

Combat System Design for Action Games: Key Concepts and Styles

Jiayong Sun

University of Utah

a2710225260@gmail.com

José P. Zagal

University of Utah

jose.zagal@utah.edu

ABSTRACT

Scholarly game analyses are typically narrow (e.g. specific games or genres) or broad – examining elements seen in most/all games. There is a need for game design analyses somewhere in between: e.g. at the level of gameplay systems. We provide a design overview of one common system; the modern action combat system as used across several game genres. We examined successful videogame titles, reviewed professional designer commentary, player discussions, and scholarly literature to identify the primary elements of current combat system design. We then show how these elements relate to each other and provide a framework for understanding the different styles of gameplay experience that games with real-time melee combat systems currently provide. We conclude with an overview of different styles of gameplay that distinguish popular action combat focused games.

Keywords

combat, system design, action combat design, game design

INTRODUCTION

Scholarly game design analyses are often narrow, focusing on specific games (e.g. Nealen 2013; Mathias 2014; Esteve 2017; Bateman and Zagal 2018) or genres (e.g. Treanor and Nelson 2019; Arnaudo 2023). Other design analyses are broad – looking at elements and concepts seen and used across most/all games (e.g. Björk and Holopainen 2005; Elverdam and Aarseth 2007; Hunicke et al. 2004; Adams and Dormans 2012; Zagal et al. 2019). These analyses are valuable but can lead to gaps. Specifically, there is a need for game design analyses at the level of gameplay systems¹, i.e. mostly self-contained rules and mechanics that refer to a specific component (i.e. “gameplay pillar”) of a game’s gameplay. Game designers often refer to combat, progression, stealth, and crafting, as distinct systems in a game. While these systems are often interrelated and influence each other, they are typically designed independently by professionals in specialized roles (e.g. combat designer, economy designer). Game systems are worthy of independent analysis because they also present distinct design challenges and considerations.

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We take an initial step by examining one common system: the action combat system as seen in fighting games (e.g. *Street Fighter*, *Mortal Kombat*), action-adventure games (e.g. *Devil May Cry*, *Assassin's Creed*), action-rpg games (e.g. *Demon's Souls*, *Hades*), and beat 'em ups (e.g. *Streets of Rage*, *Dragon's Crown*). From our analysis we provide a framework of the key concepts and elements behind current action-based combat system design. Game design is constantly shifting and evolving, with new games introducing novel design elements that are then iterated on and expanded. Thus, this work reflects a snapshot of where things currently are (combat design-wise). There are other design elements that play an important role (e.g. encounter and level design) we will not examine for scope. Our analysis broadly aligns with the mechanics, dynamics and aesthetics framework (Hunicke et al. 2004).

COMBAT SYSTEMS

Combat systems have emerged as a critical component of modern video games. A combat system broadly defines how players engage in direct conflict with enemies or other players. Osborn and colleagues (2022) provide a broad and flexible abstract model for combat and demonstrate how it applies across a variety of different games. They propose that a game that models combat must include a:

- “1) A space in which 2) multiple agents 3) exchange violent (and possibly nonviolent) actions with each other
- 4) A way to decide which actions an agent may perform, 5) whether they succeed, and 6) to what extent
- 7) Observable effects for all combat actions which are eventually visible at least to the initiator and target(s)
- 8) Circumstances under which agents enter or exit the fight and
- 9) for the combat itself to terminate” (Osborn et al. 2022).

A designer looking to create a game's combat system would thus have to (among other things) consider the role and properties of the virtual space in which combat will occur, what actions the player has available to choose from (e.g. two types of kicks and three punches, also called the moveset, see Minguell 2023); how, when, and in what way those actions are resolved (e.g. range, aiming, probabilistic resolution or based on spatial relationships, e.g. hitboxes); what effects of those actions may have (e.g. damage, protection); how everything is expected to function temporally (e.g. real-time, turn-based); and how enemies react and behave towards the player including the actions enemies have available, their resolution, and their effects. And, finally, how combat is bracketed, if at all, from other parts of the game.

Depending on the game and its intended player experience, there may exist additional elements and layers of complexity. For example, a game might have few moves, but many weapons, each with distinct properties, or there may exist multiplicity of moves – e.g. counters, parries, blocks, dodges, sidesteps, rolls – each with their own role and purpose. There can also be relationships between moves, effects, and more – e.g. moves influencing each other (e.g. combos, chains), effects based on prior moves or situational elements (weather effects, attacks of opportunity, terrain advantages, etc.) – each leading to interesting tactical and/or strategic options for players. In this context, the limits for relevance for a combat system are those of creators' imaginations – e.g. what the characters have eaten, whether a move was performed “in time” with the game's music, etc., could all play a role in a game's combat system.

Designers have developed combat systems that prioritize different player experiences and skills for player success. We broadly identify three types of combat in games. These are not strict categories and many games blend aspects of each and incorporate aspects not fully covered by any:

1. **Real-Time Combat:** players continuously act and respond to enemy actions. Players are typically challenged in their hand-eye coordination, timing, reflexes, and situational awareness.
2. **Turn-Based Combat:** player and enemies act in discrete turns during which players select their actions. Players are typically challenged in their planning, resource management, and strategic and/or tactical thinking skills.
3. **Auto-Battler:** combat unfolds without player's direct input following pre-determined rules. Players are typically challenged in terms of their planning and strategic thinking skills.

Our interest lies in real-time combat systems, specifically those emphasizing close quarters (i.e. melee, hand-to-hand) combat between opponents where players have direct control over a game character, and the players' ability to act/and react in a timely fashion are central to the game's experience. These systems are used across several genres. Broadly, we consider fighting games (e.g. *Street Fighter*, *Guilty Gear*), action adventure games (e.g. *God of War*, *Bayonetta*, *Batman: Arkham Asylum*), action role-playing games (e.g. *Dark Souls*, *Hades*), and beat 'em ups (e.g. *Streets of Rage*, *Dragon's Crown*) as subjects of analysis.

METHODS AND DATA COLLECTION

We employed a qualitative research approach combining a literature review of scholarly, professional, and player game design discourse with analyses of select game titles to create a framework of concepts and their relationships that can be used to describe combat systems (Fernandez-Vara 2015). From the scholarly discourse we draw conceptual and definitional foundations essential to this study, e.g. notions such as depth and breadth (Wagar 2015; Lantz et al. 2017), state space (Lantz et al. 2017), and emergence (Dormans 2011). From the professional and player discourse we learn how the design (and play) of action game combat systems is conceptualized and understood (e.g. Williams 2008; Lambottin 2012; Vossen 2015; Game Maker's Toolkit 2018; de Heras 2021a) and also use terminology defined and understood in these communities.²

The games analyzed deeply were selected using several criteria. First, they should include as part of their core or primary gameplay a melee real-time combat system (as defined earlier). Next, we considered the size of its player base in order to examine games with large audiences that were more likely to have "community content" including strategy guides, design analyses, etc.. To limit the scope of our work and more accurately reflect the current state-of-the-art in the design space we considered titles released after 2014. We considered player ratings as a proxy for game quality. While player reviews do not give a complete picture of the quality a game (e.g. Raison et al. 2012), for popular titles there is a strong positive correlation: higher rating usually means a more polished game combat system. While there can be value studying less well-regarded games (e.g. Zagal 2012), our research goals are better served studying better regarded combat systems. Finally, we selected for coverage of different styles (e.g. genres/subgenres) across the design space of "real-time melee

action”. Based on these criteria we focused on the following games: *Devil May Cry 5*, *Dark Souls III*, *Nioh 2*, *Monster Hunter World*, *Street Fighter 6*, and *Sekiro Shadows Die Twice*.

ACTION MELEE COMBAT SYSTEMS

Earlier we presented Osborn et. al.’s (2022) definition of a combat system. Minguell (2023) also offers a perspective on the parts of a combat system: a moveset (the collection of actions a player can do) that includes attack moves, defensive moves, and moves related to movement, range (the reach in the virtual space of a player’s move), timings (the amount of time actions require), statistics (numerical representations of the properties for everything in the combat system), camera (how the player sees information on the screen about the game’s state), environment (the virtual space within which combat occurs), and feedback (how the player will perceive the actions happening on screen) (Minguell 2023). Lambottin (2012) identifies the fundamental pillars of combat system design as (1) player’s abilities and (2) enemies that match the player abilities and provide a specific challenge for the player to overcome using their abilities. Similarly, combat designer Juan Fernandez de Simón identifies the three pillars of melee action combat design as the (1) player character, (2) enemies, (3) combat space, and describes movesets as including offensive, defensive, mobility, control (e.g. grab, throw) and auxiliary (e.g. taunt, lock target) moves (Fernandez de Simón 2018). In the following sections we describe these elements and how they relate to each other.

Moves, their Relationships, and their Effects

We could consider a **move** in a combat system as an action that happens as the result of the player providing input to the game: e.g. press X to punch, and the player-controlled character punches. However, this ignores the temporal aspects of moves as designed in current action combat games. A fundamental concept here is the **frame** – referring to a single image on screen (e.g., the first frame of an animation) and the amount of real world time that passes before the next frame is shown on the screen. So, if a game has a move that is 10 frames in duration, and the game runs at 30 frames per second, the move would have a duration of 0.33 seconds (Melenchón Maza 2022). A second concept is **window**, which refers to a span of frames during which certain things may be permitted/prevented from happening.

“Press X to punch and punch happens” oversimplifies because moves are more like processes taking place over time than instantaneous action/reaction pairs. This is because (1) there may be a designed time differential³ between a player providing input and the game responding to or executing said input, (2) moves can take time to resolve, (3) moves may require a sequence of inputs, and (4) moves may be interrupted or cancelled at different moments throughout their duration. With these considerations, and the concepts of frame and window, we can articulate additional concepts.

A **buffer window** refers to a span of frames during which an input will be accepted as valid and carried out in the next appropriate frame. A buffer window can thus allow moves that would otherwise not occur due to being late or early. For example, “coyote time” (in the context of platforming games) allows a player to jump late, e.g. after their character has run past the edge of a cliff (Pichlmair and Johansen 2022). In combat systems, games with **attack buffering** provide a window in which inputs are

“remembered” and executed as soon as they are permitted (within the window) (Melenchón Maza 2022).

As mentioned, moves take time to resolve and this period of time (frames) has also been a space for different designs. The top half of **Figure 1**, from CAPCOM’s official website, shows an 11 frame move (Mr. Skillsmith 2018). The frames are subdivided into three sections: startup, active frames, and recovery. It is only during the **active frames** (also **hit frames**) that an attack can cause damage to an opponent – the **startup** (also **anticipation frames**) are a short waiting period during which the player is waiting for the attack to become “active” while **recovery frames** represent a period of time during which an attack is finishing during which the player character is (often/sometimes) vulnerable and unable to performing another attack.

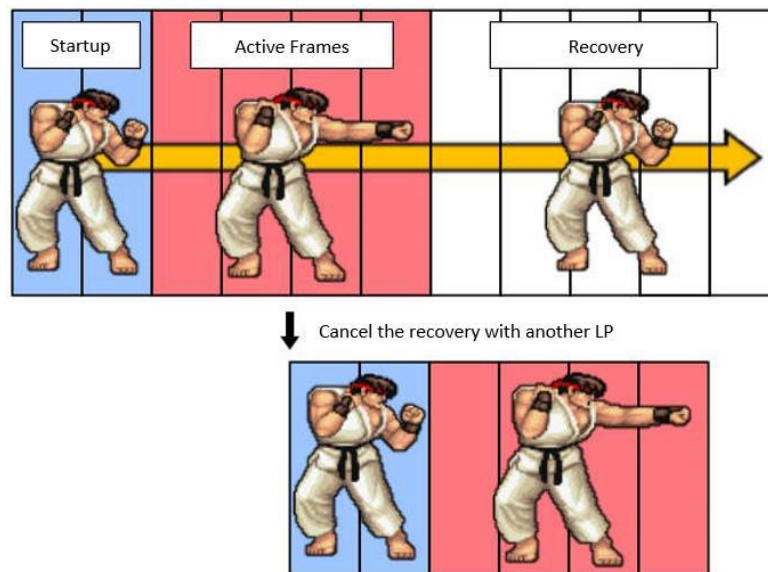


Figure 1: Move and Move Cancel (Mr. Skillsmith 2018)

The bottom half of **Figure 1** shows how while this move is being carried out, it can be **cancelled** with a new input, leading into another move, but only during the active frames of the first move. Here a skilled player can perform two attacks in quick succession without having to wait for the recovery frames from the first attack. Different combat systems have their own designs with regards to which moves can be cancelled, if/when cancelling is possible, and what effects cancelling may have. For example, some games permit canceling an attack into another attack even when the initial attack does not hit (e.g. “kara” or empty cancels, Mr. Skillsmith 2018). Melenchón (2022) identifies two types of cancels: partial (can only happen during specific windows) and complete (can happen at any moment during a move). Note the term cancel does not refer to what happens when a defender initiates their own attack and negates (“cancels”) the attacker’s attack: e.g. a move with a long startup where the attacker is vulnerable could be “negated” by a defender launching their own “fast” attack when their attack has a short startup such that its active frames “connect” with the attacker while the attacker is still in their startup frames.

The term **invincible frames** (also **i-frames**) refers to frames during which the character is invulnerable to damage. This is commonly the purpose of defensive moves (e.g. dodging, parrying, blocking) which may each have distinct frame durations with windows (e.g. vulnerability only during the startup and recovery of a dodge move).

A **cancel**, as described, denotes a relationship between moves. Another common relationship is the **combo** – typically a set of moves performed sequentially for some benefit greater than each move performed separately (Zuin et al. 2016; Zhang 2023). In *God of War (2018)* performing the same light attack four times in a row, when done with the correct cadence (timing of button presses), results in the fourth attack pushing an enemy backwards (i.e. knockback) (AfroPrime 2018).

Some moves require multiple inputs with their own timing (buttons pressed within a certain time from each other). **Figure 2** shows three moves available to the character Ryu in *Street Fighter 6* each requiring a sequence of button presses/stick movements (CAPCOM, n.d.).



Figure 2: Three of Ryu's *Street Fighter 6* moves (CAPCOM, n.d.)

A move's outcome can also depend on relationships between moves. If an attack is successful (i.e. hits the defender), the defender may be “forced” into a recovery (a window during which they cannot perform moves). If the attacker's recovery frames are fewer than the defenders, then the attacker has **advantage**: “[they] will recover faster than [their] opponent” (Mr. Skillsmith 2017c), and could then perform another move that would not be easy to interrupt.

This leads to another meaning for **combo**: allowing an attacker to perform successive attacks such that the defender cannot react (i.e., dodge, block) (Zuin et al. 2016). In this context it is commonly said that certain “moves combo” or that a move “can be linked from” or “can be comboed from/into” (Mr. Skillsmith 2017c). A related concept is **punish**: “attacks that can connect while the attacker is still in disadvantage” (Mr. Skillsmith 2017c). In *Elden Ring*, heavy weapons typically have longer recovery times thus creating a “lapse of time [in which] enemies can punish you much more easily” (Aroca 2023).

Whether a move is “successful” (e.g. attack does damage) typically depends on two things. First, the temporal relationship with other moves “active” at that time (e.g. one move having advantage over another). Second, the spatial relationship between game characters (e.g. distance, facing) such that an attack “connects” with the defender (rather than missing). Generally, the spatial relationship is resolved by determining whether a collision occurred – i.e. determining computationally if objects

(e.g. game characters) intersect, when, and for which parts of those objects (Dinas 2024).

There are many computational techniques for resolving collisions in videogames (Lazaridis et al. 2021). However, there are common concepts across these implementations: the **hitbox**, **hurtbox**, and **collision box** (Melenchón Maza 2022). **Figure 3** shows the hitbox (red square along extended arm) and hurtbox (in blue) of the character Ryu while attacking. These boxes are invisible to the player (including the collision box, not shown). Note that the boxes may not align with the character's representation: e.g. Ryu's left foot is not covered by either hitbox or hurtbox (**Figure 3**). An attack is successful when a character's hitbox collides with another character's hurtbox. The collision box is generally used to prevent characters from overlapping in space – i.e. prevent one character from moving through another.

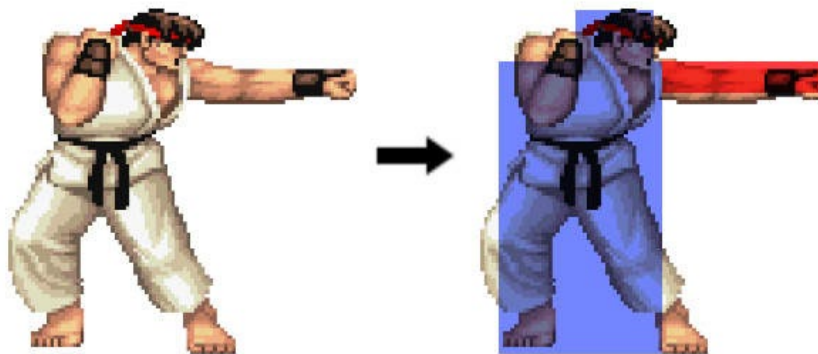


Figure 3: Ryu's hitbox (red) and hurtbox (blue) (image from Mr. Skillsmith 2017a)

Also, the boxes described earlier are typically dynamic – varying in size and location from frame to frame even within the same move (see **Figure 4**). While the term “box” is used, the shape is not necessarily rectangular (or cuboid, for games with 3D spaces).

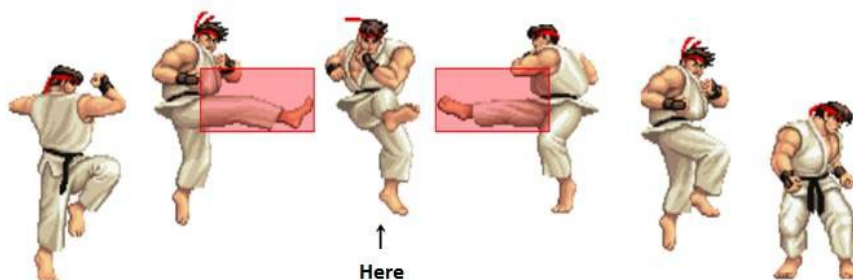


Figure 4: Different Hitboxes in red during different frames. Note the "gap" between active frames identified with "Here" (image from Mr. Skillsmith 2017b)

We have referred implicitly to the results of some moves – e.g. a successful attack would hurt/damage an opponent. There are other common results of a move: **status effects**, **cooldowns**, and **meter changes**. Status effects are momentary changes to a character's state (Melenchón Maza 2022). One common status effect is a stun (a temporary loss of control that disables a character), but there is really no limit on possible status effects (e.g. poisoned, enraged, staggered, slowed, etc.). A cooldown is a period of realworld time (e.g. seconds) during which a move is not available for

use (Melenchón Maza 2022). Meter changes refers to a resource measured by a meter (also bar, gauge) that can accumulate (fill up/charge) or deplete/empty.

Meters, Modifiers, and Effects

Meters are a visual gauge for tracking resources used to allow/limit access to certain moves in a game. Common names are stamina and super (i.e. the “super meter”). Typically, a meter’s state (how “full” or “empty” it is) can enable (or disable) moves or provides other benefits/penalties. *Nioh*’s “Final Blow – Living Weapon” move is only available “after charging it up” by hitting and defeating foes (Minguell 2023). In *Bloodborne*, however, a stamina meter decreases whenever certain moves (e.g. rolling, blocking) are performed and slowly “recovers” over time when players don’t perform those actions. If the stamina meter is ever fully depleted, it “will take longer than usual to start filling again, leaving room to receive hits without being able to evade them” (Minguell 2023). There is variety in how these elements are designed and interact with other parts of a game (e.g. de Heras 2021a): some games have multiple meters – a 2nd meter only filling up once the 1st meter is full, or meters may accumulate/deplete for different reasons or circumstances. *Nioh*’s “Ki Pulse” move restores a portion of the stamina used in the previous move if executed within a certain time (Parkin 2017).

Computer-controlled opponents can also have meters. *Sekiro* offers an alternative method for defeating enemies by building up their posture gauge which then allows for a “Deathblow” (Wiki Contributors 2024b). Meters can also be hidden from players. In *Sekiro*, some enemies have a hidden Poise meter that “allows them to not flinch when taking a single attack.” Once the meter is depleted, “the enemy will get interrupted for a few seconds, allowing [the player] to attack them dealing some extra free damage” (Wiki Contributors 2024a).

Systems of numerical modifiers that quantitatively modify aspects of a game’s combat system are also common: e.g., bonuses to damage, increased speed for moves, and more. Numerical modifiers are sometimes implemented via weapons, armor, or items that may be used, worn, or equipped. *Dark Souls*’s weapon statistics indicate how much damage they do and most can be improved: the basic Dagger does 56 pts. of damage and can be upgraded to do 140 pts. (Dagger+15) (Future Press 2011, 230). In other games, numerical modifiers are applied based on using certain moves or as effects from previous moves. In *Nioh 2*, defeating enemies provides a time-limited boost to damage (Tokyo 2023).

Finally, combat systems often include effects: typically rules dictating direct changes in the battlefield state that result from performing moves, using items, interacting with environmental elements, etc. Effects can be applied to players and computer-controlled enemies: a move might knock an enemy back some distance, reduce their movement speed, interrupt them, and/or leave them vulnerable or invulnerable. Effects can also alter the availability of certain moves: e.g. severing a Rathian’s tail in *Monster Hunter*, renders it’s poison ineffective (Wiki Contributors 2025).

CHAINS

We have described fundamental rules and mechanics that make up the design of action combat design systems. There are also common dynamics that result from them. These dynamics are akin to meta-moves that are responsive to the combat

situation – a player performs move A hoping to combo into move B for a positional advantage, their opponent, seeing move A, might anticipate move B and respond with move C – thus disrupting the advantage gained from the attacker executing moves A and B sequentially. Furthermore, move C might combo into move D giving the defender the possibility of counter-attacking. These meta-moves, or sequences of moves, are often called **chains** (also attack-defense chains and combos).

Chains, as meta-moves, are analogous to chess openings – a series of moves in chess a player makes to (hopefully) achieve strategic goals that will make it more likely they will win. Knowledgeable chess players will know many openings and responses to openings – and will adapt their play based on how their opponent responds. If an opponent deviates from the established response move, have they made a mistake or discovered a new/better response (Chassy and Gobet 2011)? While combos, as discussed earlier, can also be chains, the opposite is not necessarily the case. Chains are typically discovered and documented by players through play (see Zuin et al. 2016 for automated discovery). *SuperCombo Wiki* (<https://wiki.supercombo.gg/>) is one such source with detailed descriptions of chains for multiple fighting games presented using a specialized notation system. For example, when playing *Street Fighter 6*'s character Ryu, players can execute: “2LK ~ 2LP ~ 5LP > 214LK/623HP.⁴” - a chain consisting of four moves, the first three of which are chain/cancelled into the next, ending with two possible options to complete the chain (SuperCombo Wiki Users 2025b). Broadly, there are four types of chains: offensive, defensive, offence-into-defense, defense-into-offense.

An **offensive chain** creates advantage for an attacker over a series of moves. In *Devil May Cry 5*, Dante can perform a “Prop Trick” by chaining three moves: High Time (with Rebellion sword equipped), Prop (in Swordmaster style) and Air Trick (in Trickster style) in order to gain “consistent vertical advantage” (Taguam 2022)

A **defensive chain** is typically a response to an offensive chain by which a player aims to eliminate/reduce an opponent's advantage. In *Monster Hunter Wilds*, the “Superman Dive” grants an extended period of invincibility frames, allowing players to avoid nearly every type of attack in the game. However, it can only be performed when the player’s weapon is sheathed, meaning they must anticipate danger and cannot immediately counterattack (Moreno 2024).

A **defense-into-offense** chain is intended to manage an offensive series of moves before “turning the tables” on the attacker. *Street Fighter 6* has a mechanic called “Perfect Parry” wherein the player must press “the Medium Punch and Medium Kick buttons at the same time, but it has to be just as [their] opponent is set to make contact with an attack.” (Heaney et al. 2023) When performed successfully the player can then “cancel into [their] next move, and simultaneously prevent [their] opponent from anim cancelling, allowing for a guaranteed Punish Counter” (Heaney et al. 2023). I.e., a successful “perfect parry” can be followed by an attack guaranteed to hit.

The **offence-into-defense** chain is one where an attacker repositions themselves after a failed attack. It can be used defensively (i.e. make up for an error) or offensively, to lure/bait a defender into an attack that will be countered for greater effect. When Akuma (in *Street Fighter 6*) performs a “medium punch target combo” that is blocked by the opponent, he enters six frames of disadvantage (needs 6 additional frames to recover). By immediately following with a “Gou Hadoken” (fireball), Akuma can prevent the opponent from launching an instant counterattack, effectively turning a

risky offensive move into a defensive reset (SuperCombo Wiki Users 2025a).

Chains often interact with each other. A defensive chain might be the “best” response to a certain offensive one, but not as advantageous against other offensive chains. However, deciding what to do and being able to do it are not the same: the “optimal” damage-dealing offensive chain might be technically more difficult to accomplish, easier to respond to, or highly punishing if a player attempts it but fails complete it. The interplay between an attacker and their opponent(s) choices of moves building into chains, and how these relate to each other is one of the main sources for the dynamic experience of combat in these kinds of games.

Operational Challenge

Knowledge of the details of moves, how they might chain, and how they relate meters, modifiers and effects, creates challenge for successful play. However, there is also challenge in physically performing (and chaining) moves (i.e. pressing a button at the precise the moment). This leads to a dynamic we call **operational challenge** (a combination of Flint et al. 2023’s cognitive and controller challenge): the combination of **operational complexity** and **action precision** players manage when engaging with a game’s combat system that results from the game’s fundamental moves, move relationships, meters, modifiers, and effects.

Operational complexity typically comes from the number of moves and ways to combine them (e.g. number of combo and chain possibilities). In *Dark Souls* there are only two types of physical attacks: normal and strong. There are also some combinations: e.g. a “rolling attack” is performed by pressing the button for a normal attack as the roll completes and “behave[s] differently than when attacking while standing” (Future Press 2011, 28). Performing a backstep and then immediately executing a normal attack results instead in an “evasive attack” which is “useful after a successful backstep to quickly reclose the gap and take advantage of an enemy’s missed attack.” (Future Press 2011, 28). Conversely, in *Devil May Cry*, players can switch freely between four melee weapons and four ranged weapons, and using different weapons mid-chain enables unique attack sequences (Brouwer, 2019). Broadly, higher operational complexity means players have a wider range of attack and follow-up options, and more combo/chain possibilities.

Action precision refers to the degree of precision required to successfully perform moves, combos, and/or chains. While a player may press the correct buttons to carry out an attack or a dodge, whether it is successful depends on additional factors. **Action precision** consists of the precision needed to execute moves (**move precision**), combine moves together in combos and/or chains (**chain precision**), and doing so in the context of the game’s environment (**spatial precision**).

Move and **chain precision** refer to precision required to execute a move/chain by performing the correct input with correct timing. For example, to successfully parry with a shield in *Dark Souls III*, the player must perfectly time their input to coincide with an enemy’s attack (Fontes 2021). **Chain precision** is similar but relates to the correct timing of inputs in order for moves to chain (e.g. chaining “Oboro Throw” from “Ashura Senku”, see **Figure 5**).

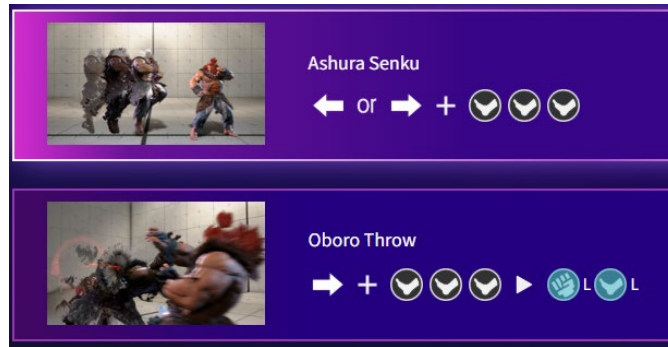


Figure 5: Controller input for two moves for Akura (*Street Fighter 6*): Arrows indicate directional input while the icons refer to the type of attack (kick, light punch and light kick). “Oboro Throw” is only possible when chained from “Ashura Senku”.

Spatial precision represents the precision required for moves to succeed within the game space: e.g. moves may succeed within specific distances between combatants (Lambottin 2012) or from a certain distance and direction (i.e. range and facing). *God of War* requires less spatial precision because it “has a generous amount of lerp⁵ that provides “suction” to an enemy ensuring the attack hits even if the player misjudges distance between player and enemy” (de Heras 2021b). Some games also reduce the need for spatial accuracy by implementing **soft targeting** (or **attack targeting**). In *God of War*, Kratos “automatically turns to his target on the initial frame the attack input is registered” (de Heras 2021b). This does not happen in *Sekiro*, where the character Wolf attacks based on his facing, thus requiring greater spatial precision from the player (de Heras 2021b). However, both games allow players to **lock-on** to enemies (automatically adjusting the character’s orientation to always face an enemy). In the *Monster Hunter* series players cannot lock onto enemies but can aim their attacks to maximize damage to specific body parts they wish to hurt, thus requiring higher spatial precision (Mackey and Williams 2018). In contrast, in the *Dark Souls* series, players can lock-on to keep enemies in sight to focus on range rather than their orientation towards the enemy (NeuralFrights 2017).

Operational challenge is similar to, but distinct from a game’s branching factor, “the number of choices presented to a player at each point in the game tree” (Lantz et al. 2017). Specifically, we aim to capture the number of options available to the player together with the challenge in exercising those options.

AESTHETIC STYLES OF ACTION COMBAT GAMES

We now describe how different combat system designs feel different to play according to the details of their design (Swink 2008). We do so by presenting pairs of concepts representing opposite ends of a spectrum. This provides a general sense of the current design space of combat system designs we have studied while not intended as being exhaustive of such space.

Fast and Slow

“What was noticeable in the way participants played [*Street Fighter 3: Third Strike*, *Soul Calibur 4*, and *SF4*] was a similarity to fencing; rather than going brutally all out to overwhelm the other player, those players instead seemed to trade a series of opening moves, feints, and forays intended to test the opponent’s defenses and

create an opening. This is actually a marked difference from the more frenetic style of play I observed for *Marvel vs. Capcom 2* and *Guilty Gear XX* [...], or *Marvel vs. Capcom 3* [...]; those games instead seem to involve a whirlwind of action and attacks rather than the slower pace of the previously mentioned games.” (Harper 2014, 42)

Harper highlights differences in the **tempo** or rhythm-of-action in fighting games that result from their different combat systems. These rhythms often alternate between **active** and **passive behavior** with **neutral periods** sometimes occurring between them. **Active behavior** refers to actions taken with the intent of changing the battlefield state, e.g. performing offensive moves, activating abilities, moving around the battlefield. **Passive behavior** typically looks to disengage, reassess, or gain an advantage through reaction; e.g., waiting to parry an attack, retreating so a shield can regenerate, baiting an opponent into attacking. **Neutral periods** are moments between actions where no attack or defense is taking place, they are a lull in the action during which players evaluate the state of the battle and make decisions regarding next steps. Neutral periods provide players the opportunity to adjust their strategy and adapt to enemy behavior without being directly under threat.

Combat systems whose moves are long (in frames) and don't support cancelling often lead to more cautious playstyles where players wait for openings defined by enemy movements. This results in a combat tempo dictated by opponent's actions with players studying enemy patterns to identify optimal attack windows, resulting in fewer chances to strike. Long moves without canceling also discourage mindless attacks (i.e. “button mashing”) lowering the tempo of the action. In games like *Dark Souls*, the universal roll move includes “invincibility frames,” allowing players to evade any attack as long as they execute the roll with precise timing (NeuralFrights 2017). However, to evade subsequent attacks, players must also choose the roll direction carefully since enemies may perform multi-hit combos, and players cannot trigger another roll before the next attack. Conversely, systems with shorter attacks and cancels encourage players to engage actively and maintain control over a battle's rhythm. Increased attack frequency and faster attack-defense exchanges speed up the game's tempo. For example, because attacks, dashes, casts, and specials can be woven together with very little downtime in *Hades*, the player is encouraged to sustain offensive momentum while continuously repositioning. The increased attack frequency and faster attack-defense exchanges therefore produce a noticeably fast-paced tempo (AwesomeWz, 2021).

When resource meters lack automatic regeneration, players actively choose certain moves to accumulate them. This, in turn, impacts the game's tempo. For example, players in fighting games often “build up” their super meter which then allows them to unleash more powerful offensive moves that can end a battle. In games with stamina-gauges, players will often retreat and play more defensively while they wait for their stamina to regenerate, thus slowing down the pace of play.

This fast/slow distinction sometimes correlates with whether the combat system emphasizes offensive over defensive moves. Games that prioritize offensive play often feature a wider variety of fast moves and intricate chains. Some have mechanics that encourage aggression like *Bloodborne's* Regain/Rally mechanic wherein you can recover some health after taking damage from an enemy, but only if you attack them within a limited window of time (Byrne et al. 2015, 15). In contrast, games that emphasize defensive play typically employ slower moves with complex and varied

enemy behaviors such that success requires learning enemy patterns, understanding attack timings, and executing precise defensive maneuvers. In such systems, victory comes from observation, anticipation, and disciplined timing rather than from creative combo construction.

Devil May Cry 5 exemplifies an offensive-oriented combat system as it provides multiple melee and ranged weapons, each with unique timing and cancel options, inviting experimentation and expressive play (Brouwer 2019). Since recovery frames are short and defensive options can be executed mid-combo, success depends on mastery of the combat system itself over reading enemy behavior. Thus, players are rewarded for maintaining offensive momentum, chaining attacks to sustain style rankings and prevent enemy retaliation (DeFreitas 2019).

Dark Souls I and III are oriented defensively: player actions are slower, stamina consumption limits moves, and recovery frames are long (Future Press 2011). Enemies, however, are fast and powerful, forcing players to study their behavior before acting. Victory relies on reading attack patterns, committing to well-timed dodges or blocks, and capitalizing on short counter windows (Fontes 2021). The system's design discourages reckless aggression, turning combat into a contest of patience and anticipation rather than mechanical speed.

Nioh 2, occupies a middle ground. The game grants players a wide variety of moves, but its stamina-based "Ki" system forces careful resource management (Hurley 2021). Aggressive play can quickly deplete stamina, leaving the player vulnerable, while well-timed defensive techniques—such as the "Ki Pulse"—allow stamina recovery and repositioning (Hurley 2021). This constant exchange of attack and defense encourages a rhythmic flow where success depends equally on offensive timing and defensive awareness. The player must both exploit openings and anticipate retaliation, creating a steady back-and-forth tempo.

We are not saying all games are fast, slow or in-between. Rather, a combat system's design can support and discourage a particular tempo for a given action game. Many games, including the ones described, are played faster/slower by players even if their preferences contrary to the game's design. Similarly, other design elements we have not analyzed can also play a role, e.g. enemy design, movement speed, etc.

Reaction and Anticipation

In **reaction-based** combat, success depends on speed, adaptability, and fluid control. In *Devil May Cry 5* both the player character and enemies move fast, and many moves can be canceled or redirected almost instantly. The game's system of jump-cancels and animation interrupts allows players to switch from offense to defense within a few frames, giving them continuous control over the battle's tempo (Williams 2008). Because defensive moves have short recovery times and no stamina consumption, players can rely on real-time reactions rather than advance planning.

In contrast, **anticipation-based** systems increase the duration of moves and shift the challenge toward prediction and timing. Here, executing the wrong move carries a larger penalty (e.g., vulnerability to counter-attack) and players must anticipate an enemy's next move to respond effectively. This kind of challenge depends heavily on readability: players must interpret telegraphing cues before an attack and form stable expectations about how particular visual patterns relate to particular outcomes

(Kubodera 2022). In anticipation-based systems, mastery therefore involves both reacting at the correct moment and learning to recognize recurring patterns and their countermeasures until they can be processed almost automatically. In *Dark Souls*, defensive moves such as rolling or blocking require having enough stamina (i.e. stamina meter), and heavier equipment also increases recovery frames and vulnerability after each action (Future Press 2011). So, as in *Dark Souls III*, a mistimed roll or depleted stamina bar often leaves the player exposed, forcing them to carefully read enemy attack patterns before deciding when to defend (Fontes 2021). In both games, players are discouraged from reacting impulsively. Instead, they must anticipate enemy behaviors and commit to a specific defensive strategy—a design that transforms every roll or block into a calculated risk.

Monster Hunter Rise offers a hybrid model. Monsters follow recognizable patterns that reward anticipation, yet also have unpredictable attacks that demand quick reflexes. Also, the game’s “Wirebug” mechanic enables instant repositioning and reactive counters (Santos 2024) while heavier weapons impose long recovery times requiring preemptive decisions. The result is a flexible system balancing anticipation and reaction—players must both study and adapt on the fly.

Strategic vs Tactical

Games that emphasize **strategic planning** encourage players to prepare for combat by selecting appropriate weapons, equipment, skills, etc. for specific encounters. Success depends on the player’s understanding of when to use certain items, skills, etc. (and when not to). In these games players explore and experiment with different **builds**—combinations of skills, abilities, equipment—in order to improve their chances of victory. In *Monster Hunter Rise*, before each monster hunt, players typically choose weapons, armor, items, and decorations tailored to the monster’s weaknesses and behavior. Different weapon types require different approaches, meaning success often depends on preparation—selecting the right build and understanding how it should be used in the upcoming fight (Ramos 2001).

Games that emphasize **tactical execution** focus on short-term decision-making and adaptability during combat. Here, success depends not on pre-battle preparation and planning but on improvisation—reading the situation, exploiting spatial or environmental opportunities, and swiftly adapting to gain the upper hand. In *Street Fighter 6* both players start each round under identical conditions, so pre-planning matters less than recognizing spacing, reacting to pressure, and adapting instantly to an opponent’s choices (Godiner 2024).

CONCLUSIONS

We have explored the fundamental elements of combat systems in video games with a focus on identifying and analyzing the key components that designers manage to create different kinds of play experiences. By examining the structure of combat systems and integrating design knowledge from existing research, designer writings, and case studies, we have articulated a general grammar (i.e. framework) that illustrates the current design space of action-based combat systems from mechanics and rules, dynamics that result from them, and differences in game feel.

The design space of combat systems is constantly evolving, and we can only hope to provide a snapshot. Currently some games implement what we could call multiple co-existing combat systems. For example, *Street Fighter 6* introduced two control

methods, “Classic” and “Modern”, with the latter designed as a simplified control system and a reduced move set. Players competing against each other could choose either control method. Should we consider this feature as co-existing systems, a larger combat system with different configurations or settings (the way we might consider different difficulty settings for the same game), or something else entirely? For now, we think this is unclear, but it illustrates how dynamic this space can be. More broadly this initial step, merging academic work together with game designer and player insights and knowledge, is something we look forward to in future work in this area. We also hope we have highlighted the need for game-analytic work focusing on a system-level “middle ground” between specific titles and games writ large.

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REFERENCES

- Adams, Ernest, and Joris Dormans. 2012. *Game Mechanics: Advanced Game Design*. New Riders.
- AfroPrime. 2018. “Beginner’s Guide to Combat - Lets Git Gud Together.” *GameFaqs - God of War - Message Board*, April 23. <https://gamefaqs.gamespot.com/boards/191627-god-of-war/76545161/900175128>.
- Arnaudo, Marco. 2023. “Studying Gamebooks: A Framework for Analysis.” *Analog Game Studies X (II)*. <https://analoggamestudies.org/2023/09/studying-gamebooks-a-framework-for-analysis/>.
- Aroca, Adrián. 2023. “Combat Systems For Third-Person Action Video Games.” Bachelor Thesis, UPC, Centre de la Imatge i la Tecnologia Multimèdia. <http://hdl.handle.net/2117/393639>.
- AwesomeWz. 2021. “Hades: Melee Combat System Breakdown” Reddit.com subreddit r/HadesTheGame, https://www.reddit.com/r/HadesTheGame/comments/pweevi/hades_melee_combat_system_breakdown/
- Bateman, Chris, and José P. Zagal. 2018. “Game Design Lineages: Minecraft’s Inventory.” *Transactions of the Digital Games Research Association (ToDiGRA)* 3 (3). <https://doi.org/10.26503/todigra.v3i3.77>.
- Björk, Staffan, and Jussi Holopainen. 2005. *Patterns in Game Design*. Game Development Series. Charles River Media Inc.
- Brouwer, Hasker. 2019. “Weapon-Switching | Quality or Quantity?” Blog. *Stinger Magazine*, March 20. <https://stinger-magazine.com/article/weapon-switching/>.
- Byrne, Bruce, Anwar Hassan, Bailey Strauss, Franz von Eisenheim, Lucas Hofstatter, and Marcus Sanders. 2015. *Bloodborne: The Old Hunters Collector’s Edition Guide*. Future Press.
- CAPCOM. n.d. “Ryu - Frame Data (Classic).” *Streetfighter.Com*. Accessed June 17, 2025. <https://www.streetfighter.com/6/en-us/character/ryu/frame>.
- Chassy, Philippe, and Fernand Gobet. 2011. “Measuring Chess Experts’ Single-Use Sequence Knowledge: An Archival Study of Departure from ‘Theoretical’ Openings.” *PLoS One* 6 (11): e26692.

- DeFreitas, Casey. 2019. "How to Get SSS Ranks in DMC5." Blog. *IGN Devil May Cry 5 Guide*, March 9. https://www.ign.com/wikis/devil-may-cry-5/How_to_Get_SSS_Ranks_in_DMC5.
- Dinas, Simena. 2024. "Collision Detection." In *Encyclopedia of Computer Graphics and Games*. Springer.
- Dormans, Joris. 2011. "Simulating Mechanics to Study Emergence in Games." *Artificial Intelligence in the Game Design Process. Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment 7 (3): 2–7*. <https://doi.org/10.1609/aiide.v7i3.12477>.
- Elverdam, Christian, and Espen Aarseth. 2007. "Game Classification and Game Design: Construction Through Critical Analysis." *Games and Culture 2 (1): 3–22*.
- Esteve, Jaume. 2017. "La Abadía Del Crimen: Anatomy of a Cult Video Game in Spain." *Well Played - Special Issue on European Videogames of the 1980s 6 (2): 15–27*. <https://doi.org/10.17613/eq706-djb20>.
- Fernandez de Simón, Juan, dir. 2018. *Combat Design and Implementation*. Youtube. 1:18:15. <https://youtu.be/xthcUAgaVcU?si=xue2ahe7q8tzGiG5>.
- Fernandez-Vara, Clara. 2015. *Introduction to Game Analysis*. Routledge, New York.
- Flint, Alex, Alena Denisova, and Nick Bowman. 2023. "Comparing Measures of Perceived Challenge and Demand in Video Games: Exploring the Conceptual Dimensions of CORGIS and VGDS." *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (New York, NY, USA), CHI '23*. <https://doi.org/10.1145/3544548.3581409>.
- Fontes, Renan. 2021. "Dark Souls 3: How to Parry Like a Pro." Blog. *TheGamer*, April 21. <https://www.thegamer.com/dark-souls-3-how-to-parry-pro-tips/>.
- Future Press. 2011. *Darks Souls - The Official Guide*. Future Press.
- Game Maker's Toolkit, dir. 2018. *What Makes a Good Combat System?* 17:24. <https://youtu.be/8X4fx-YncqA?si=H86rmRyPQfk0dToe>.
- Godiner, Jane. 2024. "Street Fighter Strategy Guide: Tips, Techniques and Character Insights." *Redbull*, April 23. <https://www.redbull.com/us-en/street-fighter-strategy-guide>.
- Harper, Todd. 2014. *The Culture of Digital Fighting Games: Performance and Practice*. Routledge.
- Heaney, Samuel, Luis Joshua Gutierrez, Axel Bosso, Angie Harvey, and Ragga_Fragga. 2023. "How to Perform Perfect Parries." Wiki. *IGN Street Fighter 6 Guide*, June 4. https://www.ign.com/wikis/street-fighter-6/How_to_Perform_Perfect_Parries.
- Heras, Jason de. 2021a. "How Do Melee Combat Systems Reinforce the Player Fantasy?" <https://www.jasondeheras.com/blog>. *Jason de Heras*, March 21. <https://www.jasondeheras.com/gamedesign/2021/3/21/how-do-melee-combat-systems-reinforce-the-fantasy-of-the-player-character>.
- Heras, Jason de. 2021b. "The Art of Melee Combat Design." *Jason de Heras Blog*, February 11. <https://www.jasondeheras.com/gamedesign/2021/2/11/meleecombatdesign>.
- Hunicke, Robin, M LeBlanc, and R Zubek. 2004. "MDA: A Formal Approach to Game Design and Game Research." In *Proceedings of the Challenges in Game AI Workshop, 19th National Conference on Artificial Intelligence (AAAI '04, San Jose, CA)*. AAAI Press.
- Hurley, Leon. 2021. "Nioh 2 Guide: Ki Pulse, Soul Cores, Amrita, Yokai Shift, and More Explained." Blog. *GamesRadar+*, February 3. <https://www.gamesradar.com/nioh-2-guide/>.

- Kubodera, Alex. 2022. "Designing for Difficulty: Readability in ARPGs" GameDeveloper.com. April 19. <https://www.gamedeveloper.com/game-platforms/designing-for-difficulty-readability-in-arpgs>
- Lambottin, Sébastien. 2012. "The Fundamental Pillars of a Combat System." Gamedeveloper.com. *Game Developer*, August 14. <https://www.gamedeveloper.com/design/the-fundamental-pillars-of-a-combat-system>.
- Lantz, Frank, Aaron Isaksen, Alexander Jaffe, Andy Nealen, and Julian Togelius. 2017. "Depth in Strategic Games." *WS-17-01*, AAAI Workshop - Technical Report, 967–74.
- Lazaridis, Lazaros, Maria Papatsimouli, Konstantinos-Filippos Kollias, Panagiotis Sarigiannidis, and George F Fragulis. 2021. "Hitboxes: A Survey about Collision Detection in Video Games." *International Conference on Human-Computer Interaction*, 314–26.
- Mackey, Bob, and Mike Williams. 2018. "The Gateway Guide to Monster Hunter: Where Should I Start?" Blog. *USGamer*, January 25. <https://web.archive.org/web/20220814175258/https://www.usgamer.net/articles/the-gateway-guide-to-monster-hunter-2018>.
- Mathias, Jason. 2014. "Ninja Gaiden Black and the Tutorial-Less Tutorial." *Well Played* 3 (1): 21–26. <https://doi.org/10.17613/2zak8-hmy47>.
- Melenchón Maza, Àlex. 2022. "Overcoming Adversity: A Design Framework for Action Melee Combat Systems." Thesis, UPC, Centre de la Imatge i la Tecnologia Multimèdia. <http://hdl.handle.net/2117/392322>.
- Minguell, Eduard. 2023. "Expanding Action RPG Combat Systems." Thesis, UPC, Centre de la Imatge i la Tecnologia Multimèdia. <http://hdl.handle.net/2117/398444>.
- Moreno, Samuel. 2024. "Monster Hunter Wilds' Superman Dive Is Your Best Defensive Technique, If You Use It Correctly." Blog. *Kotaku*, July 1. <https://kotaku.com/monster-hunter-wilds-mhw-diving-defense-roll-1851785410>.
- Mr. Skillsmith. 2017a. "Hour 7: The Basics of Boxes." *SF Seminar*, February 22. <https://game.capcom.com/cfn/sfv/column/131422>.
- Mr. Skillsmith. 2017b. "Hour 9: The Basics of Attacking: The Basics of Attack Composition." *SF Seminar*, March 8. <https://game.capcom.com/cfn/sfv/column/131432>.
- Mr. Skillsmith. 2017c. "Hour 12: The Basics of Attacking: Basic Knowledge about Advantage/Disadvantage." *SF Seminar*, April 5. <https://game.capcom.com/cfn/sfv/column/131611>.
- Mr. Skillsmith. 2018. "Hour 14: The Basics of Combos: Cancels." *SF Seminar*, June 25. <https://game.capcom.com/cfn/sfv/column/132455>.
- Nealen, Andy. 2013. "Ascension: A Case Study in Deckbuilding Games." Paper presented at DiGRA 2013, Atlanta, GA. *Proceedings of DiGRA 2013: DeFragging Game Studies*.
- NeuralFrights. 2017. "Dark Souls Combat System 101: The Complex Mechanics Explained." Blog. *Fighter 101*, March 19. <https://fighter101.com/main/dark-souls-combat-system-101-the-complex-mechanics-explained/>.
- Osborn, Joseph C, Dylan Lederle-Ensign, Noah Wardrip-Fruin, and Michael Mateas. 2022. "Combat in Games." Paper presented at Foundations of Digital Games (FDG), Pacific Grove, CA. *Proceedings of the 10th International Conference on the Foundations of Digital Games (FDG 2015)*. <https://escholarship.org/uc/item/9zj6r5wz>.

- Parkin, Jeffrey. 2017. "Nioh Guide: Understanding Ki." BLog. *Polygon*, February 7. <https://www.polygon.com/2017/2/3/14501174/ki-pulse-yokai-realm-equipment-weight/>.
- Pichlmair, Martin, and Mads Johansen. 2022. "Designing Game Feel: A Survey." *IEEE Transactions on Games* 14 (2): 138–52. <https://doi.org/10.1109/TG.2021.3072241>.
- Raison, Kevin, Noriko Tomuro, Steve Lytinen, and Jose P. Zagal. 2012. "Extraction of User Opinions by Adjective-Context Co-Clustering for Game Review Texts." In *Advances in Natural Language Processing*, edited by Hitoshi Isahara and Kyoko Kanzaki. Springer Berlin Heidelberg.
- Ramos, Jeff. 2001. "Monster Hunter Rise Beginner's Guide." Blog. *Polygon*, March 26. <https://www.polygon.com/22344425/beginners-guide-weapons-quests-best-controller/>.
- Santos, Marc. 2024. "Monster Hunter World: Long Sword Guide (Combos, Tips, and Tricks)." Blog. *GameRant*, November 14. <https://gamerant.com/monster-hunter-world-long-sword-guide-combos-tips-tricks/>.
- SuperCombo Wiki Users. 2025a. "Street Fighter 6/Akuma." Wiki. *SuperCombo Wiki*, October 30. https://wiki.supercombo.gg/w/Street_Fighter_6/Akuma.
- SuperCombo Wiki Users. 2025b. "Street Fighter 6/Ryu/Combos." Wiki. *SuperCombo Wiki*, June 8. https://wiki.supercombo.gg/w/Street_Fighter_6/Ryu/Combos.
- Swink, Steve. 2008. *Game Feel: A Game Designer's Guide to Virtual Sensation*. CRC Press.
- Taguiam, Rhenn. 2022. "Devil May Cry 5: Best Dante Combos." Blog. *GameRant*, May 25. <https://gamerant.com/devil-may-cry-5-best-dante-combos/>.
- Tokyo, Tiny Timmy. 2023. "Everything You Need to Know about Nioh 2 (2023)." Blog. *Steam Community: Nioh 2 - The Complete Edition*, February 16. <https://steamcommunity.com/sharedfiles/filedetails/?id=2384736108>.
- Treanor, Mike, and Mark J. Nelson. 2019. "Order-Fulfillment Games: An Analysis of Games about Serving Customers." *Proceedings of the 14th International Conference on the Foundations of Digital Games* (New York, NY, USA), FDG '19. <https://doi.org/10.1145/3337722.3337767>.
- Vossen, Bart. 2015. "Enemy Design and Enemy AI for Melee Combat Systems." *GameDeveloper.Com*, May 4. <https://www.gamedeveloper.com/design/enemy-design-and-enemy-ai-for-melee-combat-systems>.
- Wagar, Celia. 2015. "A Basic Introduction to Depth." Blog. *Celia Alexis Wagar's Critpoints: Critical Critique Straight to the HP*, March 21. <https://critpoints.net/2015/03/21/thoughts-on-depth-and-a-basic-introduction/>.
- Wiki Contributors. 2024a. "Poise: Sekiro Shadows Die Twice Wiki (Version 13)." Wiki. *Sekiro Shadows Die Twice Wiki*, August 11. <https://sekiroshadowsdietwice.wiki.fextralife.com/Poise>.
- Wiki Contributors. 2024b. "Posture: Sekiro Shadows Die Twice Wiki (Version 42)." Wiki. *Sekiro Shadows Die Twice Wiki*, November 19. <https://sekiroshadowsdietwice.wiki.fextralife.com/Posture>.
- Wiki Contributors. 2025. "Rathian." Wiki. *Monster Hunter Wiki*, October 27. <https://monsterhunter.fandom.com/wiki/Rathian>.
- Williams, Eric. 2008. "Combat Cancelled." *Pushing Buttons...*, January 17. <https://pushing-buttons.blogspot.com/2008/01/combat-cancelled.html>.

- Zagal, José P. 2012. "Why a Game Canon for Game Studies Education Is Wrong." In *Computer Games and New Media Cultures*, edited by J. Fromme and A. Unger. Springer. https://doi.org/10.1007/978-94-007-2777-9_42.
- Zagal, José P., and Roger Altizer. 2014. "Examining 'RPG Elements': Systems of Character Progression." Paper presented at Foundations of Digital Games (FDG) 2014. *Proceedings of the 9th International Conference on the Foundations of Digital Games*. http://www.fdg2014.org/papers/fdg2014_paper_38.pdf.
- Zagal, José P., Michael S. Debus, and Cardona-Rivera. 2019. "On the Ultimate Goals of Games: Winning, Finishing, and Prolonging." *Proceedings of the 13th International Philosophy of Computer Games Conference* 11 (October): 1–11. <http://gameconference.mediaphilosophy.ru/Papers/zagal.pdf>.
- Zhang, Zekai. 2023. "How to Achieve Aesthetic Unity in Traditional 3D Action Game." Master's Thesis, School of Informatics.
- Zuin, Gianluca L., Yuri P.A. Macedo, Luiz Chaimowicz, and Gisele L. Pappa. 2016. "Discovering Combos in Fighting Games with Evolutionary Algorithms." *Proceedings of the Genetic and Evolutionary Computation Conference 2016* (New York, NY, USA), GECCO '16, 277–84. <https://doi.org/10.1145/2908812.2908908>.

ENDNOTES

- ¹ For exceptions, see e.g. (Zagal and Altizer 2014; Minguell 2023; Melenchón Maza 2022).
- ² For example moveset, startup, recovery, cancel, i-frames, hitbox, hurtbox, punish, and soft targeting. Our use of operational challenge, active behavior, and passive behavior are used as analytical labels, and our use of neutral periods extends the more established notion of neutral to a broader range of action combat systems.
- ³ We use this language to differentiate this from latency or lag related to, for e.g., the amount of real world time it may take for a signal to "travel" from controller to a console.
- ⁴ "2LK ~ 2LP ~ 5LP > 214LK/623HP": Numbers indicate position of controller stick as mapped to a number pad. E.g. "2" is down, or the "2" on a number pad, "214" is like pressing 2, 1, and then 4 on a number pad, L is light, H is heavy, K is kick, P is punch, "~" means to chain/cancel into the next (followup) move, ">" is cancel the previous move into the following, "X/Y" means do either move X or move Y (SuperCombo Wiki Users 2025b).
- ⁵ Lerp refers to linear interpolation, a mathematical method to generate points on a line between two given points. In this context it refers to how a character's position is calculated, suggesting that the player is moved more than it should when executing an attack in order for the attack to hit the opponent.