The Power-up Experience: A Study of Power-ups in Games and Their Effect on Player Experience

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ABSTRACT
There is a lack of a comprehensive discussion in the literature of what a power-up is and how it can be studied, and the term is often used without definition. Using a case study of *Metroid Prime*, I argue that the most interesting aspect of power-ups as game mechanic is that they shift experiential character when a given power-up's implied formal use changes during gameplay. With this I mean that a power-up can at the same time be a means to achieve a goal as well as a goal to be achieved itself. A model explaining this is provided. I also propose a model for categorizing power-ups in an attempt to differentiate power-ups from other formal design elements and in such a manner provide a possible reference for designers looking to choose appropriate solutions for their games, as well as an analytical tool for researchers.

Keywords
power-up, power-ups, player experience, game design elements, Metroid Prime, game theory, game design

INTRODUCTION
Turn the tables in *Pac-Man* (Namco 1980) by eating the fruit. Now you're the hunter, at least for a little while. You can't wait to get that next weapons upgrade from beating the Air Man level boss in *Mega Man 2* (Capcom 1989). The Air Shooter you gain from him is good against Crash Man; the next level is going to be a breeze. In *Metroid Prime* (Retro Studios 2002), you spot a ledge you can't reach, which annoys you, as everything points to something interesting being there. Maybe you can reach it later… better find a means to get there!

Imagine ripping through enemies after touching the star in *Super Mario Bros* (Nintendo 1985). Or likewise, being more or less invincible and extra deadly on entering Rage of the Gods-mode after you've leveled up the Blades of Chaos in *God of War* (SCE Santa Monica 2005). The Phazon Beam, the strongest weapon, in fact – the only "kind of deadly" that will dispose of the last boss in *Metroid Prime* – is enabled when automatically entering "Hyper Mode" after stepping in liquid phazon with the Phazon Suit.

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In all the games above, the player is empowered (and her avatar augmented) for a shorter or a longer period of time by seeking out and gaining the strength of power-ups that she picks up. Some work as pace-makers to spice things up a little, others are parts of the overall reward structure, either by giving you things like new weapons (that also help or are *needed* for completion) or by giving you "a break" where you are invincible and *you* rule the system for once; seemingly unbalancing the system in your favor.

When empowering the player in such a way that she feels like master of the game, able to *play* with it, we could say power-ups bring the experience closer to what Caillois termed *paidia*, free-form play, on an axis of ludic activity (in Salen and Zimmerman 2004, 307-11). When seen as central to the winning conditions, they bring it closer to *ludus*, rule-bound play (Ibid.).

Notions like the one of empowerment described in the above examples are what I want to investigate in this paper. Salen and Zimmerman argue that "the play of a game is the *experiential* aspect of a game. Play in a game occurs as the game rules are set into motion and experienced by the players" (Salen and Zimmerman 2004, 311). They further define play as "free movement within a more rigid structure" (304). I want to look at ways in which power-ups can be analyzed in order to describe how they provide aesthetic experience – the elusive "fun" – within the structures of digital games. I attempt to expand on previous explorations of power-ups and relate it as a formal element closer to player experience. This is done by providing a model for analyzing power-ups and a case study of *Metroid Prime* to see how players' experience of a power-up can change during gameplay, and how the experience of the power-ups contribute to the way the player experiences the overall game. This will help us better understand what formal elements provide in relation to player experience in games in general.

PREVIOUS WORK

What are power-ups and how do we analyze them? In the following, I will review the formal descriptions I have found useful for discussing power-ups. Later I wish to expand on these formal approaches and relate them to player experience.

Consalvo and Dutton (2006) suggest game studies methodology keep track of all objects that can be "found, bought, stolen or created". Among the descriptions of such objects are some that might remind us of power-ups, though these descriptions don't address the nature of power-ups. They question whether objects are single or multi-use, what importance they have, if they have utility or not etc. Such questions can be interesting when thinking of power-ups as well, but here authors only relate them to what I would prefer to call *items*. A distinction has to be made, as power-ups can definitely inhabit a different character and pattern of placement and usage, for example as an integrated core mechanic and, from a design-perspective, as a reward to motivate play or a carefully timed tool for pacing and balancing. I will try to provide this distinction of which objects are power-ups and not later in the paper.

Squire et.al (2003) define the power-up as a basic convention of commercial games, "a device used in platform games to adjust some trait of the character or their worlds, such as shifts in player speed, height, or friction" (2003, 19).

They further specify these traits "of the characters or their worlds" into variables, attributes and actions:

> Players use power-ups to enhance their basic attributes; veteran players become adept at anticipating how particular power-ups affect possible actions. Educational designers can use power-ups and the subsequent choices they enable to get students to anticipate the consequences of different changes in variables. Power-ups can thus be a simple and effective trick to tie educational goals to the intrinsic motivational structures of games. (19)

It is worth noting here that Squire et al. reflect on the link between power-ups and change in player behavior, as in the example of the veteran players anticipating power-ups' changes to actions, and furthermore how to use this as a strategy for reaching an (educational) outcome.

Going from general to precise, a descriptive definition with examples can be found in Tracy Fullerton's book *Game Design Workshop* (2008):

> … [P]ower-ups … are generally objects that give a boost of some sort to the player. This boost can increase size, power, speed, wealth, or any number of game variables. Power-up objects are generally made scarce, so that finding them doesn't make the game too easy. Power-ups are also generally temporary, limited in number, available for only a short time, or useful only in certain game states. (75-76)

Power-ups are listed under the chapter section called "resources", which implies that they are something to be collected but also of a certain amount or availability. In the next part of the "resources"-section, she makes the distinction that some games allow players to "collect and manage game objects that are not power-ups or units", and names these objects "inventory" after how they are usually managed (Fullerton 2008, 76). All of this is useful for identifying power-ups, yet she leaves us with a definition without discussion.

Recognizing the wishes of many designers there *is* ongoing research into the ontology of games in the Game Ontology Project (GOP), for a vocabulary to use for game analysis (Zagal et al. 2005, 1). The purpose of this research is to "categorize things we *see* in games" (2, my emphasis). Zagal et al. briefly touch on power-ups in their article describing the top level of the ontology. One of the five top-level elements is "Entities" – "the objects that make up the reality of the game world" (8). The authors place power-ups among the entities of the game that can be manipulated. "Entity manipulation" is an action that can be performed by an in-game entity (thereby power-ups) as well as by the player (5).

Power-ups are explicitly used to exemplify the top-level element "Entity Manipulation" and also referenced indirectly where other "branches" in entity manipulation are described. Zagal et al. write that "entity manipulation consists of altering the attributes or abilities of game world entities" (8). Attributes are the properties of entities or abilities. Abilities are actions the entities are able to perform. These abilities can be gained permanently or temporarily. Being able to change like this, makes the entity a "dynamic entity" (not a "static" one, like "platforms … or *items/collectables*" (8, my emphasis)). In the text, different power-ups are used as examples of how *both* abilities and attributes can be altered. The authors emphasize that just what abilities and attributes are is fuzzy. Attributes and abilities affect each other. What determines the distinction is player choice: if it is not utilized through player choice, then it can be called an attribute, they write.

I have not found a comprehensive discussion of what a power-up is and how it could be studied. There is no agreement in the literature on a definition of a power-up and the term is often used without defining it. Entities and Entity Manipulation are what we can *see* in games, and we can study them as such when we know them as such. But what about what power-ups bring to the experience of the game, the aesthetic of the game – that aesthetic quality we know games provide as a whole and make people interested in playing them? How do we perform an aesthetic analysis of games? This is the question Aarseth (2003) asks.

Going further towards a more holistic way of formally looking at power-ups in games and the experience they provide, I take cues from Aarseth's (2003) suggestion for a methodological game research framework and the MDA-framework (Hunicke, LeBlanc, and Zubek 2004).

FRAMEWORKS FOR GAME RESEARCH

Inspired by Konzack's "seven layers" outline for a methodological framework for analyzing games, Aarseth (2003) offers a model that he argues can be used to describe almost any game in a virtual environment (2003, 2). His model consists of the following dimensions:

- Gameplay (the players' actions, strategies and motives)
- Game-structure (the rules of the game, including the simulation rules)
- Game-world (fictional content, topology/level design, textures etc.)

He recommends that researchers should pick those that fit best for the purposes of their research perspective, and remember that the combination is important as well (2003, 2-3). His interdependent dimensions have "different weight in different games" (3). In this paper I consider all the dimensions outlined by Aarseth together, supplemented by other theories reviewed. Aarseth emphasizes that game-rules always will to a degree dominate the experience in that the rules define what is possible in the virtual environment. On the other hand, "the game must take place inside a clearly defined gameworld" (2), or else only a "game skeleton" would be left (4). Hence I will use a "rules and world" approach to understand the play experience provided by power-ups, never forgetting their Gameplay dimension interdependencies.

As Aarseth does not delve into how to identify his Gameplay dimension, I turn to the MDA-framework (Hunicke, LeBlanc, and Zubek 2004) to look for what "aesthetic goals" the design is trying to accomplish for the player, which in turn the framework supposes is what the player "consumes" first (2). Gameplay can here be found at the intersection of player and system.

MDA: Mechanics-Dynamics-Aesthetics

In their article "MDA: A Formal Approach to Game Design and Game Research", Hunicke, LeBlanc, and Zubek (2004) present the Mechanics, Dynamics and Aesthetics (MDA) framework. The MDA-framework is a translation of the game components seen from the player perspective into design counterparts standing for the player's consumption and understanding of games as rules, system and "Fun" (consumed in the reverse order). "Fun" is here equated with aesthetic experience, and elaborated on in the paper (see below). By considering the aesthetic experience of the player, designers can "tune" the game mechanics and hence dynamics to alter or achieve the player experience

goal they set. Hunicke, LeBlanc, and Zubek suggest that when working with games, we can benefit from considering both the designer and player perspectives, to see how small changes can affect the whole. The components are lenses, which can be looked through separately, although they are causally linked (2) – reminiscent of Aarseth's framework (2003).

Although it is written from a more technical design outset, I want to test how the MDA framework can be used for identifying and analyzing the role of power-ups in player experience. By looking through the Aesthetic lens, stepping backwards, and looking at interdependencies, we can hopefully say something useful about what provides that experience.

As described above, the designer and player each have a different perspective: the designer looks in the direction of M-D-A while the player approaches the game first through an experience of it, the "A" - the "fun". "Fun" in this regard can be many things. The authors suggest a more directed "fun"[1] vocabulary of eight for describing the aesthetics components of a game:

1. Sensation (Game as sense-pleasure)
2. Fantasy (Game as make-believe)
3. Narrative (Game as drama)
4. Challenge (Game as obstacle course)
5. Fellowship (Game as social framework)
6. Discovery (Game as uncharted territory)
7. Expression (Game as self-discovery)
8. Submission (Game as pasttime)

In the MDA-framework, one kind of "Fun" is seen as an "aesthetic goal" from the designers' point of view, and a game can pursue multiple aesthetic goals, in varying degrees (2).

A player's aesthetic experience derives from her interaction with a system behaving according to a set of rules. These rules have their design counterparts in the Mechanics, written as code. It is these mechanics that afford the dynamics counterpart of the system behavior. Players can make different strategies based on the kind of dynamics in the system, like in Squire et al.'s (2003) example of players learning to anticipate power-ups' changes to actions. Now the "fun", the aesthetic experience, changes or intensifies when the player understands the dynamics, or when the dynamics are changed by the designer (by making changes to the mechanics).

An important thing to take away from Hunicke, LeBlanc, and Zubek is their description of mechanics as "the various actions, behaviors and control mechanisms afforded to the player within a game context. Together with the game's content (levels, assets and so on) the mechanics support overall gameplay dynamics" (3). I read this as rules and world *affording*[2] dynamics.

In this light, the design of power-ups (and their role or placement in the gameworld) and tweaking of these power-ups affect the resulting player experience. Furthermore, these

framework perspectives together are helpful for thinking about the experience that power-ups bring to gaming. As we'll see in the case of *Metroid Prime*, thinking about Aarsethian rules and world dependencies, power-ups are part of the rule set, the mechanics, used to overcome the topology of the world, the means to traverse that virtual environment.

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Utilizing the MDA-framework, I will look through its different lenses to look closer at *Metroid Prime*. I re-played *Metroid Prime* with these new "goggles", first using the Aesthetic-lens from my perspective as player to identify what player experience was provided. This meant playing while looking for the MDA taxonomy of "fun", the multiple aesthetic goals a design pursues, as well as paying attention to the degree they are pursued.

What does the power-up mean to the player at different gameplay moments? After identifying what I consider to be the different kinds of "fun" in *Metroid Prime*, I will step backwards towards the rules and game-structure; through the dynamics and mechanics, to find out how *Metroid Prime*'s aesthetic experience (the different kinds of "fun" identified) is provided through its power-ups. I'm not saying the entire experience is provided because of these power-ups. To be clear, I am arguing these power-ups *contribute* to the experience. I want to find out what they are - as "aestheticizers" – in other words, what power-ups some of the experience might derive from.

A CASE STUDY: PLAYING METROID PRIME

I have chosen *Metroid Prime* as a case study to explore power-ups using the concepts reviewed so far. The game is part of an acclaimed series, with a score of 97/100 on Metacritic (Metacritic 2011) and 96.30% on GameRankings (GameRankings 2011) known for its innovations at the time (a *first person* action-adventure platformer). The main reason I have chosen this game is that in retrospect, playing Metroid is structurally all about the power-ups. The quests are indirectly written around them or the power-ups are natural rewards that make sense in the context of enemy encounters and how the world is laid out. To overcome the hostile environment of the planet Tallon IV, interstellar bounty hunter Samus Aran needs aids to help her - aids that by the off chance perfectly fit her needs[3]. The pacing of the game, the availability of the game world, is governed by the power-ups and the abilities they provide and to get one power-up, you need another.

In the order of their emphasis, the aesthetic goals *I've* identified in *Metroid Prime* are Discovery, Challenge, and Sensation, while those of lower emphasis are Fantasy, Narrative (drama) and Submission (going for "100%" collection). Discovery is the main aesthetic goal in *Metroid Prime* and is set up through the environment and signification given in the game from the start. The following is a brief narrative account from my play-through.

Discovering the Quest for Power-ups

I start the game investigating a space station after receiving a distress call. It appears to be a recently evacuated Space Pirate research facility. The Space Pirates are always doing biological experiments on themselves and creatures and natural resources they find on other planets. This time they have found interest in the mystical Phazon liquid energy on

the planet Tallon IV, which is where Samus Aran goes after investigating the orbiting space station at the start of the game.

I am thrown into the game, gradually learning how the Scan Visor, Morph Ball and Grappling Hook work. Not all inventory is available at the beginning, although I have some different skills to inspect. The "????" labels in the inventory appeals to one's sense of discovery. What if this signification or the load screen's completeness indicator wasn't there?[4]

Beating the first boss causes the space station to collapse. I have to escape within a set time. An explosion sends me flying into a wall. Many parts of the Power Suit malfunctions – I am "reset" when I enter the big hub that is the Tallon IV planet's Overworld map.

When I get to Chozo Ruins, I am starting to get different negative feedback: "ordinary weapon cannot open this door". At a different place, I think "oh, I need the Morph Ball", upon seeing a small hole I cannot enter with my current size. So I start thinking as I go along: "I wonder what I get first? The Morph Ball or the weapon (Missile Launcher) to open the strong door?"

With the Scan-visor, I scan some treasures I've located because of the peculiar sound emanating from the power-ups when you're close. How do I get there? The scans don't say what they are, but they state "this object is on the end of a smooth ledge". I am puzzled. The other one says straight out it "cannot be accessed from this room".

I have gotten the Missile Launcher. Then in the next room I get an Energy Tank as well, upgrading my health by a 100! I am thrilled, but then the way forward is blocked – it requires the Morph Ball, as there is a single, visible hole in the wall in front of me. But I don't have the morph ball upgrade. I have to go back. But from memory now I know at least two places I can open with the missiles. And the first on my way is close to this narrow passage I saw on the map. Maybe the Morph ball is there?

It wasn't. It was the full level map, which also made me glad. We can see the world sets the stage for a lot of this anticipation and guessing. *Metroid Prime* is in a way a game about questing for power-ups – in order to overcome environmental constraints.

Creating the Power-up Experience

From here on I will discuss my play-through in greater detail related to the experience provided and relate it to how it was provided by stepping backwards through the game system as promised.

Interacting with the system changes the interaction possibilities in Metroid Prime. This is in fact how you *progress*. Through progression, old strategies get swapped or combined with new ones. Power-ups are integral to these dynamics in Metroid Prime, although seemingly indirect at first.

Jumping from ledge to ledge is enforced by the rule that regulates jump height. Many ledges cannot be reached with the normal jump, but when the jump mechanic is upgraded by obtaining the "Space Jump Boots", the dynamics change. This upgrade directly impacts on the ability to reach the aesthetic goal of Discovery. I will get back to this in a bit.

Save points address the *challenge of discovery*. Often I found myself lazily saving often, in fear of forgetting what I had explored if I were to die and have to restart from the last save. I am talking about forgetful events – you remember beating the last boss, but not necessarily how many missile expansions you've picked up. There are so many things to pick up that the route you took while exploring might have led you back and forth many times. If you had to play that part again ("now that you know the way") you might forget to pick up the things you found as a sub-set of your quest. There is a tense dynamic afforded in choosing between backtracking to the rare save points and pressing on.

You might have put it off as long as possible, but at some point, you have to go down into the Space Pirates Research Core. It is like you are being forced into the lab. Going down, down, passing containers of dangerous baby Metroids in the dark, bred by the space pirates! When you're going back up, the Metroids manage to break free and attack... Going down, knowing something bad was about to happen, you're already anxious about getting back up – but you now have an advantage. The suspense has been taken to another level, but will soon be relieved. You now have the power-up for the job, the "Thermal Visor". It's like you were forced to use it, as it's pitch black and you must get back up and out of there. Only a fool would try getting out without turning the visor on. At the top the power for the exit door is out and must be energized by a nearby power-source you can only see with the Thermal Visor. After this scenario, you constantly "check" the world with this visor to look for secrets. The later "X-Ray Visor" suggests this behavior to an even greater extent where transparent platforms or walls expands the world. All this time, there has been an extra invisible layer on top of the world you have gotten to know. Not only does the game world look different, the structure has changed, or at least your impression of it.

As in the example above, incidentally shutting the lights off and locking the doors until you've picked it up, many power-ups are "tested" in this way, "taught" after they've been acquired. Why is that? To make sure you *use* it. This usage implies not just going to B, knowing to turn on Visor X, and finding secret switch for getting past Y. The first play-through the player doesn't know yet where exactly to use the visors. She is free to look around, and learn the cues of the world, by searching every nook if she wants to; toying and experimenting with the power-up's abilities. This kind of search is a dynamic created by the rules and world, with the player's knowledge of a particular aesthetic goal of discovery at this point established in her mind. Although needed for completion of the game, this part of the discovery goal is bordering on paidia.

The main aesthetic goal identified here is that of Discovery. A dynamic model (Hunicke, LeBlanc, and Zubek 2004, 3) to create this would entail having both enticing hints and clear feedback; hints in the scenery and clear feedback from actions and objectives. Objectives in *Metroid Prime* are sometimes written suggestively, like "there is a nuclear irregularity in x" (a new power-up! But which one?) – and a check on your map is clearly indicated. On your way there you start anticipating what power-up it might be, and while it could seem it is the map that facilitates the Discovery in this example, the power-up is the indirect cause, as it is a goal and curiosity.

Many pick-ups seem optional in their non-obvious placement, but it pays off to be meticulous and curious, to do an extra round or backtrack, as bosses are harder without enough energy tanks for instance. The game *rewards* exploration; it doesn't simply depend on it.

To make Discovery *work*, the designers must have implemented mechanics that facilitate dynamics for "yearning" for discovery. An example (in addition to the example above about energy tanks, or being forced to either man up to a tougher *challenge* instead of "admitting defeat" and go searching for upgrades and return later), is through spatial cues – and through spatial cues that first become apparent after having learnt from the solution to a previous spatial problem. When seeing a ledge, you might at first dismiss it as being unreachable, then later learn that you get there easily with the "Space Jump Boots", and *then the next time around*, you come to *expect* some solution to a similar problem being offered by a similar power-up. This makes you attentive, searching for it, expecting it, wanting it, wondering about (what) it (is), and *treasuring* it when you finally get it – whatever *it* may be. Sometimes it's a surprise (as with me personally, when I found the Missile Launcher instead of "speed boots"[6] for example, then going "Oh, *now* I get it! I can use *this* to get to those places…"). The power-up as solution can be a stimulating reward – not only for your effort and expectancy, but also for your continued enthusiastic journeying.

From Discovery to Narrative (game as drama)

The game can give you an unsettling feeling of being alone, through finding the sad traces of an extinct race and discovering more and more of the barren land, stricken by a poison seeping out from its very core, tainting all remaining flora and fauna.

It was very interesting when I found the Chozo temple by chance. It was as if the designers counted on me trying out the Space Jump Boots right away after I got them. From my travels, I knew of other places where they would come in handy, but somehow I went right for the biggest reveal – making the discovery of the Space Jump Boots feel even more amazing. The Chozo temple is where you learn of the main objectives of the game, and the threat involved. You have to collect Chozo Artifacts hidden by the Chozo, to break the seal they made to secure the planet core menace, Metroid Prime. Additionaly the Space Pirates investigating the planet misunderstand the meaning of the Chozo Artifacts and write they will destroy them if they must. At this point I have already cleared the Chozo Ruins of toxic water, so I have sympathy for that world now. I feel I have to save it.

There are only vague indications of the locations of the quest "Chozo Artifacts", so I just have to search for them. This entices Discovery and Narrative, but is not motivated as finding power-ups. On the other hand, the story mechanism for seeking goals and rewards are fulfilled by using the power-ups to get there.

Influencing Dynamics

I have now talked about the experience I had when playing Metroid Prime, articulated with the MDA-vocabulary. This experience has furthermore been discussed in the light of the mechanics and dynamics it was a result of. In the following, I am going to look at possible tweaking of the dynamics provided by power-ups to highlight how this could affect the player experience.

Decreasing the pick-ups gained from fighting enemies in *Metroid Prime* is a possible tweak that would strengthen Challenge. Making them scarcer like this and perhaps turning off the pick-ups' effects or making them temporary, would make the player save and use them more strategically. This is already implemented with the different missiles. And sometimes, things temporarily malfunction. Like with the beginning of *Metroid Prime* when you have it all, and then lose it. This is good for creating a dramatic effect,

and the yearning for finding it again, as mentioned earlier. I mentioned the missiles. What if they were infinite? What if you never lost everything? Not only would Challenge be severely crippled – the whole incentive to explore might be jeopardized, or would have to be replaced by something else. There are the static "Chozo Artifacts" you must collect, and the information to scan – but this is only a third of the discovery in Metroid. The upgrades are the second third. The last third is exactly the world, architecture, landscapes, topologies and vistas you are rewarded with during your search for these collectables and power-ups – indeed provided by the power-ups as they open the way forward. This third is cheating a bit, as this reward belongs to Sensation (game as sense-pleasure). But this reward is gained through using the power-ups. In this sense, it is tempting to say power-ups are the main ergodic tool for non-trivial traversal of *Metroid Prime* (Aarseth 1997).

The designer can add or remove power-ups or obstacles in the game, or tweak attributes of the existing ones. These are quantitative changes. What about qualitative changes? Each power-up feature affects the system balance, changing the possibility space. It's like adding one more to the "power" of the mechanics. Imagine a flying mode or a dig tunnels and holes power-up. Furthermore, a power-up could yield different results if its *type* was changed (see table 1, discussed later).

To conclude this subsection, game design changes to dynamics affect different kinds of player experience, and when these are identified beforehand, the designers can intentionally *direct* player experience. This shows how malleable, yet fragile, player experience is. Small tweaks at this stage of the game can have a huge impact (which is why a big part of professional game developers invest in a lot of *play testing* to make sure the correct aesthetic goals are reached).

Players on the other hand can learn and appropriate mechanics and maybe find or invent new uses, strategies, dynamics in their quest for for example (more) discovery or challenge – or maybe for some "fun" that wasn't there?

Power-ups as Enablers

In *Metroid Prime*, I say power-ups are the *enablers* of reaching goals. But they are also the goals themselves most of the time! One power-up is of course not an enabler of a goal and that same goal at the same time; you can't need space jump boots to get the space jump boots.

To elaborate, here a power-up goes from being an enabler, to being a goal/objective – a visible entity in the world, before pick-up. Then it is visible in actions, in the HUD, Inventory and in the changed appearance of Samus Aran. Furthermore, it is also visible extended indirectly in the *outcome* of the *actions* it makes for.

There is something between the above as well. In that moment of pick-up, power-ups are rewards; a confirmation of their acquirement is output to screen with a description of their value, making you happy – giving you the feeling of accomplishment. It is more than just a "checkpoint".

The power-up changes meaning for the player in different gameplay moments. It changes character related to player experience, necessarily related to the context of where they are in the game. In figure 1 I have attempted to illustrate this multi-faceted transformation in experiential effect power-ups in *Metroid Prime* go through:

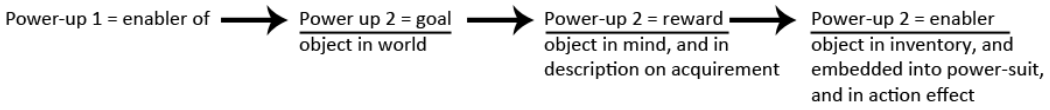

Figure 1: The changing experiential nature of the power-up through game states in *Metroid Prime*.

As we can see, the power-up changes in aesthetic nature, purpose and role depending on the game state. It can go from being a perceivable ontological object and have a role as goal, to being a gratification device, to being usable artifact with impact on the gameworld. They are "tools to get new tools" – at the same time as they are goals and rewards. They are rewarding because the player *knows* they have use value.

To conclude this subsection, power-ups are *malleable design elements* in two ways. They can be repurposed in any game, for different aesthetic goals, but at the same time they point at a specific overall use, manifested in games like *Metroid Prime*. They change their nature through changes in game state. They are both "tools to get new tools" – and goals and rewards.

DISCUSSION

After studying *Metroid Prime*, it becomes apparent that some matters should be investigated further. Power-ups can be analyzed as affordances, and as hyper-ludic elements of games. These have their effects on player experience, such as offering paidia play.

Affordances

Power-ups can be upgrades to existing mechanics, or introduce entirely new mechanics like a new tool or weapon. Formally we can place mechanics under Aarseth's *game rules*. Using the MDA framework we can see how these in turn form the basis for dynamics and the player's aesthetic experience. If we see them as rules, we can also refer to their *affordances*:

> The rules of a game ... *set up potential actions*, actions that are meaningful inside the game but meaningless outside. … Rules specify *limitations* and *affordances*. They prohibit players from performing actions … but they also add meaning to the allowed actions and this *affords* players meaningful actions that were not otherwise available; rules give games *structure*" (Juul, 2005, p.58, emphasis in original).

Power-ups as such can be seen as affordances, that affords new affordances. They are affordances themselves, scattered around the game, to upgrade the affordances of the game.

Hyper-ludicity

Steven Conway (2010) writes that effectance (on the world) is one of the big motivations for gaming. In games like *Metroid Prime*, every power-up provides a new way to affect the world. Investigating the pleasure of playing digital games, Conway found that varying effectance – increasing or limiting players' effect within a game - was a primary role of their enjoyment. He introduces the terms "hyper-ludicity (above, beyond usual play)" and "contra-ludicity (less, resisting usual play) to clearly communicate the current state of the game's fluctuating ludic system" (2010, "Introduction", para. 4). An example of hyper-

ludicity is power pellets in *Pac-Man*, where the tables turn as *you* for a short while can eat the ghosts. Hyper-ludic features also often include a heightened audio-visual signification, intensified representation and feedback, as is the case with both eating the power-pellets in *Pac-Man* and going into Hyper-mode in *Metroid Prime*, which enables the Phazon Beam. Instead of short-termed hyper-ludic boosts like this, most power-ups in *Metroid Prime* usually last (they are permanent upgrades), and have a world-traversal mechanic imbued in them as their not sole, but main purpose.

When looking at the game as a whole, *Metroid Prime* can be considered in terms of Conway's analysis of what he calls RPG's item-based hyper-ludic structure, where it begins in a state of contra-ludicity[7], stocking up on power-ups to be able to complete it: "[In many RPG's] the task of the user is to overcome these opening difficulties so that they may find the numerous items within the gameworld that provide them with the hyper-ludicity to face the challenge of the ludic system" (2010, “Hyper-Ludicity, Contra-Ludicity & The One Ring”, para. 3). In light of this I would argue power-ups are mechanics that are added, or contingent mechanics, and not among the core starting mechanics.

Power-ups Providing Paidia

In *Mega Man 2*, you also start out in a contra-ludic state. If you know the suggested order of the levels to beat the game most efficiently[8] you reach the hyper-ludic state faster in a more linear fashion. If not, some levels and boss fights might throw you back into struggle, with less-effective upgrades. The player looking for a challenge could do the levels in reverse or random order. In this sense, the contra-ludic game system as a whole can inspire paidia play, not only its hyper-ludic elements.

The upgrades in *Metroid Prime* can also offer paidia play. The Morph Ball can be played with in the environment, and one often experiments in trying to get to places with what you already have at hand even though you know you might not have what's needed (or you will come to realize this after some attempts) plus you sometimes just have a hunch there is something there. Exploration of this kind is indirectly encouraged by the the perceived affordances the power-ups give. The missiles are mainly used for opening shielded doors or special wall material, but you can choose to use them in different combinations on enemies, and try to blow up everything that looks peculiar. A balance has to be found between paidia like this and the ludus of the game by the player, as some doors and enemies might require those very missiles to be overcome. Spending all your missiles can get you into trouble. This is where one might say the contra-ludicity sets in, constraining your actions: now your new goal is to stock up again on missiles. Here we see dynamics at work.

A MODEL FOR ANALYZING POWER-UPS

Recalling my earlier review, I consider power-up as Entity with its related Manipulation something that goes well with Squire et al.(2003)’s “device for adjusting traits (attributes)”. It clarifies others' approach to it as object or resource (Consalvo and Dutton 2006; Fullerton 2008), and whether we are talking about an attribute of a static or dynamic entity or its abilities, gained temporarily or permanently.

Special items are often mentioned together with power-ups. In Consalvo and Dutton (2006), they don't seem to differ, or power-ups are not mentioned as a possible differentiation. There is a difference, though. While most power-ups take form of a collectable, visual item on screen, they are seldom just something to expend from the

inventory screen. The expendable power-ups usually resurface in the game, like a shield in a shoot-em up. I would classify these right next to the expendable inventory item, as instant-use, expendable (but resurfacing) power-ups. On the other side of the scale is the "re-chargeable" power-up (see below).

For the model proposed below, I have included the expendable inventory item as well as sorting the "odd power-ups" that might impact on the world or gameplay in a larger way without usually being seen as a power-up or upgrade. This is good for comparison and the other categories are strengthened by the odd one out.

The formal findings so far can be seen summarized in table 1:

Type:	**Expendable, stored** as inventory. Triggered by choice after acquirement.	**Expendable, instant** power-up (might resurface). Triggered on touch.	**Constant** (The "upgrade")	**Re-chargeable** (like constant, but needs other (inventory type) items to be refilled.
Example:	Potions (restores health) or Speed Drink (casts Haste) in *Final Fantasy VII* (Square, 1997)	Star Power in *Super Mario Bros*.	Space Jump Boots in *Metroid Prime*	Missile Launcher in *Metroid Prime*.
Modifiers:	"*Acquired through*": E.g.: Charge, purchase, level up, pick-up (visible or secret) vs. automatic (dominant system). In the latter case, see "*Necessity*".			
	"*Supply*": limited in numbers, or limited to time frames, vs. resurfacing at intervals. Applies to all but the "constant" (with exceptions in special cases, like in *Metroid Prime* where constant upgrades are removed once, to later be won back).			
	"*Duration*": lasts a set or variable amount of time.			
	"*Necessity*": necessary for completion, vs. optional, or permanently changing from necessary to optional at some point.			

Table 1: A model for analyzing power-ups

We can see from the categorization above that several categories of power-up can enable the same aesthetic goals: Discovery of high areas requires the constant upgrade Space Jump Boots, giving you the skill to double jump, while the ability to blow up different materials to progress depends on whether they require the re-chargeable constant super missile blast (consuming 5 missiles), or a common Morph Power Bomb (two constant upgrades).

These are just examples, the power-up determinants could be shifted around in any game, for example having double jump be an expendable or re-chargeable. Further research could be done validating this model, featuring a more extensive study and categorization of games using this model, perhaps together within a larger typological framework.

In *Metroid Prime* there are no one-time-only items, other than those you re-fill your re-chargable power-ups with. Since there is no inventory list screen in *Metroid Prime*, putting these re-fill items under "expendable" is problematic. These refills work instantly as you touch them in the environment, so there is no choice when to use them from a bag

of tricks, other than timing when to “touch them” in the gameworld. Regardless, at touch they are not used on the world – just instantly added to your ammo count or health meter. Perhaps these could instead be seen as a sub-class of the Re-chargeable instead. But they are certainly expendable, and belong there.

In some games there are also non-expendable inventory items for you to collect, without any effect on any trait. These do not fit inside the model, and cannot be seen as power-ups.

~

At the beginning of this paper I mentioned some examples of power-ups and their use from some other games. Now that we know more, let’s return to them and see while still just being referred to as “power-ups” how interesting and different they seem when we take the preceding considerations and discussions into account:

The starpower in *Super Mario Bros*. works for a short time – it speeds you up and makes you invincible and deadly. There is not much choice about when to use it, only in whether to use it or not. It is “activated” after touching the star after it is found hidden in “?”-boxes in the gameworld.

You decide when to use Rage of the Gods in *God of War*, after you've gained and charged it. It is temporary and must be re-charged. When you use it, you take less damage, you hit much harder, and some special attacks become available in this mode – later in the game after you've leveled certain objects.

Phazon Beam/Hyper Mode in *Metroid Prime* is necessary for being able to kill the final boss andcomplete the game. The Phazon Beam only works when Samus stands in a pool of liquid phazon which is dropped by the boss at intervals. It is scarce – it is used up, and you must wait for a new pool of phazon to be able to use it again.

All three examples change the appearance of the avatar to seem empowered as well as empowering the user, and can be seen as hyper-ludic states, or “boosts” as Fullerton calls it (2008, 75). They are different in duration and their availability depends on certain requirements. They are acquired in different ways, while some are necessary for playing the game, some not.

CONCLUSION

In this paper I have looked at different approaches to the formal elements of digital games commonly known as “power-ups”, and attempted to synthesize these into one model, differentiating them from other elements, so that we can further study power-ups in games. I reviewed previous descriptions of power-ups in an effort to have a clearer sense of the object of study while attempting to relate power-ups to player experience. The aesthetic experience provided through power-ups in the game *Metroid Prime* was analyzed and discussed within a framework based on Aarseth (2003) and Hunicke, LeBlanc, and Zubek’s MDA framework (2004). In *Metroid Prime*, different kinds of aesthetic experience such as Discovery, Challenge, Sensation, and Narrative (drama) were provided by power-ups in different ways. The power-ups discussed here were found to change in ontology, purpose, meaning and effect, exemplified in a model of power-up role change during game states. I have argued that power-ups impact on the player experience, and changes to power-ups in turn impact on that experience. As the MDA-

framework suggests, designers can tweak the dynamics by altering mechanics to reach aesthetic goals in their design. A mention of other games and how comparable yet different power-ups were implemented in these was also provided. For the benefit of further work, both models can be used to inspect and compare other games to better be able to compare them and further increase our understanding of games' formal elements, and, their impact on player experience.

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ENDNOTES

[1] For the purposes of this paper, I am not going to debate any of the approaches to "what is fun", just acknowledge that my subjective notions of fun and understanding of what the MDA framework's authors implied with their model are relative.

[2] Based on not only environment, but the actors background, "affordances 'suggest' how an object may be interacted with», according to Donald Norman. Instead of meaning 'to provide' or 'to make available', today, designers often use *afford* as meaning "to 'suggest' or 'to invite'". Source: Wikipedia contributors. 2011. "Affordance". *Wikipedia, The Free Encyclopedia*. Accessed August 7. http://en.wikipedia.org/w/index.php?title=Affordance&oldid=434433899

[3] Quite literally - the planet has several small tunnels where only the Morph Ball can get through. It is explained that the extinct «Chozo»-inhabitants on Tallon IV foresaw her coming, and left upgrades around the world for her power suit.

[4] This hints at more possible upgrades, and you quickly learn to appreciate those you already have – which will soon be ripped away from you, making you miss them.

[6] There are no "speed boots" in *Metroid Prime* – this is just a made up example of how we after a while can start imagining what could be given next to solve the spatial puzzle.

[7] As mentioned, after the player has been given a sneak peek into the hyper-ludic possibilities in *Metroid Prime*, many of the powers in Samus Aran's power suit malfunctions at the end of the first scenario as you escape the self-destructing enemy space station.

[8] Each boss has a weakness – the gun you obtain from defeating another boss.