the game state from the perspective of a player, together with a pattern of repetitive perceptual, cognitive, and motor operations. A particular gameplay gestalt could be unique to a person, a game, or even a playing occasion. Unique gameplay gestalts can also be identified across games, game genres, and players." (Lindley 2004: 183-194). See also Salen and Zimmerman (2004): "Game play is the formalized interaction that occurs when players follow the rules of a game and experience its system through play."

4 For example Adams and Dormans: "We define *gameplay* as the challenges that a game poses to a player and the actions the player can perform in the game. Most actions enable the player to overcome challenges [...]. The actions that *are* related to challenges are governed by the game mechanics." (Adams and Dormans 2012: 43)

Figure 2: Game mechanics create the game experience via gameplay.

Source: Hofmann

The clear conceptual distinction between gameplay and game mechanics should also have implications for the design process. Game designers have to distinguish between (at least) two different levels of design:

1. Gameplay design: this could be regarded as "motivation design" *for the player*, taking into consideration the perspective of the player.
2. Game mechanics design: this would contain the programmable "visceral construction" *of the architecture of the game* which manifests itself on the level of the program code or an abstraction of it, such as Unified Modeling Language (UML).

Of course, both levels are intertwined. If we take into account that the ultimate goal of game design is to achieve a great game experience we can conclude that the design process will start with the gameplay and end with game mechanics.
We now can distinguish between

1. Game experience (subjective, player-focused *experience*)
2. Gameplay (objective, player-focused *actions*)
3. Game mechanics (objective, game-focused *rules*).

Brief digression: the MDA framework

The MDA framework by Hunicke, LeBlanc and Zubek (2004) proposes a categorical distinction that at first sight seems to correspond with the distinction explained above (see also figure 3). One might be tempted to correlate the terms in the following manner:

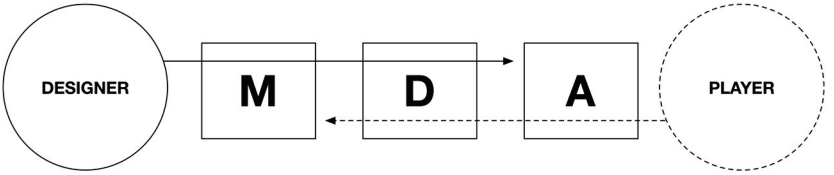
1. Game experience (subjective, player-focused experience) > *Aesthetics*
2. Gameplay (objective, player-focused actions) > *Dynamics*
3. Game mechanics (objective, game-focused rules) > *Mechanics*

But in my opinion the MDA framework is conceptually and ontologically inconsistent. This follows on from my definition of the game experience as ontologi-

cally subjective, which implies a sharp division between game experience and game mechanics whereas the MDA framework seems to suggest some kind of continuum. The authors of the MDA framework also tend to think of the "aesthetics" component as player-oriented and subjective when they label it with the term "fun". But when they further explain the aesthetics component they end up using a taxonomy of "sensation", "fantasy", "narrative", "challenge", "fellowship", "discovery", "expression" and "submission". It is obvious that some of these concepts can be seen as describing a subjective player's experience (i.e. "sensation") while others rather refer to objective features that describe either the gameplay (i.e. "challenge", "discovery") or even the game itself, such as the "narrative". It would be misleading to think that the game can be regarded as identical with the game mechanics. A game as such also consists at the very least of a semantic narrative (the "story") and something like the designed aesthetics of the game's world. But while these features also play a role in creating the game experience they themselves are part of the game itself.

There are similar concerns regarding the "dynamics" component. If this concept describes "the run-time behavior of the mechanics" (ibid) it is essentially just another description of the mechanics. The "dynamics" component could therefore only be identified with gameplay if by "the run-time behavior" one meant nothing but the player-focused behavior. I therefore recommend that the terminology of the MDA framework should be avoided for its lack of conceptual accuracy and consistency.

Figure 3: The MDA framework. The arrow beginning with the "designer" shows the causal connection between mechanics, dynamics and aesthetics.



Source: Hofmann

THE NECESSARY REQUIREMENTS OF A GAME MECHANICS FRAMEWORK

What conclusions can be drawn from this for our draft of a comprehensive and general game mechanics theory? I believe that our deliberations thus far allow us to deduce a normative matrix of necessary requirements for a game mechanics framework.

If one of the crucial distinctions between game mechanics and gameplay is that the latter is player-focused[5] and if we agree to use the term "game mechanics" for the systemic whole of a game, we can deduce a first and crucial normative requirement for a game mechanics framework: non-player focusing (criterion: "player-focusing"). In order to adequately describe the whole of a game's mechanics, its perspective must not be player-focused (but game-focused). A player-focused perspective is by definition too narrow to encompass the whole of a game's changes of states and causal relationships.

I further contend that we can at least partially deduce three additional requirements from this first one. If a theoretical game mechanics framework is expected to be not player-focused but *game-focused* then it has to describe the systemic whole of a game and not only its particular mechanics (criterion: "holisticism"). And if we omit the player in these considerations it becomes obvious that game mechanics is about rules, not the actions of the player or other agents (criterion: "rule focusing"). However, as I have mentioned before, some rules can be considered as "input actions". Therefore if a game mechanics framework describes interactions, it has to do so on the level of quantitative input/output values and not on the level of complex activities or abstract strategies (criterion: "interaction resolution").

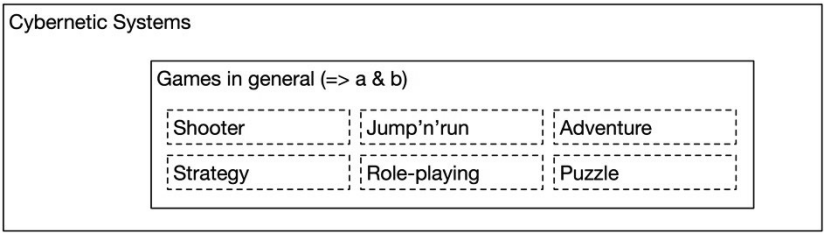
I would suggest adding one more requirement that follows on from the need for definitional accuracy. A sound game mechanics theory has to meet two complementary logical requirements at the same time:

a) It has to be sufficiently abstract and formal *to be applicable to all sorts of (video?) games*, and not just a subclass (i.e. "shooters").
b) It has to be as definite as possible in order *to distinguish (video?) games clearly and precisely from any other possible rule-based cybernetic system*.

5 Notice that I use the term "focused" synonymously as other authors (i.e. Fabricatore) use the term "centered".

Therefore an ideal game mechanics framework needs a certain degree of formal abstraction that contains all possible games without containing other elements, such as cybernetic systems (criterion: "formal abstraction", see table 1).

Table 1: The definition of "games" must distinguish them from other cybernetic systems and simultaneously contain all sorts of games.



Source: Hofmann

The resulting matrix with the five normative requirements (required value highlighted) looks like this (table 2):

Table 2: Five requirements of a game mechanics framework.

CRITERIA	MINIMUM	MAXIMUM
player focusing	**not player-focused**	player-focused
holisticism	partial mechanics	**systems mechanics**
rule focusing	actions	**rules**
interaction resolution	**input/output**	strategies
formal abstraction	genre specific	**for all games**

It should be clear that the criteria denote gradual transitions that leave a lot of space between the extremes. And it has to be added that even though the requirements tend to emphasize the end points of the continuum, these define just the necessary minimal requirements of a game mechanics framework. Once such a framework has established a holistic, formal, rule-based and not player-focused model of game mechanics, it would obviously be desirable if it were also able to switch to a player-focused perspective and depict complex interactions or partial mechanics.

There might be some confusion about the seemingly opposed "directions" of the criteria of "holisticism" and "interaction resolution". Whereas the criterion of

holisticism requires that the game is considered as a complex system as a whole, the criterion of interaction resolution calls for the description of elementary small level units. I would argue that this opposition does not constitute a contradiction but rather spans the cornerstones of the fields of observation and analysis.

With this set of normative requirements at hand I will now examine the existing game mechanics models with regard to their ability to fulfil these requirements.

1. FRAMEWORK: FABRICATORE

In his work *Gameplay and Mechanics Design: A Key to Quality in Videogames*, Carlo Fabricatore (2007) takes a decidedly player-focused stance – or "player-centered", as he would say – since he focuses on the design goal of player satisfaction. He therefore gives a lot of thought to game experience and gameplay and his deliberations often remain in the realm of mental concepts (i.e. motivation, learning and reward).

In his view, game mechanics seem to be the correlating rule set counterpart to gameplay.

Fabricatore defines game mechanics as "proper tools for gameplay, atomic rule-based interactive subsystems capable of receiving an input and reacting by producing an output. Such output translates into a state change of the mechanics itself and/or into the triggering of new interactions with other game mechanics." (Fabricatore 2007: 5) He offers as examples of such singular mechanics the mechanics of a door or an alarm.

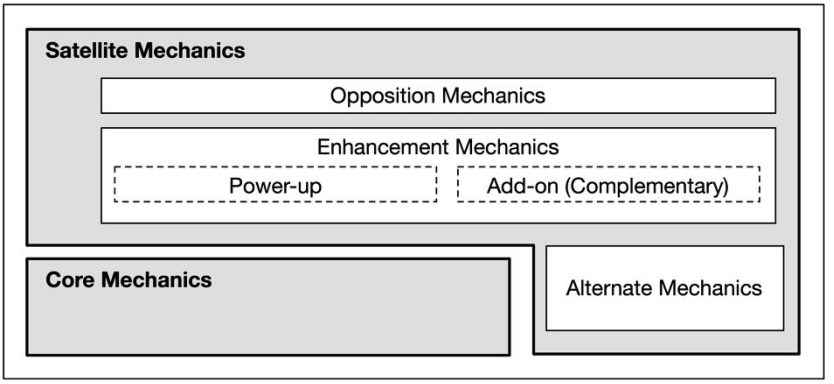
It is worth mentioning that Fabricatore uses the term "game mechanics" only for the mechanics of individual "toys" (ibid: 4) that can be interacted with by the player, but almost never for the game system as a whole. Even though the use of the term "subsystem" in the quote above implies the presupposed existence of a main system, Fabricatore doesn't ponder on the game as a whole. His concerns about game mechanics refer to the player's perspective and experience. This is the case for instance when he explains how the player's goals of challenge, mastery and reward correspond with "mechanic-related activities" (ibid: 6), such as learning and using the mechanics for different goals. This allows him to arrive at some guidelines for the design of game mechanics.[6] Once again, it is obvious

6 These guidelines are: "1) Estimate the learning time for each feature of a specific mechanics, and make sure that the time to learn is proportional to player's perceived

that his reflections on game mechanics are solely oriented towards gameplay and/or game experiences.

His focus on gameplay leads Fabricatore to distinguish different kinds of gameplay and the corresponding mechanics in respect to their relevance to the player. These are: 1. “Core gameplay”, 2. “Core meta-gameplay”, 3. “Satellite Mechanics”, and 4. “Peripheral gameplay” (ibid: 11)

Table 3: Fabricatore’s architectural model of game mechanics.



Source: Hofmann

He defines “core gameplay as the set of activities that the player will undertake more frequently during the game experience, and which are indispensable to win the game. The game mechanics which allow carrying out the core gameplay activities are called ‘core mechanics’, and are, consequently, the most important in the game” (ibid: 11).

He then delineates an architectural model of different types of mechanics and their relations (see table 3).

As can be seen the term “architectural” might be misleading because the building structure Fabricatore refers to is not that of a game but rather one of dependencies between different categories of game mechanics.

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complexity and relevance of the feature itself. 2) In order to avoid burnout, design the game to allow players using game mechanics as gameplay tools as soon as they feel they’ve learned them. 3) To further decrease the possibility of burnout, and increase the perceived appeal and relevance of the mechanics, ensure that players will have enough opportunities to use game mechanics’ features enhanced through the influence of external factors, achieving otherwise unattainable goals.” (Fabricatore 2007: 10)

We can now conclude that since Fabricatore's proposal is geared towards game experience and gameplay and since it lacks the perspective on the game as such and as a whole, it does not fulfil the requirement of not being player-focused. It is only apt for considering questions concerning gameplay (motivation) design (see table 4).

Table 4: Positioning of Fabricatore's framework within the matrix

CRITERIA	MINIMUM	MAXIMUM
player focusing	not player-focused	**player-focused**
holisticism	**partial mechanics**	systems mechanics
rule focusing	actions	**rules**
interaction resolution	**input/output**	strategies
formal abstraction	genre specific	**for all games**

2. FRAMEWORK: SICART

Miguel Sicart defines game mechanics in his article *Defining Game Mechanics* (2008) "in relation to rules and challenges. Game mechanics are methods invoked by agents for interacting with the game world." (Sicart 2008). "I define game mechanics, using concepts from object-oriented programing, as methods invoked by agents, designed for interaction with the game state." (ibid) It is obvious that he seems to define game mechanics in a similar way to Fabricatore as player-focused and tied to gameplay. But there are some crucial differences between the two frameworks.

This definition is

1. formal (because it can be used to "describe, and interrelate game mechanics in any given game" (ibid). His framework therefore implies a formal universality since it is applicable to all games and implies a transferability between different levels of description (without identifying them): from player to game and from design to analysis. The use of the programing concept of "method" allows the framework to be translated into UML. By this means the mechanics of a game can be formally designed (production) as well as analyzed (reception);

2. agency-focused, but not just player-focused, because any interacting entity can be an agent. This consideration of all kinds of virtual agents (or "objects") makes it possible to decouple the description of in-game agency from the player focus. Therefore the focus of the framework is somewhat broader than Fabricatore's approach. Nevertheless, player focus remains a dominant concern when he claims that his approach helps "mapping mechanics to input procedures and player emotions" (ibid);
3. more action-focused and less rule-focused.

It seems to be a significant advantage of this framework that it relies on "concepts from object-oriented programing". Yet, by defining game mechanics as the "methods invoked by agents for interacting with the game world", by understanding methods as "the actions or behaviors available to a class" (ibid) and by affirming that methods can best be described by verbs, Sicart clearly distinguishes between the rules of a game and the actions allowed by these rules. He also argues that the mechanics only consist of the actions (methods) of an object whereas the rules are defined by the limiting properties of an object: "All of these [verbs] are methods for agency within the game world, actions the player can take within the space of possibility created by the rules." (Ibid)

I have already made it clear that I would challenge the terminological restriction to possible actions because it raises the question of what term we should then use for the other elements underlying a game. In other words: Once the concept of agency is opened to any virtual agent why still limit the game mechanics framework to methods, why not also encompass all classes and properties of the game as a complex cybernetic system?[7] This restriction of the concept of game mechanics to "interactions" seems to me to be the biggest flaw in

7 To a certain degree Sicart seems to admit this when he explains the correlation of rules and actions: "In this object oriented framework, rules could be considered general or particular properties of the game system and its agents. All objects in games have properties. These properties are often either rules or determined by rules. These rules are evaluated by a game loop, an algorithm that relates the current state of the game and the properties of the objects with a number of conditions that consequently can modify the game state. For example, the winning condition, the losing condition and the effects of action in the player's avatar health are calculated when running the game loop. This algorithm relates rules with mechanics, exemplifying the applicability of an ontological distinction between rules and mechanics." (Sicart 2008) It remains unclear why there is an ontological distinction between rules and actions and why just the latter shall be identified with the mechanics of a game.

Sicart's framework because it hinders an adequate description of the game as a whole.

This goes together with another deficit in his model, which is the lack of a holistic approach. Like Fabricatore he moves away from the common use of the term "game mechanics" that describes game behavior as individual actions, such as jumping or shooting. And Sicart also offers a distinction of core, primary and secondary mechanics. The only instance where he goes beyond Fabricatore's perspective is when he introduces the concept of "compound game mechanic" (ibid):

"[A] compound game mechanic is a set of related game mechanics that function together within one delimited agent interaction mode. These modes are defined by the interaction of these different modalities: as such, the driving compound mechanic is composed by a set of mechanics interrelated to provide a relatively accurate model of driving. When playing, and, on occasion, when analyzing, it is useful to think about these compound mechanics as a whole and not as a collection of formally differentiated mechanics." (Ibid)

The concept of compound mechanics makes it possible to turn the focus away from singular and elementary methods, towards complex systems and therefore also towards the game as a systemic whole.

This consideration of more complex units of interaction can be linked to the concept of challenge. Sicart relates game mechanics to the concept of challenge because they offer the "actions afforded to agents to overcome challenges" (ibid). In his examination of the concept of challenge Sicart mentions a necessary supplement to my primary definition of game mechanics. A challenge implies a success condition, and if we take each game as a whole, its challenge involves a starting and a winning condition, a property that other programs do not need.

We can now conclude that Sicart's game mechanics theory is positioned as follows within our matrix (table 5):

Table 5: Positioning of Sicart's framework within the matrix.

CRITERIA	MINIMUM	MAXIMUM
player focusing	**not player-focused**	player-focused
interaction resolution	**input/output**	strategies
holisticism	**partial mechanics**	**systems mechanics**
rule focusing	**actions**	rules
formal abstraction	genre specific	**for all games**

Even though Sicart's formalization can be regarded as a step in the right direction, the focus on actions and partial mechanics still disqualifies his proposition as a general game mechanics framework.

Concerning "player focusing" and "interaction resolution" Sicart takes an intermediate position that is open towards a holistic description of a game.

3. FRAMEWORK: ADAMS AND DORMANS

With their book *Game Mechanics. Advanced Game Design*, Ernest Adams and Joris Dormans (2012) have very practical intentions. Its aim is to answer the question "How to design a game?", and therefore the authors do not bother much about technical definitions. Yet, it is evident that they also understand games as rule-based cybernetic systems ("state machines"). For them, the mechanics of a game encompass all the concrete details that contain but also go beyond a general rule.[8]

Adams and Dormans propose a categorization of five different types (or rather layers) of game mechanics. Since they do not burden themselves with the explanation of how they arrived at these categories one cannot help but get the impression that they lack a theoretical foundation (ibid: 6-7):

8 "Rules and mechanics are related concepts, but mechanics are more detailed and concrete. For example, the rules of *Monopoly* consists of only a few pages, but the mechanics of *Monopoly* include prices of all the properties and the text of all the Chance and Community Chest cards – in other words, everything that affects the operation of the game." (Adams and Dormans 2012: 3-4)

1. Physics (the physical laws of the virtual world. How can one move in space and time, what happens if one uses certain forces?)
2. Internal economy (laws of production and distribution of elementary value units, like money, health or competence. These units can be produced, collected, traded or consumed.)
3. Progression (level design vs. cybernetic emergence. What is the design of each single level, what are the conditions of progress, which processes tend to result from cybernetic feedback governed by rules?)
4. Tactical maneuvering (strategic distribution of game units, in particular with respect to combat)
5. Social interaction (rules, techniques and processes that allow and define interaction between players)

The authors show that these categories allow us to illuminate the differences between the different genres of games. For example, it is obvious that the mechanics of economy and progression are predominant in a role play whereas physics has a much bigger impact in action games.

Even though their categories can claim some intuitive plausibility[9] and practical usability they do not convey the impression of a coherent and holistic theoretical framework. Rather, they introduce a different kind of fragmentation, in this case one where the whole of the game is not divided into smaller units of interaction but rather into overlapping simultaneous layers of description.

It is the mechanics of an "internal economy" that provides a promising outlook for a systemic and holistic description. The concept involves every countable resource that can become relevant for the progression of the game, and for many games economic factors are decisive in respect of winning or losing. Because of this holistic perspective the paradigm of an internal economy seems to be an appropriate approach to adequately map the cybernetic complexity of the game as a whole. That might be one of the reasons why Adams and Dormans have formulated their *Machinations Framework* as an economic feedback system. By its ability to formalize and simulate economic relations in a game, and by doing so at different levels of interaction resolution from basic elements on to complex subsystems, the *Machinations Framework* seems to be a very promising and powerful tool for developing or analyzing a game.

9 There is no doubt that the duality of narrowly scripted "games of progression" versus cybernetically evolving "games of emergence" highlights a cardinal point of the debate between narratologists and ludologists.

On the other hand, I wonder whether all games can be described properly by the economic paradigm. Some games such as action and sports games depend more on additional factors such as dexterity that can hardly be translated into an internal economy. This means that a purely economic description ignores crucial features of the mechanics of these games. I therefore doubt the universal usability of the *Machinations Framework* because it is built on the premise that the internal economy is an adequate means to comprehensively map the mechanics of every game.

The model by Adams and Dormans can be considered as one that refrains from taking a player-focused perspective, and this at least implicitly entails a holistic analysis. Within the *Machinations Framework* various levels of interaction resolution can be described, starting with basic elements. This allows us to conclude that their framework covers many of the requirements expected from a universal game mechanics framework (see table 6). Yet, the lack of theoretical coherence and the fact that the economic formalization is probably not universally applicable cast a negative light on the theory.

Table 6: Positioning of Adams and Dormans' framework within the matrix.

CRITERIA	MINIMUM	MAXIMUM
player focusing	**not player-focused**	player-focused
interaction resolution	**input/output**	strategies
holisticism	**partial mechanics**	**systems mechanics**
rule focusing	actions	**rules**
formal abstraction	**genre specific**	**for all games**

Based on the distinction between games of progression and games of emergence, my earlier definition of "game mechanics" as "the objective structures and properties of a game that cybernetically organize the changes of a game's states through rule-based interaction and causal relationships" can now be narrowed down. The "ludic emergence" of an enormous and complex probability space through the use of a relatively small set of rules can be considered as the distinguishing feature of games in comparison with other cultural products, such as films or literature.

4. HOW FAR HAVE WE GOT SO FAR?

My terminological deliberations have led me to conclude that a sound comprehensive and general game mechanics theory would at least need to

1. be focused on the game and not the player;
2. have a high interaction resolution describing interactions at the input/output level;
3. offer a holistic description of system mechanics of the game as a whole;
4. focus on rules (and input/output activities) and not on actions;
5. be formally sufficiently abstract to be applicable to any game, but only to games.

In my opinion, none of the proposals I discussed were able to fulfil all of these requirements, with most of them lacking a decisive holistic approach and exhibiting conceptual limitations. This means that we are still in need of a sound framework and further theoretical work needs to be done. I would argue that the requirements mentioned above prepare the ground for this further research. Yet, at the same time the comparative analysis revealed the limitations of the normative matrix of necessary requirements I suggested. It is too simple in itself to comprehensively capture the particular characteristics of the different existing game mechanics frameworks. It might fulfil its task to give an overview of the qualifications of existing game mechanics theories but it would probably also need further elaboration in order to become the theoretical foundation for the construction of a sound game mechanics framework.

With regard to my initial definition of the concept of game mechanics, the examination of the three frameworks offered two more specifications. I initially defined "game mechanics" as "the objective structures and properties of a game that cybernetically organize the changes of a game's states through rule-based interaction and causal relationships" and stated that we still need to identify the defining properties which distinguish games in general from other programs. We can now make this definition more specific by introducing the following features:

Games and their mechanics

1. offer a challenge that implies a starting and a winning condition (Sicart) and
2. they tend to evolve a ludic emergence of an enormous probability space (Adams and Dormans).

It must be added, though, that these features cannot serve as sufficient or necessary conditions of a game. It is not unusual that a game can do without a winning condition, and the distinction between a game and a theater play is also a very fine one.

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