# Good Game Feel: An Empirically Grounded Framework for Juicy Design

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## ABSTRACT
Juicy design refers to the idea that large amounts of audiovisual feedback contribute to a positive player experience. While the concept is popular in the game design community, definitions of the concept remain vague, and it is difficult to analyze which elements contribute to whether a game is perceived as juicy. In this paper, we address this issue through a combination of industry perspectives and academic analysis to provide a more detailed understanding of contributors to *juicy design*. We present results from an online survey that received responses from 17 game developers, and create an affinity diagram to derive a framework that facilitates the analysis of juicy design rooted in developers' perspectives. Through application to two commercially available games, we refine the framework, and contribute a tool that makes the idea of juiciness actionable for researchers and designers.

## Keywords
Juiciness, Game feel, Design, Framework

## INTRODUCTION
Juicy design refers to the idea that large amounts of audiovisual feedback contribute to a positive player experience (Gabler, 2005.; Jonasson 2012), and there is anecdotal evidence that some of its elements can contribute to positive player experience and continued engagement (e.g., Gerling et al., 2013; Vanden Abeele et al., 2015). However, while the concept is popular in academic game design communities (e.g., Deterding et al., 2015; Schell, 2014) and frequently referred to by industry representatives as a means of creating engaging experiences (e.g., Jonasson et al., 2012: "*[..]the juicier your game is, the more fun it will be to play"*), definitions remain vague (e.g., juicy design needing to evoke a 'visceral' feeling in the player; Brown, 2013), and design advice suggests that developers need to have an intuitive understanding of what constitutes juicy feedback (e.g., Deterding et al., 2015: "*Is there a material or creature whose sensual properties might inspire your feedback?*"). Therefore, it remains difficult to understand which elements of a game contribute to *juiciness*, and how exactly feedback needs to be constructed to be perceived as *juicy*, with a first exploratory academic study by Juul and Begy (2016) returning null results when comparing a 'juicy' and 'non-juicy' tile matching game. In this paper, we address this

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issue through a combination of industry perspectives and academic analysis to provide a more detailed understanding of contributors to *juicy design*. We present results from an online survey on *juicy design* and *game feel* that received responses from 17 game developers. Through creation of an affinity diagram, we derive a framework that facilitates the analysis of juicy design rooted in developers' perspectives, and we refine the framework through application to two examples of commercially available games commonly considered *juicy*, the casual game *Candy Crush Saga* (King, 2012), and the independent game *Downwell* (Fumoto, 2015) Thereby, we provide a tangible perspective on juiciness in games, and contribute a tool for the academic analysis of *juicy design* that makes the concept actionable for researchers and designers. We further discuss implications of developers' perspectives on juicy design, and reflect upon the idea of *juiciness* and good *game feel* from an academic perspective.

## BACKGROUND

Here, we give an overview of previous work exploring juicy design or *juiciness*, game feel, and feedback in games.

### Juiciness and Game Feel

Juiciness refers to large amounts of visual and audio feedback that games can provide to players in order to induce a positive player experience (Gabler, 2005.; Jonasson 2012). For example, *Peggle* (PopCap, 2007) rewards the player with music, ascending tones and, particle effects when completing a level, thereby reinforcing the notion that the player is successfully progressing through the game. Studying juiciness from an academic perspective, Juul's definition of the term primarily focuses on abundant positive feedback (2009). In contrast, Swink (2009) argues that both negative and positive feedback need to be considered, and draws attention to the immediacy and abundance of feedback as a core aspect contributing to a game being perceived as juicy. Brown describes juiciness as a 'visceral feeling' that gives the user a satisfaction (2013). The importance of feedback to player actions has also been linked to a key attribute for successful games (Morris, 2003). When interviewing game designers, Hagen (2011) found they frequently used the term 'juicy' to describe the sensuous feeling they were trying to achieve.

This evidences that the concept of juiciness is often used to reflect on games; however, all definitions remain vague and do not lend themselves to detailed analysis or development. Addressing this issue from a theoretical perspective, Schell (2014) proposed the 'Lens of Juiciness' that can be used to explore whether a game interface is juicy. To this end, the lens of juiciness asks if a game is giving continuous feedback to the player for their actions and are the results of those actions rewarding. Deterding et al. (2015) used an adapted version of this lens to support gameful design, which picks up on important aspects of juicy design (e.g., the sensuous nature of juiciness, its impact on perceived competence among players, and some tangible design advice such as the careful exaggeration of feedback), but remains vague in core areas (i.e., suggests examples of sensuous experiences in the real world to inspire sensuous game design, but does not provide tangible insights into the *sensuous* dimension itself).

From an industry perspective, game designers have previously discussed the usefulness of the term (e.g., Whitkin, 2014), while industry postmortems reflect on the implementation and effects of adding juiciness to games (LeRey, 2014). This industry discourse on juiciness places a strong emphasis on the overall polished aesthetics of the game (Nijman, 2013), which has also been explored in non-gaming settings in academia (e.g., Hassenzahl, 2008, 2010). Further, numerous game designers have presented how they perceive and design for juiciness, for example with Nijman (2013) detailing the juicy elements (e.g., slow motion to place emphasis on action and environmental permanence) that he frequently used in his games. Jonasson and Purho

(2012) also detailed a list of juicy elements they assume creates great feeling and juicy games (e.g., everything reacts to the player and adding sound effects with lots of bass). This theme is also reflected in further industry sources (e.g., Núñez 2015.; LeRay, 2016.; Loeschen, 2017), all commenting on the importance of juicy design and outlining specific elements, but often remaining vague at crucial points (e.g., "*Add weight to actions*"), leaving room for a more structured academic perspective that facilitates further, more detailed analysis of juicy design.

Finally, the concept of *game feel* frequently emerges in discourse on juiciness, suggesting that juicy design can contribute to good game feel (Swink, 2009). According to Swink (2009), positive game feel is associated with seven aspects: (1) Predictable results that allow a sense of mastery and control by correctly and consistently interpreting player input. (2) Novelty that engages the player over time. (3) Good feedback enabling mastery, control, and learning by rewarding player experimentation. (4) A low skill floor, high skill ceiling should be present to maintain short- and long-term engagement. (5) Actions should have context that facilitates meaningful game mechanics. (6) Impact and satisfying resolution which defines the weight and size of objects through their interaction with each other and the environment. (7) Appealing reaction producing appealing reaction regardless of context or input. Some of these elements share characteristics with the current definition of juiciness: For example, predictable results are fostered through abundant feedback to actions that makes an action chain easy to understand; additionally, juicy feedback contributes to creation of weight and impact in objects and actions.

## Feedback in Games

An area that is inherently linked to the idea of juicy design is the element of feedback in games, i.e. the information that the player receives about their input, and changes in game state. Feedback can be audio, visual, haptic, or a combination thereof; feedback elements are important to improve player experience (Fullerton, 2014). Beyond establishing that feedback to player actions is established a crucial element of successful games (Reeves, 2010), existing work has explored how variances in feedback affect player performance and experience. For example, in an exergaming setting Lamoth (2012) found that participants performed better when given explicit visual feedback on performance, looking at educational games Erhel (2013) found that regular performance feedback increases learning, and in the context of persuasive games feedback plays a vital role in facilitating behavior change (Bång 2009).

Numerous lenses, frameworks, and heuristics exist that seek to categorize and explain the nature of feedback in games. For example, Schell proposed several lenses that address the nature and design of feedback in games. The *Lens of Feedback* raises questions about how feedback on the game state is delivered to the player, e.g., "*What do players need to know at this moment?*" (Schell, 2014). The lens also focuses on what the player should feel at any given moment, challenging designers to consider what feedback will help elicit the intended feelings. Further addressing the nature of feedback, Deterding (2015) presented design lenses that detail different characteristics of feedback to elicit a positive player experience, e.g., surprising, immediate and varied. Among others, Dersurvire's PLAY heuristics (2009) contain a category devoted to the nature of feedback, proposing a focus on consistent and immediate feedback to player actions while also highlighting that feedback should be simultaneously delivered on different feedback channels, e.g., audiovisual.

In our work, we address the intangible nature of juicy design by exploring its relationship with feedback through an online survey that incorporates game developers' perspectives on juiciness and game feel. Drawing from their responses, we derive a

framework of juicy design that offers a refined perspective on juiciness, and can be applied by researchers and designers wishing to analyze this feature of games.

## AN ONLINE SURVEY TO INVESTIGATE GAME DEVELOPERS' PERSPECTIVES ON JUICINESS AND GAME FEEL

Here, we report findings from an in-depth online questionnaire exploring the concepts game feel and juiciness. We recruited participants through Twitter and game development communities such as the Steam developer portal and the *gamedev* subreddit, and received 17 responses (mean age 29, 11 male) from developers that work in a professional, game design-related role.

### Questionnaire

The questionnaire was designed to explore how developers understand and design for game feel and juiciness, with two separate elements of the questionnaire addressing each of the constructs. The questionnaire took around 30 minutes to complete.

#### *Juiciness*

This section of the questionnaire asked respondents about their understanding of juiciness, and what effect they felt it had on player experience. To support game developers previously not familiar with the idea of juicy design, we further provided definitions of juicy effects derived from industry talks (e.g., Nijman, 2013) and a short description of juiciness based on Juul's work (2009) Additionally, we supplied two animated GIFs that visualized a cube character attacking another cube without (Figure 1) and with juicy effects (Figure 2) in line with these definitions. Follow-up questions included an exploration of the impact of juiciness on player experience, and we asked respondents to give examples of games and game elements they considered juicy.

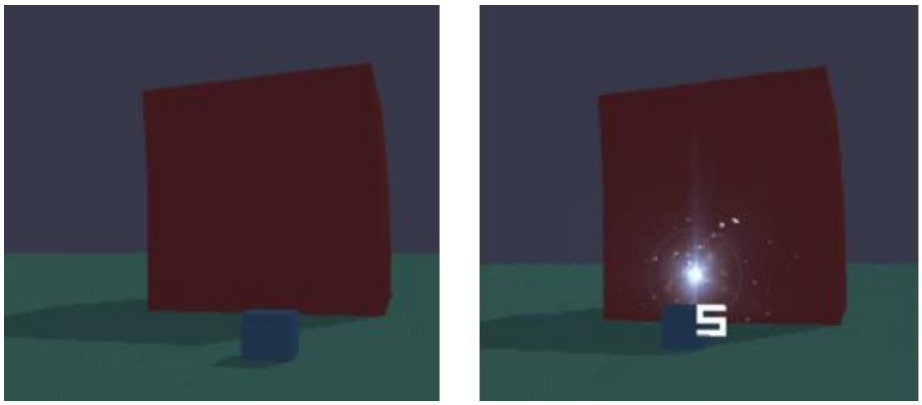

**Figure 1 (Left).** A Cube attacking another cube with no effects. **Figure 2 (right).** The same attacking cube but with seveal 'juicy' effects.

#### *Game Feel*

This section of the questionnaire was devoted to exploring developers' perspectives of game feel. Similar to juiciness, we asked respondents to give their own definition of game feel, and then explored which game mechanics and further elements foster a positive and/or negative game feel. Finally, we asked respondents to give examples of games they considered to provide positive game feel.

### Data Analysis

Questionnaire responses were very broad while also providing a high level of detail. We therefore opted for analysis through creation of an affinity diagram that allows us to organize and connect ideas shared through different responses: Affinity diagrams (Holtzblatt, 2004) facilitate categorization of independent responses into groups that

share topics, and have previously been used within the DiGRA community as a tool for analysis of open ended responses (Ho, 2015). The initial analysis was carried out by two researchers. First, all responses were broken down into sentences, and each sentence was written down on a post-it note. These notes were displayed for analysis; each note was discussed and given a category based on the idea it represented. Once a few notes were assigned categories, we initiated a grouping process into existing categories. New categories were created for notes that did not clearly fit into existing ones. Some notes contained several ideas and were broken down further to represent each thought and then placed in their respective categories. After initial sorting, we refined the resulting affinity diagram by rearranging notes where necessary, and then began to explore potential connections between groups. We finalized the affinity diagram with a three-tier structure, the higher tiers relating to more high-level topics. Figure 3 provides an overview of the final affinity diagram.

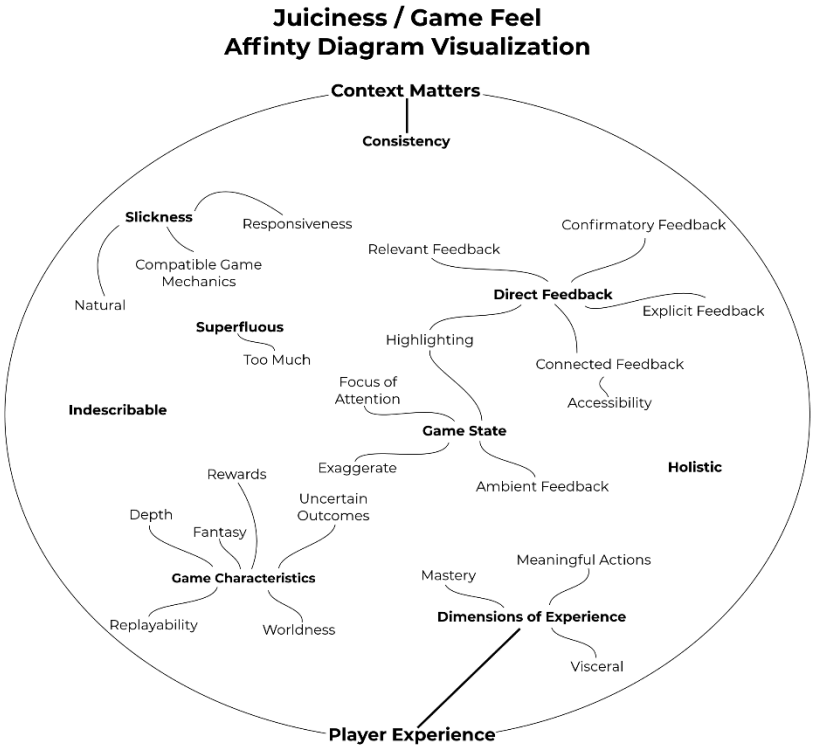


**Figure 3.** An overview of the final affinity diagram structure

## Results

The results of the affinity diagram reveal that game concepts and elements that create good feeling games frequently overlap with what designers also consider juicy characteristics. Designers placed emphasis on how juicy design can affect the player experience. Also revealed was the importance of using juiciness to convey the state of the game using different aspects such as ambient and unambiguous feedback. Lastly responses covered the difficult task of making all elements of the game cohesive making actions and feedback complement each other whilst also feeling believable in the game context. Here, we detail some of the more nuanced categories that emerged from the affinity diagram.

### *1. Contextualised Experiences (First Tier)*

This perhaps surprising overarching category was repeatedly referred to in participant responses, and highlights the importance of integration of all game elements (e.g., core mechanics, feedback, and overall design of the game) into an overall context, including those that would contribute to juiciness and a positive game feel. Participants highlighted the importance of *how* these elements are used in the context of the genre (e.g. "*The usage also needs to match the game type*"). Depending on the nature of the game, some game elements were considered to have a detrimental effect on game feel (e.g., reflecting the mood of the game), although participants also expressed that some aspects are similar across games. The importance of this category is that it governs all of the other emerging sub-categories in that the integration of all elements of a game into a coherent, contextualized experience is key to consider for designers.

### *1.1 Player Experience (Second Tier)*

The player experience category summarises how player experience is influenced by different aspects of juicy design, and how player reflection on game content can contribute to a game being perceived as juicy. It includes the sub-categories *Game Characteristics* and *Dimensions of Experience*.

### *1.1.1 Game Characteristics (Third Tier)*

This category summarizes basic characteristics of game elements (and thereby the resulting game) that developers thought to contribute to a positive player experience (see Table 1). For example, developers expressed how game elements need to provide consistent feedback to player actions, and that juiciness (in this case the amount of feedback) should help the player understand their actions, with one respondent stating that "*You should be able to estimate from the juiciness of each action the utility of that action*". This consistency also extends to other game elements, i.e., providing a consistent, believable game world that contributes to a positive player experience. Further emerging from the diagram was the idea that the game needs to offer incentives for replayability through either mechanics that lend themselves to repeated interaction, or by supporting different styles of play. This ties into the concept of uncertain outcomes that was present in this category: while the game should be consistent in general, it should also provide the opportunity for uncertain outcomes that induce curiosity and encourage repeat engagement, e.g., random loot in a Diablo game. Other game characteristics that were mentioned by developers as contributors to juicy design include the learning curve, with one developer stating that games need to be "*easy to learn but [have] a high skill ceiling*".

*Table 1. Overview of the game characteristics most commonly brought up by developers in the context of juicy design and good game feel.*

| **Game Characteristics** | Features (elements) that contribute to player experience. |
|---|---|
| Consistency | Game elements need to behave consistently with expectations |
| Worldness | Consistent game world with elements that foster believability (not necessarily realism) |
| Replayability | The game includes elements that lend themselves to replayability making the game fun to play multiple times |
| Rewards | Responses to player actions should foster sense of reward |
| Uncertain Outcomes | Player actions should have uncertain outcomes outside of the players control when adequate |
| Learning Curve | Game mechanics should be simple to learn but hard to master |

### *1.1.2 Dimensions of Experience (Third Tier)*

This category summarizes different dimensions of experience that can emerge from play (Table 2), i.e., experiences that can be *designed for* through the interplay of different characteristics (1.1.1), and that developers thought were integral to good game feel. This includes opportunity for visceral responses that games can trigger through feedback and certain game elements. For example, one respondent suggested that "*speed, power, sex, pain, chaos*" would contribute to such a response. Further, the sense of mastery that a game can provide need to be considered; in this context an emphasis was placed on fine tuning and balancing game elements to facilitate this experience. In this context, developers thought that some game elements can contribute to the player not only experiencing mastery but also finding meaning in their actions: Games should provide the player with the possibility of having both meaningful inputs and meaningful choices e.g. "*Feedback of the results of player actions is gradual but meaningful*". However, they did not elaborate how meaningfulness could be communicated. Developers also focuses on the fantasy fulfillment that can be provided, through the pleasurable nature of a games reactions for example crashing a car and seeing the explosive chain reaction.

*Table 2. Overview of the dimensions of experience that emerge through play most commonly brought up by developers in the context of juicy design and good game feel.*

| **Dimensions of Experience** | Emerge through engagement with a game, are *designed for* |
|---|---|
| Visceral | The impact of game elements on 'visceral emotions', intuitive and immediate player responses to game content |
| Fantasy | A game should facilitate achievement of a player's fantasy goals |
| Mastery | Feelings of mastery and competence should be facilitated through choice of games elements and feedback |
| Meaningful Actions | Player actions need to be meaningful within game world |

### *1.2 Game State (Second Tier)*

This category contains responses that relate to how the current state of the game is communicated to the player through different game elements. Most prominently, the provision of exaggerated feedback emerged as a key strategy to effectively communicate changes in game state, with one responding commenting that "*If you're going at max speed the ball deforms slightly"*. However, developers also outlined that "*Juice should be used to direct the players attention, not divide it"*, suggesting that it can be a means of focusing players on relevant game elements and needs to be applied to game elements strategically as to not overwhelm the player. This goes along with the idea of using game elements that highlight other relevant aspects of the game *without* drawing the full attention of the player. Finally, ambient cues describe a type of feedback that provides subtle cues without explicit input, thereby informing players that the game world is still live even in idle states, e.g., trees swaying in the wind. In this context, developers pointed out that juicy design "*should be about creating useful feedback that naturally tells the player about what's going on*".

*Table 3. Ways of communicating game state most commonly brought up by developers in the context of juicy design and good game feel.*

| **Game State** | The importance of game elements feeding back to the player the state of the game |
|---|---|
| Exaggerate | To effectively inform the player of the state of the game reactive elements should be exaggerated to more effectively show how |

| | |
|---|---|
| | the state has changed |
| Focus of Attention | Feedback elements can be used to direct the player to critical game state information which guides the attention of the player |
| Highlighting | Feedback elements that highlight game state information are important |
| Ambient Cues | Considers the importance of feedback that is received by the player without input |

### *1.3 Direct Feedback (Second Tier)*

In contrast to feedback that is provided to communicate the game state, the concept of direct feedback emerged as a separate category of feedback given in direct response to player actions. Most importantly, confirmatory feedback "*[…] to physical actions such as moving a controller or pressing a button"* helps to create a responsive experience; one designer commented that "*When the player presses input to engage the action, the juice makes the action feel impactful and meaningful".* This relates to the concept of multimodal feedback, where multiple communication channels are chosen to convey information. For example, the player pressing the jump button is accompanied by the sound, visual and, in some cases haptic effects at the same time. Respondents expressed how important it was for feedback to be given to the player in multiple ways simultaneously "*Every action that the player can take is accompanied by animation, sound, special effects*". Along these lines, respondents mentioned integration of multimodal feedback as an accessibility feature, e.g., "*hard of hearing players will require strong visual feedback, and sight impaired will require audio feedback*". Further specifying direct feedback, a recurring element was that juicy feedback needs to be relevant in the context of the player's actions, and that it should provide cues to help players understand game mechanics. Likewise, developers discussed the importance of explicit feedback without need for interpretation that is applied in critical situations, as for example implemented through non-diegetic interface elements that provide numerical information on the state of the player.

*Table 4. Categories of direct feedback that developers consider to support juicy design.*

| **Direct Feedback** | The differing types of direct feedback that the player receives |
|---|---|
| Confirmatory Feedback | Direct reaction to an input from the player which contributes to the game feeling good |
| Multimodal Feedback | Multiple feedback elements are present for any one thing at a point in time |
| Relevant Feedback | Feedback elements are relevant in the context of the action the player has performed |
| Explicit Feedback | Feedback should exist that is explicit in nature and requires no interpretation of meaning |
| Feedback to Improve Accessibility | Extra feedback can improve the accessibility through making game information understandable when missing feedback elements |

### *1.4 Redundancy (Second Tier)*

Many respondents commented on the redundant nature of juicy feedback (not referring to just-in-time multimodal feedback), relaying information repeatedly through the same channel (i.e., providing multiple forms of visual feedback on one event). This redundant or perhaps superfluous characteristic of juicy design can be challenging when it overwhelms the player, with one respondent commenting that "*The pleasure aspects should not detract from the others like too much screenshake.*". Developers highlighted that abundant overwhelming feedback has negative implications for player

experience, e.g., commenting that "*These aspects can easily get in the way and detract from the game*".

*Table 5. The role of redundancy in the context of juicy design.*

| **Redundancy** | Feedback elements that repeatedly convey previously presented information (through same channels) |
|---|---|
| Overwhelming | Amount of feedback overwhelms the player |

### *1.5 Holistic Nature (Second Tier)*

Many developers commented along the lines of juicy design alone not making a positive game experience, e.g., "*Juice alone isn't enough*", outlining that "*Game Feel is the feature that emerges from the interaction of all the others*". This underlines the holistic nature of juicy design that was touched upon by previous aspects (e.g., consistency and integration of elements with each other), but also formulates one of the key challenges for developers: it is not enough to 'sprinkle' a game with elements of juicy design; it is something that needs to be approached from a holistic perspective.

### *1.6 Intuitive and Indescribable (Second Tier)*

This category summarizes comments that were made regarding the intuitive and therefore indescribable nature of game feel and juicy design. Respondents highlighted their difficulties when trying to put an intuitive understanding of what constitutes a positive game experience into words, and instead relied on examples they hoped other people could relate to, e.g., one developer stated that "*Game feel is like how well you fit into a new pair of shoes*" or, more openly stating the issue, "*I have no f[…]ing clue*". Developers did however point out that juicy design is instantly recognized by players, suggesting that it does in fact exist as a design approach, but is hard to verbalize.

### *1.7 Slickness (Second Tier)*

The category 'slickness' summarizes developers' comments that pointed out how juicy design leads to games that feel 'smooth and silky' to play, which goes hand in hand with fostering positive game feel. Factors that contribute to 'slickness' include visual aspects such as smooth animations (e.g., "*Animation curves go a long way in creating more pleasant, varied and communicative effects*"), but it can also be as simple as "*smooth movement along the track"*. Technical aspects also play a part here with the render rate of the game being attributed to creating feelings of slickness. A further key element that participants raised in this category directly related to responsiveness; e.g., "*Our character runs and jumps responsively even when smacking into a wall or leaping off a ledge, and aerial control is very good making it easy and satisfying to pinpoint landings*". Also emerging in this category were how the game elements can feel natural in the context of the game world. This includes how movement in the game should feel real using both "*momentum and friction*". The controls should not feel like a barrier to the player and instead they should disappear in the mind of the player e.g. "*The control is good enough that they disappear [..]"*. Lastly some responses also surrounded individual game elements that participants felt created game feel and discussed how certain game elements work well together providing a great benefit e.g. "*I think well-chosen mechanics that work together in an appropriate way and create a whole game experience*". Also arising in this theme was how juicy feedback elements are excellent when they work in tandem with the game mechanics.

*Table 6. Elements that contribute to a game being perceived as 'slick'.*

| **Slickness** | Aspects of the game that contribute to it feeling smooth and silky to play |
|---|---|
| Responsiveness | The game needs to feel responsive to the players action through |

| | |
|---|---|
| | immediate reactions through feedback and mechanics |
| Natural | Game aspects feeling natural in the context of the game world. |
| Complimentary Game Elements | Game elements working together to be greater than if they were alone |

## DEVELOPING A FRAMEWORK TO STUDY JUICY DESIGN

Building on the affinity diagram, we derived an initial framework for game analysis. This was done by two researchers with design background, the method involved exploring the second and third tire categories of the affinity diagram and deriving questions based on the category for example, for the *Consistency* category details how a game should respond consistently to player actions, the question derived from this was "*Do the actions of the player translate into feedback the player expects to see"*. The framework comprises five main components (Game Characteristics, Direct Feedback, Game State, Dimensions of Experience, Slickness) that do not have to be followed linearly for game analysis. Each of the components contains several contributing factors that are operationalized through questions that can be asked during analysis.

### Overview: Initial Framework

Table 7 gives an overview of the initial version of the framework. In the remainder of this section, we give an overview of how the framework was applied to two commercially available games for refinement. First, we study *Candy Crush Saga*, second, we investigate juicy design in *Downwell*, two games that were frequently cited as examples of good game feel and juiciness in our initial survey.

| **Game Juiciness** |
|---|
| **A. Game Characteristics** |
| **A1. Consistency:** Do the actions of the player translate into feedback the player expects to see?<br>**A2. World-ness:** Are the world and its reactions to player events believable in the context of the game?<br>**A3. Replayability:** Does the game cater to different styles of play or feature mechanics that encourage repeated engagement?<br>**A4. Rewards:** Are the mechanics and feedback elements rewarding in nature?<br>**A5. Depth:** Are the mechanics of the game easy to grasp but hard to master? |
| **B. Direct Feedback** |
| **B1. Confirmatory Feedback:** Does the game give a direct response to physical input (e.g., button press)?<br>**B2. Multimodal Feedback:** Is feedback for one action simultaneously presented through multiple channels at (e.g., visual, audio, haptic)?<br>**B3. Relevant Feedback:** When the player receives feedback, is it relevant to the action they have performed?<br>**B4. Explicit Feedback:** Is game critical information relayed explicitly?<br>**B5. Accessible:** Are feedback elements designed with accessibility in mind, e.g., do they use multiple channels?<br>**B6. Overwhelming:** Does the game overwhelm or distract by offering too much game information? |
| **C. Slickness** |

| |
|---|
| **C1. Responsiveness:** Is the game responsive to player inputs for game and UI control?<br>**C2. Natural:** Do the game elements feel natural and straightforward to engage with?<br>**C3. Complimentary Game Mechanics/Elements:** Are the mechanics suited to each other? |
| **D. Dimensions of Experience** |
| **D1. Fantasy:** Does the game support opportunities that cannot safely be explored in real life, e.g., crashing a car?<br>**D2. Visceral:** Are the actions in the game 'meaty' and evoke a visceral feeling?<br>**D3. Mastery:** Are you rewarded through persistence and growth?<br>**D4. Meaningful Actions:** Are actions meaningful to the player (e.g., through consequences within the game)? |
| **E. Game State** |
| **E1. Exaggerate:** Are reactive elements exaggerated to detail state change?<br>**E2. Focus of Attention:** Does the game feature feedback elements that draw your attention?<br>**E3. Highlighting:** Are feedback elements that highlight information in harmony with other systems?<br>**E4. Ambient Feedback:** Is there feedback about the state of the world that is available without explicit player input? |

**Table 7:** The first version of the framework derived from the affinity diagram.

## Step 1: Refinement Through Analysis – Candy Crush

To evaluate the initial version of the framework, we applied it to the commercially available game *Candy Crush Saga* in the first step (available at www.king.com/candycrush). *Candy Crush Saga* was frequently named as a 'juicy' game by the respondents; *Candy Crush Saga* is a puzzle game where the player is challenged to complete levels by matching sweets in groups of three or more by moving sweets around. The game features lots of "juicy" feedback with cascading audio and visual feedback showering the player when they successfully match three sweets. Additionally the game features multi-modal feedback for any player driven event effectively communicating the state of the game to the player.

### *Analysis and Refinement Process*

Two researchers with a background in game design applied the initial version of the framework to *Candy Crush Saga* independently. Each researcher played the game for around 30 minutes and then addressed each of the questions posed by the framework in a couple of sentences. For example, for the question "Is there ambient feedback displayed without input?", one of the researchers answered "Yes. The game has one particularly nice ambient feedback element through player inaction, if taking more than a few seconds to choose the game highlights and pulses a potential next moved for the player to make". Once the initial note-taking process was finished, both researchers met to discuss analysis results of *Candy Crush Saga* with the goal of (1) achieving a focus on the contribution of elements of the initial framework to the analysis of juiciness, (2) refining vague elements that were not directly actionable, and (3) the removal of elements no longer relevant. The discussion was structured as follows: both researchers compared their notes on each of the aspects of the framework and ranked them based on relevance in the context of juicy design. Further, researchers explored whether elements were directly actionable (i.e., contained a tangible description rather

than wording that left room for interpretation), and tried to either refine these elements, or marked them for removal from the framework. Finally, the researchers revisited the initial framework, added refined elements, and removed unclear / irrelevant elements.

**(1) Identification of highly relevant elements.** Some elements of the framework were revealed to be highly relevant for analysing 'juiciness', for example questions exploring how the game state is conveyed to the player, questions on the exaggeration of elements, and focus of attention, which highlighted some of the elements that *Candy Crush Saga* uses to convey important aspects to the player. The game characteristics were also relevant, further revealing how complimentary mechanics and systems make *Candy Crush Saga* feel juicy. Additionally, questions surrounding direct feedback mechanics granted insight into the differing types of feedback elements used to foster a 'juicy' feeling.

**(2) Refinement of elements.** Throughout discussion, some difficulty in interpreting terminology and questions was revealed. Therefore, we refined parts of the framework to use more precise language: For example, 'meaningful' actions were changed to 'actions impactful in the game world', and 'World-ness' was changed to thematic coherence to better reflect the nature of the accompanying question.

**(3) Removal of elements.** Several sections of the framework were removed as application to *Candy Crush Saga* and further analysis revealed that they were either too vague (and could not be specified), or too broad and therefore not relevant in the context of juicy design (e.g., containing general game design advice). Table 8 provides an overview of these elements along with brief justification of our decision.

*Table 8. Elements of the initial framework that were removed after discussion'.*

| Element | Justification |
|---|---|
| Slickness | Questions did not reveal anything about juiciness in the game as they were too high level. |
| Replayability | Too open-ended and targeted high level design choices that are not relevant |
| Rewards | Other questions cover the rewarding nature of the feedback elements which made this redundant. |
| Depth | Not related to juiciness. |
| Responsiveness | Redundant as responses were the same as the confirmatory input section. |
| Natural | Answers were vague to the ambiguous terminology. |
| Dimensions of Experience | The category was removed as the questions were better suited to other game aspects. |
| Fantasy | The question was vague and hard to interpret while not providing relevant answers. |
| Mastery | The answers from this question focused on feedback rather than mastery. |

## *A Revised Version of the Framework*

Table 9 presents the second version of the framework including all changes resulting from the analysis of *Candy Crush Saga* and discussion. This version was then applied to the game *Downwell*.

| **Game Juiciness** |
|---|
| **A. Game Characteristics** |

| |
|---|
| **A1. Mechanic:** Do the actions of the player translate into feedback that the player expects to see?<br>**A2. Thematic:** Is the world and reactions to events believable in the context of the game world?<br>**A3. Complementary Game Elements:** Are the mechanics compatible with each other?<br>**A4. Visceral:** Are the actions in the game 'meaty' and evoke a visceral feeling?<br>**A5. Impactful Actions:** Do player actions make a tangible impact on the game? |
| **B. Game State** |
| **B1. Exaggerate:** Are reactive elements exaggerated to detail state change?<br>**B2. Focus of Attention:** Does the game feature feedback elements that draw your attention?<br>**B3. Highlighting:** Are feedback elements that highlight information in harmony with other systems?<br>**B4. Ambient Feedback:** Is there feedback about the state of the world that is available without explicit player input? |
| **C. Direct Feedback** |
| **C1. Confirmatory:** Does the game give a direct response to physical input (e.g., button press)?<br>**C2. Multimodal:** Is feedback for one action simultaneously presented through multiple channels at (e.g., visual, audio, haptic)?<br>**C3. Relevant:** When the player receives feedback, is it relevant to the action they have performed?<br>**C4. Explicit:** Is game critical information relayed explicitly? |

**Table 9:** The second version of the framework.

## Step 2: Refinement Through Analysis – Downwell

To further refine the framework, we applied the second version to the commercially available game *Downwell* (available at www.downwellgame.com). *Downwell* was named several times by respondents as a 'juicy' game; *Downwell* is a 2D action platformer in which the player controls a character with the goal of reaching the bottom of the well. The player can move left and right, and has ability to jump and shoot (controlled by the same button). *Downwell* has a simplified art style and color scheme which allows the game to easily draw the attention of the player though the reserved use of colour. All player actions lead to immediate visual and auditory response, e.g., jumping is accompanied by an impulse visual effect, an animation change for the avatar, and two sounds for initial jumping and landing.

### *Analysis and Refinement Process*

Four researchers with a background in game design independently applied the second version of the framework to *Downwell*. Each researcher played the game for around 30 minutes and then addressed each of the questions posed by the framework in a couple of sentences. For example, for the question "Are reactive elements exaggerated to detail state change?", one of the researchers answered, "The weapon discharge recoil is highly exaggerated to emphasize the power of the action; the level of exaggeration in weapon discharge effects in rapid succession can overwhelm the player". Once the initial note-taking process was finished, the researchers discussed analysis results of *Downwell* with the goal of (1) refinement of vague or difficult to interpret elements, (2) removing any elements that were not directly actionable or required the designer to assume knowledge of the player. The discussion was structured as follows: researchers'

notes on each of the aspects of the framework were compared, and discussed to examine whether they were unambiguous and actionable whilst still relevant to juiciness. Elements were then refined or removed from the framework.

**(1) Refinement of vague elements.** Questions regarding complimentary game mechanics and thematic elements were a source of ambiguity in the analysis resulting into 'coherence of the game world and mechanics'. The question of ambient feedback was also refined; through analysis it emerged that ambient feedback contained several aspects that could be missed as the initial terminology was too vague. The question on the delivery of explicit feedback was rephrased to unambiguous feedback. Lastly, the question on relevance of feedback was tweaked as during discussions revealed that the idea of 'relevance' needed further clarification.

**(2) Removing non-actionable elements.** A reoccurring issue that researchers came across during analysis was the intangible nature of the questions concerning 'visceral' and 'impactful' feedback. While the concept of visceral feedback is unambiguous, the provision of a tangible definition prove to be difficult; likewise, whether feedback is 'impactful' is eventually determined by the player. However, discussion revelaed that both categories could in part be described by more tangible constructs: feedback coherence (i.e., whether feedback is appropriate considering the nature and importance of the preceding player action), and the idea of supplementary feedback that emphasizes certain elements of the game.

## Final Version of the Framework

Here, we present the refined version of our framework for analysis of juiciness in games (Table 10). It features three main components (Game Characteristics, Game State, and Direct Feedback); each of these components contains several factors that can be populated through asking tangible questions provided as part of the framework.

| **Game Juiciness** |
|---|
| **B. Game Characteristics** |
| **A1. Mechanic:** Do actions translate into feedback that is expected?<br>**A2. Thematic Coherence:** Are the world and reactions to events believable in the context of the game?<br>**A3. Gameplay Coherence:** Are the mechanics compatible with each other?<br>**A4. Feedback Coherence:** Does feedback reflect the importance of the event? |
| **B. Game State** |
| **B1. Exaggerate:** Are reactions to action exaggerated to detail state change?<br>**B2. Focus of Attention:** Does the game feature feedback elements that draw your attention?<br>**B3. Highlighting:** Are feedback elements that highlight information in harmony with other systems?<br>**B4. Ambient Feedback:** Is there feedback about the state of the world that is available without explicit player input, making the world appear real and interactive? |
| **C. Direct Feedback** |
| **C1. Confirmatory:** Does the game give a direct response to physical input of a button?<br>**C2. Multimodal:** Is feedback for one action presented on multiple channels at |

once? (visual, audio, haptic)

**C3. Unambiguous:** Can information be connected to actions and only interpreted in one way?

**C4.A Relevant:** Is feedback giving in response to game critical events or is feedback received on minor player actions that require no further action.

**C4.B. Supplementary feedback:** Does the game offer subtle additional feedback to emphasize actions already communicated in other ways, or minor player actions (without overlaps with C4.A)?

**Table 10:** The final version of the framework.

## DISCUSSION

Our work explores game developers' understanding of game feel and juiciness, and builds on their perspectives along with a review of academic literature to provide a framework for the analysis of juiciness in games. Here, we discuss our framework in the context of related work, and we provide a high-level reflection on developers' survey responses.

While our work is not the first to consider the benefits of juicy design, we are the first to investigate the concept from a perspective that bridges academia and industry. While previous work predominantly focused on juiciness as a kind of feedback – juicy feedback (see Juul, 2009; Schell, 2014; Deterding, 2015) – the key insight that emerged from our analysis is that developers understand juiciness to be more than just feedback, shifting our focus on the game as a whole.

One aspect that pervaded data analysis and perhaps warrants further discussion is that many game developers seemed to have an intuitive understanding of juicy design, but struggled to put their ideas into words. For example, many responses contained examples of what would feel juicy (e.g., "a shoe that fits well"), and throughout our analysis many similar examples came up (e.g., "like walking on fresh snow"). This tendency is interesting for two reasons: first, it suggests that some aspects of games perhaps cannot (or should not) be turned into straightforward advice for analysis and design (similar to other arts); and second, it suggests that there exists a body of inherently pleasant experiences (perhaps linked to shared cultural background) that allows us to communicate intangible experiences (also leveraged by Deterding et al., 2015) that is also relevant in the context of game design.

## LIMITATIONS AND FUTURE WORK

There are a few limitations that need to be considered when interpreting our results. Most importantly, we only sampled a small number of developers to allow for in-depth analysis; here it might be worthwhile to follow up with a broader survey to validate the resulting framework. Likewise, our survey included responses from a number of independent developers, whose perspectives may differ from those of developers working at bigger studios. Along these lines, we currently only examined developers' perspectives. Future work should also explore the view that players have on juiciness, and investigate in detail what role visuals and audio play in this context.

## CONCLUSION

Juicy design and a positive game feel are important goals for designers wishing to create engaging games, however, the concept is difficult to define, and often described in vague terms. To address this issue, we draw from academic work and a survey of industry perspectives, and contribute a framework for analysis that can serve as a tool to make the idea of juiciness actionable for researchers and designers.

## BIBLIOGRAPHY


Bång, Magnus, Mattias Svahn, Anton Gustafsson. 2009. “Persuave design of a mobile energy conservation game with direct feedback and social cues”. In *Proceedings of DiGRA 2009.*

Bateman, Scott, Regan L. Mandryk, Carl Gutwin, Aaron Genest, David McDine, Christopher Brooks. 2010. “Useful junk?: the effects of visual embellishment on comprehension and memorability of charts”. In *Proceedings of the SIGCHI Conference on Human Factors in Computer Systems,* 2573-2582.

Blizzard Entertainment. 2016. *Overwatch.* Online Game. Blizzard Entertainment.

Brown, Morgan, Chuck Longanecker. *How to Design for the Gut.* 2013. UX Magazine. May 29.

Desurvire, Heather, Charlotte Wiberg. 2009. “Game usability heuristics (PLAY) for evaluating and designing better games: The next iteration.” In *Internation Conference on Online Communities and Social Computing.* Springer; 557-566.

Deterding, Sebastian. 2015. “The Lens of Intrinsic Skill Atoms: A Method for Gameful Design.” Human-Computer Interaction 30, 3-4: 294-335. http://dx.doi.org/10.1080/07370024.2014.993471

Erhel, Séverine, Eric Jamet. 2013. "Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness." Computers & Education 67: 156-167

Fullerton, Tracy. 2014. “Game Design Workshop: A Playcentric Approach to Creating Innovative Games”. Third Edition. CRC Press.

Fumoto, Ojiro. 2015. *Downwell.* Digital Game. Devolver Digitial.

Gabler, Kyle, Kyle Gray, Matt Kucic, and Shalin Shodhan. 2005. *How to Prototype a Game in Under 7 Days*. Gamasutra, October 26.

Gerling, Kathrin M, Max Birk, Regan L. Mandryk, Andre Doucette. 2013. “The Effects of Graphical Fidelity on Player Experience”. In *Proceedings of Academic MindTrek ’13,* 229-236. https://doi.org/10.1145/2523429.2523473

Hassenzahl, Marc. 2008. “Aesthetics in interactive products: correlates and consequences of beauty.” In *Product Experience,* 287-302.

Hassenzahl, Marc, Andrew Monk. 2010. “The inference of perceived usability from beauty”. *Human-Computer Interaction 25(3),* 235-260.

Hagen, Ulf. 2011. *Designing for player experience: How professional game developers communicate design visions.* Journal of Gaming and Virtual Worlds 3, no.3 (2011): 259-275.

Ho, Xavier, Martin Tomitsch, Tomasz Bednarz. 2015. “Conceptualising Inspiration Networks in Game Design”. In *Transactions of the Digital Games Research Association* 2, no. 1.

Holtzblatt, Karen, Jessamyn Burns Wendell, Shelley Wood. 2004. *Rapid contextual design: a how-to guide to key techniques for user-centered design.* Elsevier.

Jonasson, Martin, Petri Purho .2012. *Juice it or lose it.* Video. GDC Vault. GDC Europe 2012.

Juul, Jesper. 2009. *A Casual Revolution.* Cambridge, MA:MIT Press.

Juul, Jesper, Jason S. Begy. 2016. “Good Feedback for bad Players? A preliminary Study of ‘juicy’ Interface feedback.” In *Proceedings of the First Joint FDG/DiGRA Conference.*

King. 2012. *Candy Crush Saga*. Browser Game. King.

Lamoth, Claudine JC, Rolinde Alingh, Simone R. Calijouw. 2012. “Exergaming for elderly: effects of different types of game feedback on performance of a balance task”. 103-107

LeRay, Lene. 2016. *Filling Luna’s touchable VR gameworld with ‘juicy’ feedback.* Gamasutra. November 10. Available at https://i.redd.it/p2x8yt2w5wox.png

Loeschen, Sam. 2017. “How to Juice your game” Zine. Richmond Zine Fest.

Mullet, Kevin, Darrell Sano. 1996. “Designing visual interfaces”. *ACM SIGCHI Bulletin 28*, no. 2: 82-83.

Nijman, Jan Willem. 2013. *The art of screenshake.* Video. YouTube. Dutch Game Garder 2013.

Núñez, Arturo. 2015. “Make your game feel juicy with Unity”. Video. YouTube. Unite 2015.

Norman, Donald A. 1988. *The design of everyday things*. Doubled Currency.

Norman, Donald A. 2005. *Emotional Design*. New York, NY: Basic Books.

PopCap Games. 2007. *Peggle.* Digital Game. PopCap Games.

Reeves, Byron, J. Leighton Read. 2010. “Ten Ingredients of Great Games”. Web Article. April 10.

Rollings, Andrew, Dave Morris. 2003. *Game architecture and design: a new edition*. New Riders. November 3.

Schell, Jesse. 2014. *The Art of Game Design: A book of lenses.* CRC Press.

Sharp, Helen, Yvonne Rogers, Jenny Preece. 2007. “Interaction design: beyond human-computer interaction”.

Swink, Steve. 2009. *Game Feel: A Game Designer’s Guide to Virtual Sensation.* Amsterdam: Boston: Morgan Kaufmann Publishers/Elsevier

Wensveen, Stephan AG, Johan Partomo Djajadiningrat, C. J. Overbeeke. 2004. “Interaction frogger: a design framework to couple action and function through feedback and feedforward." In *Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques*, 177-184.

Whitkin, Josh. 2014. *Juicy: a useful game design term?.* Gamasutra. January 31.

Vero Vanden Abeele, Jan Wouters, Pol Ghesquière, Ann Goeleven, Luc Geurts. 2015. “Game-based assessment of Psycho-acoustic Thresholds: Not All Games Are Equal!”. In *Proceedings of CHI PLAY ’15,* 331-341. https://doi.org/10.1145/2793107.2793132