Weapons of Microcontroller Destruction
Tangible Playthings for Roleplaying in Dungeons & Dragons

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ABSTRACT

This project aims to explore how interactive tangible playthings can be designed to enhance the roleplaying aspect of Dungeons & Dragons. Further, the project juxtaposed D&D and interaction design as practices to examine if D&D can contribute to interaction design. The project adopted research through design methodology and applied different methods, emphasizing playful and movement-based approaches. A handful of tangible electronic prototypes were created using Arduino Nano BLE Sense, gesture recognition combined with a NeoPixel Circle, a Humidifier, and a Vibration motor combined with 3D-printed objects. The prototypes were tested during a D&D playing session to evaluate their impact on the roleplaying experience. The result of the project suggests that interactive tangible artifacts enhance the experiential, expressive, and sensory qualities of roleplaying in D&D by adding interactivity and tangibility. Furthermore, the results suggest that the playthings increase the player's connection to their character. Finally, the project's result suggests that interaction design can learn from D&D's playful and creative nature by adopting the Magic Circle concept to interaction design methodology.

Keywords: Tangle and embodied interaction, Play, Roleplaying, Dungeons & Dragons
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1 INTRODUCTION

You and your adventuring party have ventured across the land to explore a legendary dungeon said to be filled with magic, monsters, and, most important, treasure. As you enter the dungeon, you hear a rumbling sound that you cannot quite make up the source of origin. It comes from inside the cave and seems to approach you hastily. As the sound makes it closer and closer, you start to feel the ground quaking, and a flock of frightened bats flies right through your party. You shake off the impact of the colliding bats. By now, the sound is getting louder, and you perceive a giant figure in the cave. It is charging right at you. You see a full-grown dragon charging toward you. You take out your spellbook and prepare to cast a fireball. Roll initiative¹.

Dungeons & Dragons (D&D) is the original table-top roleplaying game (Arneson & Gygax, 1974; Dungeons & Dragons, 2014) and have endured for half a century, rising in popularity over the past five years (Sidhu & Carter, 2020). The game's longevity and social implications suggest its a topic worthy of research (Adams, 2013). This project began with an interest in Dungeons & Dragons (D&D) and an appreciation for the incredible creative freedom it empowers its players. Despite the creative freedom to explore limitless make-believe worlds, D&D mainly uses verbal interaction (Adams, 2013) around a table with analog objects (Chung, 2013). There is an opportunity to enhance the roleplaying experience of D&D by introducing movement-based interaction (Buruk et al., 2017) and sensory experience (Buruk & Özcan, 2017) facilitated by interactive and tangible playthings.

Nevertheless, many contemporary interactive artifacts for D&D, e.g., D&D Beyond, One D&D, and Roll 20, encourage players to play in front of computer screens, negatively affecting the situatedness and physical and social interaction of playing D&D together in the same room. Moreover, tangible artifacts losing their physical form in favor of digital versions is a contemporary phenomenon in interaction design (Van Campenhout et al., 2013) This project aimed at designing an interactive tangible plaything that combined the physical and digital world, which is a sought-after goal in interaction design (Avrahami et al., 2011). Furthermore, tangible and embodied interaction design needs to design interactive artifacts going beyond passive input devices and one-to-one mappings and instead seize opportunities to employ magical metaphors (Hornecker & Buur, 2006)—creating digitally augmented physical artifacts that act simultaneously as input and output devices (Antle et al., 2011). Moreover, like D&D, interactive artifacts often appeal to cognitive skills and neglect the user's bodily and sensory experience (Overbeeke et al., 2005; Van Campenhout et al., 2013).

Furthermore, this project converges at a point between tangible and embodied interaction design, play, and D&D, which entails fascinating opportunities. First, there is a need to design artifacts that operate in specific contexts, starting from existing physical activities rather than creating addons to digital applications (van den Hoven et al., 2007). Furthermore, while tangible and embodied interaction has explored paradigms of technology and interaction, it now needs to focus on play (Sicart, 2017; van den Hoven et al., 2007). Second, there is a growing need for design-oriented approaches that focus on qualities of interaction (Shaer & Hornecker, 2010) beyond screen-based interaction and instead use embodied approaches (Levisohn & Schiphorst, 2011) in order to understand the body's role in creating experiences with technology (Loke & Robertson, 2013).

Third, there is a growing interest and need to research the design of table-top game experiences, e.g., creative expression in play (Sidhu, 2022), integrating story and gameplay,

¹ In Dungeons & Dragons, Initiative refers to a game mechanic using dice used at the start of combat to determine the order in which players take turns during combat—who acts first, second, and so on.
more profound empathy for characters in-game, and creating emotionally rich gameplay (Fullerton, 2009). This project aimed to approach this design space from two different inquiries, 1) designing an interactive tangible plaything for roleplaying in D&D, and 2) juxtaposing D&D and interaction design as practices. The project, therefore, posed the following research questions:

1. How can an interactive tangible plaything be designed to enhance roleplaying in Dungeons & Dragons?
2. How does an interactive tangible plaything affect the experiential aspects of roleplaying in Dungeons & Dragons?
3. In what way can a close examination of Dungeons & Dragons contribute concepts, methods, and practices to Interaction Design?
2 BACKGROUND

2.1 Tangible and Embodied Interaction

2.1.1 Embodiment

Embodiment is an interaction design concept aimed at understanding the body's role in how people experience and interact with the world (Antle et al., 2011)—examining the relationship between computational artifacts and humans and how it is situated in the physical and social world (Dourish, 2004). Moreover, physical phenomena, body awareness, and social interaction are essential (Levisohn & Schiphorst, 2011; Shaer & Hornecker, 2010) since individuals and artifacts cannot be separated from the physical and social world in which they interact (Dourish, 2004; Höök, 2018). The body is the basis for experience (Levisohn & Schiphorst, 2011), and bodily movement is varied, adaptive, and in dialogue with the environment (Höök, 2018). The hands and the face are two primary areas for personal bodily expression in how they are structured, function, and behave (Napier, 1993). Furthermore, it is through the hands that humans experience the world up close by manipulating objects, primarily through their sense of touch but also through vision (Bret, 2011). Hands have evolved for rich, expressive movements, and the sense of touch is essential to the experience, e.g., tactility, weight distribution. A gesture is an expressive form of bodily movement that includes the body, face, hands, and sometimes tools intending to communicate emotions, expression, and interaction to another human or a computer (Hummels et al., 2007; Hummels & Stappers, 1998). When used moderately, gestures enrich and enhance communication (Napier, 1993) and capture spatial information (Hummels & Stappers, 1998), and explain, direct, and enforce the words used (Napier, 1993). Facial expressions and bodily movements, in combination with speech, in a performative context, allow the performer to express things that can be hard to verbalize.

2.1.2 Tangibility

Tangible Interaction (TI) is about digitally augmenting and enriching physical space while emphasizing tangible, material, and social aspects of interacting with interactive artifacts (Dourish, 2004; Hornecker & Buur, 2006; Shaer & Hornecker, 2010)—controlling physical objects rather than digital information (Jensen et al., 2005). TI can be used to augment artistic performance and expression digitally (Krestanova et al., 2021; Shaer & Hornecker, 2010), using, e.g., gesture recognition (Krestanova et al., 2021). Moreover, tangible artifacts can be used when designing bodily interaction to utilize the sensory and expressive physical richness and creative power inherent in the human body (Bakker et al., 2012; Hornecker & Buur, 2006; Hummels et al., 2007; Shaer & Hornecker, 2010). Additionally, tangible artifacts support social and contextual aspects of interaction with the body to make references and as thinking props (Hornecker & Buur, 2006; Shaer & Hornecker, 2010) and support the performative aspect of interaction and how well information is communicated (Hornecker & Buur, 2006) by using the user's body as an input device in space (Shaer & Hornecker, 2010). Also, the tactile qualities of the artifact provide

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2 Design research has, over the years, curated a wide variety of terminology concerning tangibles, including tangible computing, tangible user interfaces, tangible systems, and tangible interaction, to mention a few. Tangible Interaction will be used to avoid mixing terms since it is considered a broader term (Hornecker & Buur, 2006; Shaer & Hornecker, 2010).
haptic feedback, among other material qualities enhancing the interaction by appealing to
different sensory experiences and play (Fernæus et al., 2008; Hornecker & Buur, 2006;
Krestanova et al., 2021). When designing sensor-based interaction, it is essential to be
intentional about the degree of continuity of interaction, sensor precision, and whether or
not the interaction is explicit or implicit (Shaer & Hornecker, 2010). Additionally, it is
essential to remember that the interaction between the user and artifact produces meaning
and not the sensor data (Fernæus et al., 2008).

2.2 Play

2.2.1 Playing

_Play_ is a way of exploring the world, ourselves, and engaging with others and can be
described as a time-limited contextual performative activity with goals, rules, and a
delimited space (Sicart, 2017). Additionally, play is a voluntary activity in a make-believe
world (Caillois, 2001; Huizinga, 2016). Play is a source of creative expression facilitated by
creating make-believe worlds through interaction and engaging with objects, technology,
people, and different contexts (Sicart, 2017). At the same time, it demands that the players
accept the rules of the game of the playing community. Furthermore, play is a phenomenon
that draws people together and promotes social interaction (Huizinga, 2016; Sicart, 2017).
Even though people play together, they experience the play individually and develop their
interaction tactics (Sicart, 2017). For that reason, interactive artifacts designed for play must
incorporate this appropriative aspect of play (Sicart, 2017), allowing users to use it in their
way (Gaver, 2002). Moreover, play mainly happens in a context designed for play, which
comprises a network of playthings, people, and the environment; e.g., playthings are often
embedded with cues that signal to the user that an object or space is used for play (Sicart,
2017).

2.2.2 Make-believe

_The Magic Circle_ is a concept that describes the barrier between the mundane world
and the make-believe world, created or entered when people play (Caillois, 2001; Huizinga,
2016; Salen & Zimmerman, 2003; Sicart, 2023). Make-believe is one of the principal
classifications of games and exhibits all play characteristics (Caillois, 2001) and is becoming
the dominant form of play in the information age (Sicart, 2023). Moreover, play is not
limited to contesting, winning, or losing; instead, the essential aspect of play is being able to
travel between make-believe worlds (Sicart, 2023). Play based on make-believe enables
people to enter different worlds (Sicart, 2023), and the art of becoming something different
and being somewhere else is where play reaches perfection (Huizinga, 2016). Furthermore,
make-believe is a temporary act of changing personality–becoming another–that includes
theatrical performance (Caillois, 2001). _Performance_ can be defined as a public
demonstration of actions generating meaning in the engagement (Hannah & Harsløf, 2008).
Furthermore, the role of the context and the designed artifacts of the performance is often
neglected even though they are inextricably bound to the performance through its
embodiment; through them, stories are told, and roles are played out.
2.2.3 Playthings

Playthings are instruments—the ultimate prop—of play that enable people to realize that play is possible (Sicart, 2017) and can be defined as material and computational things involved in digital play, e.g., games and toys (Sicart, 2023). Since playable software can include more categories than toys and games, Sicart (2023) proposes playthings as the general description of things people interact with during play. Playthings can have agency—acting on their own, being acted upon, or acting on the environment. The concept of plaything puts the body at the center of possibilities of technology when it comes to playing (Sicart, 2023), which is essential since people use their bodies to explore and appropriate playthings (Sicart, 2017). The body is often the instrument or recipient of the pleasures of playing, e.g., feeling the body in movement or the material qualities of playthings, proximity of other people, and laws of physics (Sicart, 2023).

2.2.4 Play and computation

Computers are playthings that perform calculations quickly and precisely, acting on complex input and using sensors to transform analog input into computable data (Sicart, 2017). Playthings with computation can sense, interpret, and communicate with the environment, enriching play possibilities. Furthermore, playthings make suitable play companions as they augment the world by enhancing perception, providing feedback during play, and processing multiple data layers. Computation, e.g., sensors and data, is a form of expression and can facilitate sensual play and enhance the aesthetics of play. Finally, computation and play are natural partners as expressive ways of interacting in the world.

2.3 Table-top Roleplaying: Dungeons & Dragons

2.3.1 Games

Games are systems where players engage in make-believe conflict, defined by rules that end in some form of quantifiable outcome (Salen & Zimmerman, 2003). Further, a basic pattern of games can be described as 1) input from player action, 2) output of the game to the player, and 3) players' internal process, e.g., decision-making. Playing a game is experiential (Salen & Zimmerman, 2003), experienced through participation (Fullerton, 2009), and games facilitate play and can naturally occur as players interact with each other and the game (Salen & Zimmerman, 2003).

2.3.2 Table-top Roleplaying

Table-top roleplaying games (TTRPGs), e.g., D&D, are one of the three basic types of roleplaying games (RPGs) (Medler & Magerko, 2010). Table-top implies a physical aspect of using pen-and-paper around a table (Chung, 2013). RPG is defined as a shared fantasy that engages individual imagination guided by game rules (Chung, 2013)–constraints concerning game mechanics and content (Medler & Magerko, 2010). Also, the game rules influence the gameplay and the make-believe story (Lankoski & Järvelä, 2012). Additionally, every TTRPG has a rulebook, a gamemaster facilitating the game, and players that adopt the role of a character (Chung, 2013). Furthermore, the player designs and roleplays their character while interacting with other characters–making decisions and performing as their character with facial expressions, voices, and gestures. Also, roleplaying a character’s decision-making and
performative aspects have theatrical and improvisational qualities as the players collectively shape their game's fantasy (Medler & Magerko, 2010). The defining feature of roleplaying is taking the role of and pretending to be a character (Lankoski & Järvelä, 2012). Further, a character can be defined as an interpretation of a make-believe character in a game, and immersion is a state where the make-believe, to some extent, takes over the game's experience.

Typically, TTRPGs do not include digital artifacts but rather use supportive physical objects like dice, character sheets, boards, and miniatures (Buruk et al., 2017; Buruk & Özcan, 2016) and players' imagination (Buruk & Özcan, 2017). Also, TTRPGs are guided primarily by talk and interaction (Adams, 2013). Moreover, action, perceived action, and described action are cognitively similar, while sensory and experientially different (Lankoski & Järvelä, 2012). However, recent research integrates digital artifacts to alter narrative, playful, and functional properties (Buruk et al., 2017). Digital artifacts in the context of TTRPGs should avoid using excessive visual feedback to avoid distracting from the game, should not prevent social communication, and preferably use gestures, voice, and tangible inputs (Buruk & Özcan, 2017). Furthermore, the artifact should be used for simple actions like attacks or skills connected to the outcome of the dice roll, which the players can express concerning the narrative. The artifact can be a part of the make-believe characters toolset and be upgraded in-game and in the physical world, preferably customizable from scratch with pre-designed parts. Additionally, having the artifacts connected to the character can increase the immersion and connection to the make-believe world (Buruk et al., 2017; Buruk & Özcan, 2016, 2017), which is further enhanced by movement-based gameplay (Buruk et al., 2017). Finally, previous studies suggest that computation may enhance the sensory experience of TTRPGs (Buruk & Özcan, 2017).

2.3.3 Dungeons & Dragons

“Remember, the games are about the people, not the rules, the dice, the weapons, the kill, no, people are the game.” – Frank Mentzer, Editor 1st Edition D&D Core Rules (Forgia Storie, 2022)

Games are a great way of exploring worlds that do not exist, and Dungeons & Dragons (D&D) is the original (Arneson & Gygax, 1974; Dungeons & Dragons, 2014). D&D is an exercise in collaborative creation, story-building, and making memories and friendships (Dungeons & Dragons, 2014). Furthermore, D&D is a complex combination of rules, imagination, randomness, determinism, discovery, knowledge, cooperation, and competition (Ellis & Hendler, 2017). Moreover, roleplaying allows players to engage in extraordinary activities, become new people, and witness unbelievable situations restricted only by their shared creativity (Adams, 2013). Also, players roleplay characters with diverse motivations, backgrounds, and abilities to explore make-believe worlds, overcome challenges, and build relationships using dice rolls to determine the outcome of their actions (Sidhu & Carter, 2021). Players do this by taking control of a character's dialogue and actions, which can be a deeply personal process as a player merges their mind with a make-believe character resulting in a high level of attachment (Adams, 2013).

Moreover, D&D requires players to willingly use their imagination and push themselves to solve problems, share ideas, and imagine what could be (Dungeons & Dragons, 2014). D&D is designed with rules to structure these make-believe worlds to determine the consequences of actions. There are two roles of players in D&D, the adventurers and the Dungeon Master (DM) (Ellis & Hendler, 2017). Each adventurer creates a character and collaborates with other characters to solve puzzles, battle monsters, and discover treasure in
dungeons and ruined cities (Dungeons & Dragons, 2014). The other role is the Dungeon Master (DM), played by one player and acts as the game’s lead storyteller and referee—creating adventures, determining the outcome of player action, and narrating the experience. Additionally, the DM roleplay every other character and monster in the adventure.

Anything is possible in a game of D&D, but the dice make particular outcomes more probable than others. In essence, the basic pattern of playing D&D can be described in three steps: 1) DM describes the environment in which the players are located, 2) the players describe their actions and what they want to do, 3) the DM narrates the result of the player’s actions (Dungeons & Dragons, 2014). Finally, the three pillars of adventuring into the game of D&D include exploration of the make-believe world, social interaction between adventurers and monsters, and combat, maneuvering battles with weapons, spells, and movement.

2.3.4 Game Mechanics, Dynamics, Aesthetics and Player Actions

First, game mechanics can be defined as the components of the game level of data (Hunicke et al., 2004), essentially being the functionality—dice rolling, ability checks, combat actions in D&D. Second, game dynamics is the behavior acting on player inputs over time, and encourages and enables individual aesthetic player expression, in D&D this relates to players creatively solving obstacles, roleplaying the results of the dice rolls, and using gestures and speech to explain what they do. Third and final, game aesthetics is the emotional reactions evoked in the players while interacting with the game dynamics and mechanics. Additionally, aesthetics relate to sensory experience, make-believe, drama, obstacles, social interaction, discovery, and personal expression, and most of these are emphasized in D&D. D&D is a game of make-believe and drama where players face obstacles in uncharted territory facilitated by social interaction and self-expression. However, the sensory experience of D&D is sometimes limited to cognitive experience and imagination. The qualities mentioned above of aesthetics are brought to life through the game rules, make-believe world, and roleplaying. This project focuses on game dynamics and aesthetics through roleplaying with a tangible interactive plaything.

The core dynamic of D&D, particularly interesting for this project, is attack rolls. They require using a dice roll and verbal explanation of what the player is doing—attacking and casting a spell (Dungeons & Dragons, 2014). Attack rolls are related to player combat, including swinging, shooting, throwing weapons, and casting magical spells, and these actions have different requirements in the game. For example, a sword can be two-handed or a spell requiring ingredients, bodily movements, or spoken language. Moreover, players roll dice for attack rolls to determine, e.g., the spell's outcome concerning if it hits and how much damage it does.

2.3.5 Roleplaying and Interaction Design

Roleplaying and improvisation are techniques to supplement design methodologies (Medler & Magerko, 2010). Improvisation requires few constraints and designing in real-time without a facilitator and can benefit the design process by enabling the creation of new ideas without the fear of being judged. On the other hand, roleplaying is suitable for design methods with more constraints and can help evaluate prototypes. However, a combination of both improvisation and roleplaying may be beneficial for the design process. Furthermore, roleplaying is an interactive process of defining and re-defining the state,
properties, and contents of a make-believe world, with a power hierarchy between participants, where participants define the game through their character (Lankoski & Järvelä, 2012).

Design research relies on human connection and narrative tools to gather data through storytelling and experiences (Mcetee, 2017), and there are several methods utilizing roleplaying, narratives, and characters throughout the design process. For example, roleplaying and improvisation are essential for Bodystorming and user testing, enabling users to provide insights about the artifact and context (Medler & Magerko, 2010). Furthermore, Personas are often used to represent archetypical descriptions of users (Hanington & Martin, 2021) by visualizing user behavior and values (van Boeijen et al., 2020). Moreover, Scenarios are narratives designed to explore future user experiences by making ideas explicit and concrete, bringing personas to life, and following traditional story arcs (Hanington & Martin, 2021). Design Improvisation is a performative method for understanding the users’ experience of performing an existing action and can be used to connect with users’ experiences (Laurel, 2003). Design Games is a method inspired by games for breaking down power structures while collaboratively exploring various design aspects (Brandt & Messeter, 2004).

As a game, D&D fulfills a need for exploration and creativity that other games and mediums lack (Sidhu, 2022). Additionally, spontaneous creativity in D&D provides unique creative and improvised experiences without constraints and the need for perfection. There are few safe social spaces for adults to test and try out ways of being without repercussions, and D&D’s flexible game design offers players great agency to express themselves, as creativity is a natural part of playing the game. Further, the creative freedom offered by D&D is the primary motivation for its contemporary appeal.
3 RELEVANT DESIGN EXAMPLES

3.1 The Deck of Many Animated Spells

_The Deck of Many Animated Spells_ (Figure 1) is a deck of animated cards designed to create the feeling of casting a spell in D&D. Additionally, it provides the user with a tangible artifact with descriptive information about the qualities of the spell, e.g., range and components. For this study, _The Deck of Many Animated Spells_ provides an example of a tangible artifact that offers the user a tangible experience of using spells while playing D&D. It also provides quick access to the information needed to use the spell. With that said, even if the cards take one step towards embodying the make-believe spellcasting of D&D, the card lacks interactive qualities beyond tilting with the hand, e.g., individual creativity and expression concerning the embodiment of casting a spell.

![Figure 1. The Deck of Many Animated Spells](image1)

3.2 D&D Beyond

_D&D Beyond_ (Figure 2) is a digital platform for playing D&D that allows players to create and manage characters and access rulebooks and other resources. Additionally, it allows the player to roll virtual dice, e.g., on a smartphone or computer. It is one platform containing everything a player needs to manage their character. In contrast to _The Deck of Many Animated Spells_, _D&D Beyond_ employs digital means to provide players with easy access to the information and tools they need to play their character. More, _D&D Beyond_ is a comprehensive tool providing information concerning all aspects of the game, whereas _The Deck of Many Animated Spells_ is specifically for spells. Furthermore, what is fascinating about _D&D Beyond_ as a design example in this project is their choice of providing players the option to completely digitalize dice, removing the need for interaction with tangible artifacts beyond screens.
3.3 Roll20

Roll20 (Figure 3) is a virtual tabletop platform that enables players to play D&D remotely, digitalizing, e.g., character miniatures and maps. Furthermore, players can chat via voice and text while sitting on their computers, and it can be used in combination with D&D Beyond. As such, Roll20 is another example of moving D&D into the digital world, removing the need for tangible miniatures of player characters, monsters, and environments. It also removes the need for socially interacting in a physical context.
3.4 Wyldcard

Wyldcard (Figure 4) is an interactive card artifact for tabletop gaming made up of plastic cards with e-ink screens that players can customize. More, the cards can contain information such as character statistics and attacks. The cards were designed to be grounded in the physical world while at the same time implementing complex game mechanics run by a computer—essentially combining the benefits of the physical and digital worlds. Wyldcard is an incredibly fascinating design example for this project as it tries to accomplish a similar aim—designing a tangible interactive artifact to enhance the tabletop gaming experience. The artifact combines the tangible and instructive aspects of The Deck of Many Animated Spells while providing the customizability of a digital artifact such as D&D Beyond. Nevertheless, it does not prompt or allow the user to, in an embodied way, creatively express and roleplay their character's actions, e.g., swinging a sword or casting a spell, which is the direction of this project.

Figure 4. Wyldcard

3. WEARPG

WEARPG is an RPG system based on a make-believe world where characters are granted the power of the elements, choosing two to define the character's main attributes (Buruk et al., 2017). To play the game, players use a wearable called Elemental Gauntlet (Figure 5) which is an arm-worm device with motion tracking, haptics, and visual feedback. Additionally, a tangible prop called Luck Stone (Figure 5) is included and is similar to a conventional dice. What is fascinating with WEARPG is that players can customize the wearable artifact based on their character's characteristics—elemental powers used and placement on the arm. This customization aimed to create a perception that the artifact was connected to the character and have the artifact be viewed as part of the character's costume to increase immersion which is also relevant for this project. However, whereas WEARPG approaches the customizable, designed artifact from a wearable perspective, this project approaches it from a tangible handheld perspective. Another fascinating aspect of WEARPG is that the goal of the artifact's interactivity was to appeal to the senses without being distracting from the game, which is also essential in this project. WEARPG diverges from this
project as it was created as a new game in a vacuum, whereas this project needs to be designed specifically for the context, rules, actions, and culture of D&D.

**Figure 5.** Elemental Gauntlet and Luck Stone
4 METHODS

4.1 Methodological Approach

This project adopted research through design (RtD) as a methodological approach. RtD values designing and building experimental artifacts to develop knowledge, critique the present, or discuss the future (Gaver, 2012; van den Hoven et al., 2007; Zimmerman et al., 2007) through creatively and iteratively exploring the design space by making artifacts (Bardzell et al., 2015; Bekker et al., 2010). Moreover, these designed artifacts embody the combined knowledge of the design process (Zimmerman et al., 2007). Furthermore, RtD is appropriate for tangible and embodied interaction as it encourages the creation of several prototypes and learning by doing (van den Hoven et al., 2007). In addition to RtD, tangible and embodied interaction design requires a design process with methods focused beyond screen-based interaction (Jensen et al., 2005), meaning an embodied design approach that values understanding the central role of the body and movement when designing interactive artifacts (Loke & Robertson, 2013). Further, in design for movement-based interaction, designers need to become experts in movement, which, similar to RtD, is done through doing and experiencing (Hummels et al., 2007). This project applied movement-based methods such as Design Improvisation (Laurel, 2003) and Bodystorming (Márquez Segura et al., 2016) to understand the role of the body in the project’s design space. Another aspect of the project’s methodological approach includes play design. Play can be designed by considering play’s material and contextual aspects (Sicart, 2017), and designing interactive play experiences requires combining digital and physical material (Uğur Yavuz et al., 2021).

4.2 Literature Review

A literature review is a method for collecting and synthesizing the essence of previous research on topics of interest (Hanington & Martin, 2021). It enables the researcher to specify and understand the fundamentals of their design space, refine the research questions, and adjust their methods accordingly.

4.3 User Interviews

Interviews collect first-hand accounts of experience, opinions, and attitudes, cultivating a deeper understanding of people’s behavior in a specific context (Hanington & Martin, 2021; van Boeijen et al., 2020). The structure of interviews includes a script of questions (Hanington & Martin, 2021), and the interviews in this project were semi-structured (Myers, 2013), allowing for going off script to allow follow-up questions if the participant mentioned something fascinating.

4.4 Design Improvisation

Design Improvisation is a performative method to understand observed experience by mimicking physical posture and facial and gestural expressions of an action–invoking physiological reactions (Laurel, 2003). By getting into the body and emotions of a person performing an action, designers can notice what might be designed to make that action or role more enjoyable and rewarding to play. The method starts by capturing an interaction on
video and memorizing it to perform the action from the user's perspective. As the designer learns to perform the action, they can move on to improvising and exploring solutions to the problem. Even though rough, preliminary, or illogical, it stimulates creativity and leads to new solution spaces.

4.5 Bodystorming Workshop

Workshops are a participatory method to understand the user's world, e.g., through roleplay interactions and engaging participants in creative activities focused on assigned problems (Hanington & Martin, 2021). Bodystorming is an embodied ideation method for movement-based interaction design that enables reflecting on a design space's physical, relational, and social aspects (Márquez Segura et al., 2016). Further, Bodystorming is a sort of roleplaying that facilitates the creation of new ideas (Medler & Magerko, 2010). Roleplaying is facilitated by prompts describing the situation and suggestions of actions to be performed (Hanington & Martin, 2021) and enables designers to understand, develop, and determine the interaction between users and the interaction with a context by having participants use their bodies, senses, and minds (van Boeijen et al., 2020).

4.6 Synthesis

Synthesis is a method designers use to identify relationships and meaning in observed behavior in the research data through a process of visually organizing by externalization and spatialization (Kolko, 2010). Moreover, synthesizing human stories, e.g., interviews, is suitable for uncovering insights buried in the transcripts (Hanington & Martin, 2021). Affinity Diagramming is a method of synthesis where insights are put on individual notes and organized into relationships that arise over the activity of visual clustering.

4.7 Sketching

Sketching allows designers to work through their ideas and thoughts and stimulate new interpretations by externalization (Buxton, 2010). It dominates the early ideation stages of designing tangible interactive artifacts (Shaer & Hornecker, 2010). Sketches are quick and disposable expressions of unfinished design concepts and a way to reflect on ideas early (Buxton, 2010; Shaer & Hornecker, 2010). They are an exercise of imagination and exploration aiming to understand the materials used (Buxton, 2010). Sketching is an activity that goes beyond drawing on pen and paper (Buxton, 2010), and in this project, sketching included Physical Sketching (Shaer & Hornecker, 2010) to test out physical material and interaction, e.g., electronics and physical form and Pen and paper sketching (Buxton, 2010) to document and sketch out concepts. Furthermore, designing tangible and embodied interactive artifacts requires sketching methods that encourage and include integrating code, artifact form, behavior, information, and interaction (Shaer & Hornecker, 2010).

4.8 Prototyping and Testing

Prototyping is an essential design method used for iteratively creating and testing design artifacts with varying maturity levels (Hanington & Martin, 2021; van Boeijen et al., 2020) and is an essential method for designing interactive artifacts (Buchenau & Suri, 2000). A prototype represents the design concept created before the final design concept
exists to gain a first-hand understanding of existing and future conditions through interacting with the prototype. Prototypes have different goals and are built to test different aspects of the designed artifact (Houde & Hill, 1997). A functional prototype can be used to test technological functionality, e.g., using Arduino, which is advantageous because the low threshold of implementing functionality allows for experimenting with interactive behavior (Shaer & Hornecker, 2010). Equally important are experience prototypes, which focus on the experiential aspects of interacting with an artifact (Buchenau & Suri, 2000).

Experience Prototyping is valuable for understanding user experiences and context, exploring and evaluating design concepts, and communicating ideas to an audience (Buchenau & Suri, 2000). Furthermore, an experience prototype aims to explore what it may be like to interact with a design concept, emphasizing the experiential aspect situated in a broader context of use and how they influence each other (Buchenau & Suri, 2000; Hanington & Martin, 2021; van Boeijen et al., 2020). Experience prototypes use physical and digital prototypes and props with varying levels of functionality to create a realistic scenario to enable the user to experience the artifact (Hanington & Martin, 2021; van Boeijen et al., 2020). Adding some level of interactivity to the prototype enables realistic engagement (Hanington & Martin, 2021), and the designer must identify the essential part of the design concept to prototype interactivity (van Boeijen et al., 2020).
5 DESIGN PROCESS

5.1 Design Space and Design Process

The project's design process is based on the notion that every activity throughout the design process contributes to a deepening understanding of the design space (Figure 6). Design space is a space of potential made available by the context, e.g., collaborators, users, tools, technologies, materials, and social processes (Botero et al., 2010). Within that space are designers making decisions leading to design concepts. With this in mind, the designer's understanding of the design space is at the center of the design process, iteratively developing more profound knowledge through design methods and working with users and collaborators. Additionally, the tools, technology, and materials used by the designer inform their understanding of the possibilities within the design space. When the designer's understanding of the design space is mature enough, a design concept can be created—within the bounds of the context that make up the space—which can be tested to deepen the designer's understanding of the design space.

Figure 6. Design Model: Process and Space

5.2 Literature Review

The literature review used search engines and digital libraries, e.g., Google Scholar, ACM, DIGRA, and Malmö University library. Keywords used in the search included playful interaction, tangible interaction, Dungeons & Dragons, play, playfulness, playful artifacts, roleplaying games, embodied interaction, and table-top roleplaying. Additionally, literature was found by scanning the reference lists of papers, and specific authors were targeted in searches to find papers from established researchers in specific fields, e.g., Overbeeke for tangible interaction and Sicart for play.
5.3 User Group

The user group of this project was young adults playing D&D, aged between 20-40, representing a variety of ages, gender, ethnicity, and nationality. The experience of D&D varied from newcomer to experienced player and benefitted the understanding of the player experience. Additionally, some participants in the project were recruited specifically because of their combination of being interaction design students and D&D players—enabling inquiry related to D&D juxtaposed to Interaction Design.

5.3.1 Ethical considerations

Research ethics concerns the nature of the research and the researcher’s conduct, and the Swedish Research Council (2019), e.g., treating participants respectfully and honestly in conducting research (Myers, 2013; Swedish Research Council, 2019). The participants received an information letter in advance, followed by signing a consent form to make sure that they could make an informed decision about their participation, the project’s aim, and the data collection and usage of the project (see Appendix 1). This is an essential practice for the ethical usage of data in research (Myers, 2013).

5.4 User Interviews

Eight interviews were conducted, three in Swedish and five in English, each lasting 30-60 minutes. The interview participants were between the ages of 23 to 34, of different European nationalities, and had varying experiences playing D&D (Table 1). Five participants identified themselves as women and three as men. As an effort to keep participants anonymous, their data related to age, nationality, and gender has not been included in the figure below. The interview questions were generated in collaboration with ChatGPT and prompted based on insights gained from the literature review and concerning the project’s research questions (see Appendix 2). ChatGPT was used as a tool to kickstart inspiration in writing interview questions. Once generated, the questions were edited or removed to fit the aim of the interviews, and additional questions not prompted by ChatGPT were added. The audio of the interviews was recorded, with consent, and transcribed using the tool Descript.

<table>
<thead>
<tr>
<th>Interview Participant ID</th>
<th>Experience with playing D&amp;D</th>
<th>Interaction Design Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>Played Once.</td>
<td>Yes</td>
</tr>
<tr>
<td>I2</td>
<td>Around 3.5 years.</td>
<td>No</td>
</tr>
<tr>
<td>I3</td>
<td>5 months.</td>
<td>Yes</td>
</tr>
<tr>
<td>I4</td>
<td>5 months.</td>
<td>Yes</td>
</tr>
<tr>
<td>I5</td>
<td>20 years.</td>
<td>No</td>
</tr>
<tr>
<td>I6</td>
<td>5 months.</td>
<td>Yes</td>
</tr>
<tr>
<td>I7</td>
<td>5 months.</td>
<td>Yes</td>
</tr>
<tr>
<td>I8</td>
<td>About 1.5 to 2 years.</td>
<td>No</td>
</tr>
</tbody>
</table>
5.4.1 Synthesis User Interviews

The synthesis of the user interviews, using Affinity Diagramming, resulted in 10 themes touching upon different aspects of playing D&D, how interactive tangible playthings can be designed to enhance roleplaying in the game context and comparing D&D and interaction design.

1) Make-Believe

All interview participants mentioned that the freedom of roleplaying and improvisation that the game fosters is an essential part of the enjoyment of D&D, both concerning freedom of action and freedom of how the outcomes affect how the player may roleplay their character. Additionally, one participant mentioned that one cannot necessarily do anything wrong in D&D.

"There are no proper rules applicable. This is what I find interesting, that you can do whatever you want to do, and somehow the story still plays out and something happens." – I6

2) Roleplaying as Performativity or Loyalty to Character

The interview participants divided roleplaying into performativity and loyalty to character. Performativity concerns the theatrical aspect of playing another character, e.g., changing the voice or using gestures. Loyalty to character is concerned with staying true to the character when making decisions and actions within the game. Moreover, the performative aspect of roleplaying is applied explicitly for particular moments or actions, while loyalty to the character is seen as a permanent form of roleplaying during the game. Finally, having a character to perform also acted as a constraint to stick to while roleplaying in the otherwise limitless game.

"I think it is important. I get that people have different investment to their roleplay, their character. Some people just play and roll the dice and decide things. Other people delve into more on how their characters sound or do things. For me, I think it is really important that you do things as your character might have done them. It's really nice if you could actually perform as well a little bit. /.../ I wouldn't expect that people would do this in all of their games, but I think that being loyal to your character, the way that they behave is important." – I4

When it comes to roleplaying in D&D, it was interesting to learn from multiple experienced players that roleplaying is part of the game but not a requirement. It is better if players are allowed the freedom to roleplay as much as they want. It was fascinating to hear from the interview participant with about 20 years of experience that roleplaying can be discarded if a player does not want to roleplay, focusing on the performative aspects of playing a role in the game, while the loyalty to character seemed like a baseline requirement for roleplaying in D&D.

"If you think it's fun, absolutely. It can contribute to the immersion, then there are those who are not comfortable at all with roleplaying and in that case I don't think you should do it. Then it takes away from the experience /.../ Some may not be particularly comfortable with making a voice for their roleplaying or talking, acting out their character. They might just sit and know how their character sounds and play it in their head instead." – I5
3) Tangible Playthings for Communication

Several interview participants mentioned tangible playthings as an essential factor of the game. One way was for communicative purposes—explaining actions—and tangible playthings or digital artifacts make it easier. Multiple players expressed that explaining their imagined actions to other players and ensuring everyone understands can be challenging, as what is imagined in someone’s head probably will not be the same as in someone else. One player with experience as a DM appreciated using a 3D printer to create tangible objects to help visualize the otherwise hard-to-explain environment.

"It feels like it could become more alive. It is often that I think that when you want to explain something that you do and then like, it is missing. I don't think it's very easy to describe everything that you do, but then sound effects usually come into the picture instead. But it would have been nice if there were some kind of props that also, together with sound effects and the like, to make it easier to explain what I'm doing." – 12

Moreover, tangible playthings support roleplaying and immersion in D&D. Tangible playthings were described as visual playthings that could potentially encourage play and performance. Furthermore, they were described as a link between the imaginary world and the natural world, and the plaything could facilitate immersion and make the play experience more exciting. Additionally, the tangible playthings could connect the player and their character—prompting the player to feel more like their character. Finally, tangible playthings could be a more subtle way of embedding digital functionality in the physical world.

"First of all because it's a bit cool when you're a nerd and think that's fun. Secondly, it's probably easier to get into a role because once I hold the stuff, then I become my character and think of him in a different way than when I don't have it and I am still myself. /.../ And then it is very fun to swing a sword, staff or something." – 18

4) Tangible Playthings for Visualizing Character Actions

Another aspect of tangible playthings to consider was visualizing the players' character actions and building on the communication aspect previously mentioned. To be able to, in a more tangible and embodied way, use technology to visualize and show magic spells or weapons. Also, one participant reflected during the interview that the thought of having a tangible artifact for casting spells made them reflect on how the spell would be cast using bodily movements, which the participant had not considered before.

"I think an interactive D&D in which you play with some weapons that makes you move would be more interactive and exciting to play if you integrate a bit of technology in that. /.../ For D&D I want more of a reaction or interactivity from the weapon. /.../ I talk about these wands but for Magic Missile, that's the one [spell] I use the most because apparently I really like it. I never pictured how I throw it actually, so this would actually be really interesting. Like how would you throw three objects and what kind of technology you would use to do that and what your body movements would be." – 16

Another aspect concerning tangible playthings was the frequency of use. The most experienced player of the interview participants mentioned that combats in D&D can take much time already, and adding playthings to embody and roleplay every action would extend
it immensely. For this reason, the playthings might have more effect and use for particular essential moments or when there is a need for more detailed explanations.

5) Around-the-Table Experience
All interview participants prefer playing in a physical environment around a table. Being around a table supports social interaction when roleplaying the character, discussing what to do, grabbing physical objects with hands, and making gestures or expressions. These qualities were negatively affected when D&D was played remotely or through a screen. One participant expressed that human interaction is lost when playing remotely through a computer screen. Additionally, technology can enhance the around-the-table experience if it is unobtrusive and preferably without screens because when screens mediate the experience, the immersion is damaged.

"I would insist on maintaining the around-the-table social aspect and being able to perform freely around your character so you can actually keep the elements and qualities of D&D as it is, and not transfer them to the digital world." – 14

Additionally, there is a spatial aspect of tangible playthings in the context of D&D. Two participants reflected on the crowded space in a game, where a game usually takes place in a room around a table filled with other things such as food, maps, and miniatures. Further, the participants reflected on the size of a potential interactive plaything and how much one can move the body in physical space.

"I think this is interesting, but it also depends on the space and how much you want to embody. Because if you play on a board and let's say that you sit down and you play, I think it depends on the size of the prop, material or weapon. If you do use some weapons, some materials, I feel like there is a bit of like, need for more space so you can actually move your whole body to do that." – 16

6) Social Interaction
Social interaction when playing D&D relates to temporal and make-believe aspects–roleplaying, communicating, and reacting as their character to moment-to-moment events. Also, the blend between the player's personality and their character's personality created fascinating layers of social interaction. Also, players can talk about anything in the make-believe world, developing internal jokes and ways of communicating and interacting. Another aspect of social interaction in D&D is the recurring social gathering at someone's place to spend time together and play, which was highly appreciated by all participants, going as far as saying there is no D&D without social interaction.

"I think it is very fun, it is socializing within a fantasy world so there is a lot you can talk about during a session, high and low." – 12

7) Dungeons & Dragons and Interaction Design
All interview participants mentioned that there are ways of enhancing D&D as a game with the help of technology, although it should keep everything from the tangible and embodied aspects of D&D.
"I think it would be useful. I think actually D&D would be a good place to use technology. /.../ Sounds, good /.../ visuals definitely. I think visuals are what I miss the most. Like having a representation of the things that I use. /.../ You need to remember everything and I think having this kind of visual representation of what is happening would be helpful for me.” – I

Interview participants compared the process of playing D&D with design methods like Bodystorming and Design improvisation as methods of embodying the user's actions and acting them out and adding that performative elements found in D&D are already part of interaction design but that it can be done more. Several participants also compared playing D&D with the design process concerning researching, ideating, and testing.

8) Dice Rolling and Sketching

Two participants compared sketching to dice as a way of keeping an open mind and seeing what happens—focusing on trying things out to see what happens rather than thinking everything through before starting.

“I would roll the dice, have more randomness in interaction design. Trying out things and seeing how the work rather thinking a lot before you implement them. I would be more, sketching, prototyping, testing things rather than having this huge step of research before doing this. For example, this element of you do things in D&D, you may die and people can help you or not but that's fine. Because its just a game. /.../ Missing the responsibility if things don't go well, that's totally fine in D&D. This would be really nice to use in interaction design.” – I

9) Playful Space

Comparing the D&D space to design space, several participants expressed that D&D was inherently more light-hearted and left space open for creativity that encouraged risk-taking rather than following a strict process. Furthermore, participants expressed that D&D is supposed to be fun and make little sense, while interaction has to make more sense of things and be serious, with responsibilities. Also, a few participants reflected on applying the playful space mindset to parts or the whole design process.

“The way you decide on an action to achieve this goal is very different. In interaction design you need to reason the decisions, follow some methodological steps to arrive at the best conclusion. In D&D its more open because you can discuss and sometimes you just take a risk and make a decision that is totally irrational.” – I

10) Roleplaying for Understanding Design Space

Multiple participants connected the roleplaying aspect of D&D with user research in interaction design, making a difference between making a representation of a user and embodying a character. Interaction design often requires entering people's lives, and instead of having an interview, the designer can get immersed in the activity and participate. Additionally, adding a contextual aspect to the roleplaying as the characters in D&D make different decisions depending on where they are in the game. Furthermore, one participant suggested roleplaying as a user and as an artifact.
“I’m thinking about the part of interaction design when you have to get into people’s lives and understand some activity around them and I would say that there are a lot of times that the researcher needs to be part of a process. Instead of having an interview with questions, you go and run with the athlete that you want to ask questions. The researcher needs to be part of another world for some seconds is something that shares a lot with D&D” – 

5.5 Design Improvisation

Two fantasy movie scenes from YouTube were chosen as the material for Design Improvisation, 1) Conan the Barbarian practicing his sword (ajoynrz, 2006) and 2) Jonathan Strange magically creating sand horses (shivnz, 2015). Each scene was looped, performed, and analyzed, focusing on understanding the bodily movements and experience of performing the actions (Figure 7). Moreover, a metal pipe was used as a sword prop for the Conan the Barbarian scene, and no props were used for Jonathan Strange. Each scene was about one minute long and performed ten times, with pauses in-between to reflect on the experience of performing the scene. Performing this method generated a more profound understanding of how the body is used and experienced when performing fantasy-themed actions—sword usage and spellcasting. Moreover, it generated insights into how to design interactions with an interactive artifact to enable these performances.

Performing and analyzing the Conan the Barbarian scene gave insights into the experience of the sword as a performative art (Figure 8). The way the sword is used is quite deliberate, swift, precise, and fluent. Moreover, it is more zen-like rather than an act of mindless intensive swinging. Mimicking how Conan moves with the sword instilled the feeling of an emotional connection between the body and the sword. Furthermore, there is a level of confidence reclaimed through bodily movements as the scene progresses. The whole body is used, and each swing is a clear and distinct gesture.
Performing and analyzing the Jonathan Strange scene allowed for an immersive experience of casting magical spells (Figure 9). It feels like Jonathan casts the spell with his entire being–body, and soul–requiring much concentration. Further, he prepares himself by shaking his arms and taking a deep breath as he walks up to perform the spell. Moreover, it seems neither easy nor convenient, and one can feel his body shaking, especially the face tensing up, and hear him growling and exhaling. Also, casting the spell seems deeply embodied and contextual as he uses his body and the resources at hand–the sand beach. The spell goes through a few phases. First, Jonathan establishes a connection with the natural material of the environment, in this instance, sand. The moment he feels the connection, he knows he can command it–casting the spell.

Furthermore, his interaction with the sand becomes the input device, controlled directly with gestures. Second, he shapes the sand into horses, sending them toward the shipwreck. Third, he uses a distinct action to command the horses to jump over the boat. Finally, Jonathan uses another distinct action, lifting his body and commanding the sand to lift the boat. The spell is channeled throughout the event, requiring unbroken concentration and distinct movements. In the end, Jonathan is somewhat surprised that he managed to pull it off, again echoing the notion of difficulty casting magic.
5.5.1 Synthesis Design Improvisation

Through Design Improvisation, the experience of embodying Conan the Barbarian and Jonathan Strange and their techniques provided insight into the bodily movements related to the make-believe usage of swords and spellcasting—the experiences described above guided the sketching, Roleplaying Bodystorming Workshop and the final concept. E.g., mimicking Conan gave insights into the connection between the person and the sword and how deliberate every swing is. Also, mimicking Jonathan gave insight into how spellcasting can be embodied and connected to the environment around him. Furthermore, both actions rely on bodily movements to communicate the action, which can be directly compared to actions in D&D.

5.6 Bodystorming Workshop

Five people (Table 2) participated in a 30-minute roleplaying workshop to explore bodily movements and embodied expression and imagination related to D&D actions—weapons and spells. Four participants identified themselves as women and one as men, and each participant received 1-2 prompts to perform and was recorded with consent.

<table>
<thead>
<tr>
<th>Workshop Participant ID</th>
<th>Experience with playing D&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>3 month</td>
</tr>
<tr>
<td>W2</td>
<td>5 months</td>
</tr>
<tr>
<td>W3</td>
<td>5 months</td>
</tr>
<tr>
<td>W4</td>
<td>5 months</td>
</tr>
<tr>
<td>W5</td>
<td>5 months</td>
</tr>
</tbody>
</table>

The workshop was conducted around a table, and the participants were confined to roleplaying their prompt around the table to keep it close to a typical D&D playing session to keep the spatial aspect the same, a decision informed by the result of the user interviews. Nine character prompts, based on information from D&D Beyond (2023), was created and described a character's race, class, and action (weapon or magic), e.g., a Dragonborn Wizard casting Magic Missile (Figure 10) and the complete list of prompts can be viewed in Appendix 3.
5.6.1 Synthesis Bodystorming Workshop

The Bodystorming Workshop provided fascinating insights concerning performing weapon attacks and spellcasting in D&D while sitting around a table (Figure 11). There were a few takeaways from the workshop. The first takeaway is that even if players sit around a table while playing D&D, there is plenty of opportunity for bodily movements, especially with the upper body. Second, also identified in the interviews, was that players have different comfort levels when it comes to performative roleplaying using their bodies. Third, a final takeaway, also identified in the Design Improvisation, was that the performed make-believe actions were distinct, embodied, and short.

Figure 10. Character prompt: Dragonborn Wizard casting Magic Missile

Figure 11. Bodystorming Workshop
5.7 Sketching

5.7.1 Physical Sketching

Physical sketching was conducted in a few different ways to gain an understanding of electronics and tangible materials in the project context. First, sketching with Arduino was conducted to understand better how sensors and actuators, e.g., gesture and voice recognition, work to gain insights into the opportunities and obstacles of using technology in the project. Further, it was used to playfully explore bodily movements with electronics (Figure 12). For example, separate sketches exploring gesture recognition using an Arduino Nano BLE Sense and TinyML and TensorFlow to train a model to recognize different movements, controlling a vibration motor using an Arduino Uno and a potentiometer, and visuals and light using Arduino Uno and RGB LED. Insights gained from sketching with electronics include:

● Learning predefined gestures based on existing ML models is hard to mimic, even with written and visual instructions.
● The size and amount of electronics needed to produce the outputs for the concept are small.
● Roleplaying gestures, voice, and bodily movements can be individually designed using machine learning—using Arduino Nano, TinyML, and TensorFlow.

Second, sketching was done by exploring physical objects with varying shapes and sizes (Figure 13). Further, the objects were explored as handheld and wearable, exploring moving them around and using gestures. The purpose of sketching using different physical objects was to understand better what type of shape and size of an interactive artifact would be appropriate for the context and how these qualities limit or enable movement-based interaction standing up or sitting down. Insights gained from sketching with physical objects include:

● The objects need to be constrained in size because of the spatial aspect of sitting down around a crowded table, e.g., having a real-sized sword would limit movements and use.
● Holding a physical object limits gestures from the hand; on the other hand, will the device be able to notice the subtle finger or hand movements, and does it need to?
● A handheld device could be designed to resemble weapons and magical objects, e.g., spellbook and sword, more precisely than a wearable.
5.7.2 Pen and Paper Sketching

Pen and paper sketching was conducted to draw out and visualize the different components of the design concept, e.g., sensors, actuators, interaction qualities, and material form (Figure 14). Insights gained from sketching with pen and paper include:

- The players can get nuanced output depending on their level of roleplaying.
- The precision of the sensor reading is less important than the impact of the juicy\(^3\) output received.
- The concept should focus on the ability to facilitate roleplaying action and experience.
- The physical form should resemble objects from the make-believe world rather than being abstract to help players relate to their characters.
- Spell casting is more interesting to prototype in this project because it lacks real-life representations.
- Spells in D&D require components, verbal, somatic, and material; these can be directly translated to inputs.

\(^3\) The term *juicy* comes from game design describing minimal input generating tons of cascading action and response (Johansson & Purho, 2012).
5.8 Prototyping and Testing

5.8.1 Prototyping

Prototyping was conducted in different phases. The first step was to get the different sensors and actuators—gesture, visual, haptics, and olfactory—working as separate prototypes—gathering the right components, wiring the electronics, and writing the code (Figure 15). ChatGPT was tried once for one of the coded prototypes and provided a helpful base for editing the code to fit the purpose of the prototype, but for most of the prototyping, coding was done by the designer. The second step was to, one at a time, combine the individual prototypes to make a complete prototype using all the sensors and actuators (Figure 16). The third step was to 3D-print physical prototypes of the artifact representing weapons and spellcasting actions (Figure 17). The fourth and final step was to combine the electronic prototypes with the physical 3D-printed prototypes (Figure 18). The prototyping ended up in three interactive prototypes and three prop prototypes to be used for testing. All were 3D-printed weapons, e.g., sword and spell book, made to fit the game’s characters.

Furthermore, the interactive prototypes were augmented with Arduino Nano boards and designed to react to user input to provide output. The interactive prototypes for the test used gesture recognition as input and different combinations of haptics, olfactory, and visual as outputs. Also, all prototypes were intentionally 3D-printed in varying sizes.
Figure 15. Separate Electronic Prototypes

Figure 16. Combined Electronic Prototype

Figure 17. Physical Prototypes
5.8.2 Testing

The prototype test was conducted during a regular D&D play session with five participants and lasted about 60 minutes (Table 3). The prototypes were introduced when the players entered combat, and during each player's turn, they could use the prototypes to perform their action if they made an attack roll. To make their attack, the players rolled the dice to determine whether or not their character's attack hit. If the attack was successful, the player used one of the prototypes to perform their attack (Figure 19). At the end of the play session, each participant reflected on how the prototypes impacted the experience of playing D&D with interactive artifacts.

<table>
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<tr>
<th>Prototype Test participant ID</th>
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</tr>
</thead>
<tbody>
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<td>5 month</td>
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<tr>
<td>PTP2</td>
<td>3 months</td>
</tr>
<tr>
<td>PTP3</td>
<td>5 months</td>
</tr>
<tr>
<td>PTP4</td>
<td>5 months</td>
</tr>
<tr>
<td>PTP5</td>
<td>5 months</td>
</tr>
</tbody>
</table>
The Experience Prototype test gave some fascinating insights about the concept. All participants expressed that the interactivity of the tangible plaything was enjoyable, and a few participants explicitly noted that the olfactory interaction was unexpectedly satisfying. Also, the smell produced by the spell needed to resemble how it would smell in real life, e.g., casting a fireball smelled like smoke. Furthermore, the haptic and visual feedback supported the player in feeling like they performed the action, and the bodily movement allowed them to connect with it. Moreover, the light from casting a spell from the spell book hitting the Wizard player's face was appreciated. Overall, the prototype's interactive aspects enhanced the roleplaying experience in D&D. Nevertheless, there may be a risk of the interactive tangible playthings limiting the imagination due to their tangibility and interactivity.

Another aspect that all participants brought up was how the interactive tangible playthings allowed them to get more into character. They enjoyed interacting with the playthings because it gave them a better sense of their character and their character's weapon, and using it enhanced their relationship. Moreover, the interactive tangible playthings made the roleplaying experience less abstract and more embodied, making it easier to get into fighting mode. Further, one participant expressed that the interactive tangible playthings allowed for playful situations and creativity in using the weapons in the game. Moreover, another participant expressed that, e.g., the light hitting another player's face when performing an attack enhanced the aesthetic and narrative experience. Even though participants appreciated the tangibility, interactivity, and increased realism of the playthings, two participants showed signs of having a hard time acting like killing someone because it seemed rather violent.

Finally, participants expressed an interest in customizing the playthings and adding additional outputs, e.g., lights for the sword. Also, the size of the playthings was appropriate for D&D and could be increased a little bit.
6 FINAL DESIGN CONCEPT

The final design concept is based on the notion that D&D players want to customize and personalize their weapons based on their character. One character may use a sword while another uses a bow, or one may use a spellbook to cast a spell, and another uses a wand. The design concept comprises two parts, 1) a modular electronic component and 2) a tangible plaything to make the threshold for a player making and customizing them as low as possible. The modular electronic component includes an Arduino Nano using built-in gesture recognition as input and gives visual, olfactory, and haptic outputs (Figure 20). The tangible plaything can be a 3D model downloaded on an open source site, designed in a 3D-modeling software, or made from other physical materials like cardboard (Figure 21). These two parts can be combined to create interactive and tangible Weapons of Microcontroller Destruction for any make-believe D&D adventure (Figure 22).

![Figure 20. Modular Electronic Component](image)

![Figure 21. Tangible Plaything](image)
Depending on the player's preference, the artifact outputs can be added or removed to create the desired experience. The final design concept focused on spellcasting, and in this case, a spellbook. The artifact is loaded with a handful of spells, triggered by gestures with different combinations of output intensity, e.g., depending on the power of the spell, the visuals, vibration, and olfactory output is more or less intense. Casting a Fireball glows red, smells like smoke, and makes the spellbook vibrate, and casting Magic Missiles glows purple, odorless, and makes the spellbook vibrate. The spellbook adheres to the component rules needed by each spell in D&D, where some spells require bodily movements, speech, materials, or a combination. The player can use the basic predefined gestures: up, down, left, and right as input, or for more advanced customization, personalize their gesture recognition using TensorFlow and Machine Learning.
7 DISCUSSION

7.1 Tangible and Embodied Interaction for Dungeons & Dragons

7.1.1 Interactive Tangible Artifacts for Dungeons & Dragons

Tangible artifacts utilize the sensory and expressive physical capabilities of the human body by augmenting playthings with computation (Bakker et al., 2012; Hornecker & Buur, 2006; Hummels et al., 2007; Shaer & Hornecker, 2010), enhancing performance (Krestanova et al., 2021; Shaer & Hornecker, 2010). These playthings can have agency (Sicart, 2023) and act on combinations of inputs from the environment to enrich play possibilities by providing feedback (Sicart, 2017). Testing the concept revealed that interactive playthings enhance the sensory and experiential aspects of playing D&D. Multiple test participants mentioned how the olfactory interaction related to magic spells was satisfying and improved the roleplay experience, and one participant mentioned that it had an impact on their decision-making as a result of giving context to the spell. “The most unpredictable satisfying element for me was the burning smell with the magic attack which gave some context on the spell the wizard was using and led me to direct the next actions of my character. Really cool experience.” – PTP4

Further, the concept’s combination of feedback supported understanding the game’s performed make-believe action. The sense of touch and hand are essential for experience (Bret, 2011), and haptically rich materials evoke gestural interaction (Döring et al., 2012). The concept’s tangible and haptic feedback was highlighted as elements that contributed positively to the experience of playing—the weight and material presence of having it around were considered good additions. Another type of feedback that can be seen as distracting if used excessively is visual feedback (Buruk & Özcan, 2017). The concept used bright visual feedback, which was received positively in this test. The visuals contributed to the other types of feedback in creating more immersion, and the effect of light coming out of the spellbook, reflecting on the player’s face, was enjoyable. “It felt very animated to have something buzzing in my hand while gesturing the attack. The light in a players face when they were pretending to hit was a nice touch aesthetically and in a narrative sense.” – PTP4

Playthings augmented by computation are suggested to enhance the sensory experience (Buruk & Özcan, 2017) when using movement-based gameplay (Buruk et al., 2017) using the body as an input device in physical space (Shaer & Hornecker, 2010). The result of testing the concept adds to this conclusion and suggests that interactive tangible playthings for D&D improve the roleplaying experience and immersion. Furthermore, game dynamics and aesthetics concern the player’s behavior and sensory experience (Hunicke et al., 2004), and the dynamic use of the concept generated emotional responses in players that affected their roleplaying experience. Also, this may partly result from applying juicy feedback—minimal input generating much output (Johansson & Purho, 2012). Further, when designing sensor interaction, sensor precision, explicit and implicit interaction (Shaer & Hornecker, 2010), and the meaning of the data are important to consider (Fernæus et al., 2008). Also, interactive artifacts designed for play must include the appropriate aspect of play (Sicart, 2017). The concept applied the juicy feedback, with minimal focus on sensory precision and meaning of data, focusing on providing explicit interaction where the player’s
actions in the context of D&D created the experience. “The spellbook was very fun, it was nicer with the smell as well, although I would make it either more intense or put multiple donuts spraying from multiple spots.” – PTP1

Furthermore, this was a successful approach to tangible playthings for roleplaying in D&D because the computational aspect only is mainly noticeable by the feedback it provides to enrich the experience. Meaning that the player could appropriate the concept to their expression as the meaning of the input and output were not predefined with meaning or connection to the game’s outcomes. Instead, the concept was enhancing the roleplaying aspect of the game. Finally, one participant reflected on whether there is a risk that the tangible qualities of the concept have a risk of negatively impacting the imaginative part of D&D for players who are invested in performing freely. “About the interactivity, surely adds to the experience for me as a beginner. I guess if someone is very into performance they might have taken something from the imagination.” – PTP5

7.1.2 Interactive Tangible Artifact as a Gateway to Make-Believe Worlds

TTRPGs are typically analog games guided by physical objects (Buruk et al., 2017; Buruk & Özcan, 2016), speech (Adams, 2013), and players' imagination (Buruk & Özcan, 2017). Additionally, players roleplay a character–performing and making decisions based on their characteristics (Chung, 2013). These parts shape a collective make-believe world (Medler & Magerko, 2010). A challenge emerges as action, perceived action, and described actions are similar cognitively in the brain but different regarding sensory and experiential qualities (Lankoski & Järvelä, 2012). Additionally, multiple participants in the project expressed difficulty in communicating actions, and players risked not viewing a described event similarly. The results from testing the concept suggest that an interactive tangible artifact can enhance roleplaying and support players by making the game experience less abstract and more realistic and embodied. “I liked that it has some tangible feedback (vibrations, visuals etc) because you also know you performed the action. In general it makes the whole playing experience less abstract and more realistic and embodied.” – PTP2

At the same time, using the tangible artifact enhanced the immersion of roleplaying in a make-believe world. Tangible artifacts can be designed to be a physical part of the make-believe character’s toolset and increase immersion and connection to the make-believe world (Buruk & Özcan, 2017). Interacting with the concept allowed the players to get more into their character and better understand the type of character they roleplay and what weapons they use. Further, having a physically present plaything gave some players an extra pleasant feeling. “I like interacting with the artifacts because it gives a better idea on the type of the character you play - you see the weapons that she/he is using and by that you can better identify with her/him.” – PTP2

Tangible and Embodied interaction focuses on the relationship between computational artifacts, humans, and their situatedness in the physical and social world (Dourish, 2004) to enrich physical space with digital functionality (Shaer & Hornecker, 2010). Moreover, play happens in contexts designed for play shaped by playthings, people, and the environment (Sicart, 2017). The inclusion of the concept in the context of D&D impacted the connection between the make-believe world and the physical world, where the concept acted as a gateway to immersion into the make-believe world. The digitally augmented tangible artifact linked the physical and the make-believe world together, enriching the aesthetic experience of roleplaying in D&D. “I think it enhances the roleplaying, makes you get more into character” – PTP1
Playthings are the ultimate thing for realizing play is possible (Sicart, 2017), and the inclusion computation that supported movement-based and sensory experience supported the players in getting into their character and the make-believe world. Combining speech and bodily movement enhances performance (Napier, 1993), and interactive tangible artifacts can enhance performance, expression, and storytelling (Krestanova et al., 2021). The concept enhanced the experiential aspect of playing D&D by creating opportunities for being playful and creative in the use of weapons in D&D. The concept was also described as narratively and aesthetically pleasing in the sense that it created new sensory, movement-based, and tangible experiences in D&D's make-believe gameplay. Further, this is fascinating because the sensory and bodily experiences in D&D can often be neglected in favor of cognitive imagination. “Leads to more playful situations in the game and let's you be more creative of how to use the weapons” – PTP3

Throughout the project, the voluntary aspect of roleplaying was considered noteworthy. Players expressed both in the interviews, showed in the Bodystorming workshop, and during the prototype testing that there are varying levels of interest and comfort concerning roleplaying in a performative manner in D&D. Performance is a public display of actions (Hannah & Harsløf, 2008) and is not appealing to every player. Players during the workshop and prototype test demonstrated different levels of performance and comfort when roleplaying actions. A particular example was two test participants who showed exceptional resistance to using the concept to attack because it felt too real. These players, who usually have no problem verbally describing and being okay with killing monsters in the make-believe world of D&D, struggled to commit acts of violence with the concept, e.g., using the sword to tap the enemy gently on their head instead of swinging it. “It was interesting and exciting to have the props. It made it more real. I found it hard to act like killing someone because it seemed quite violent.” – PTP5

7.2 Juxtaposing Dungeons & Dragons with Interaction Design

When asked to compare D&D and interaction design, all interview participants initially needed help. However, it got easier as the interview continued once specific concepts such as design process, social interaction, and roleplaying were compared. Most of the interview participants compared the practice of playing D&D with design practice. Both practices require research, generating ideas, and testing things, but one significant distinction exists. D&D provides another level of freedom concerning actions and consequences. All interview participants described D&D as a game where one can do anything without consequences. The game is designed to allow for that type of behavior, a playful space for creativity—a game, a Magic Circle. Play is described as a space of creative expression in make-believe worlds where people interact with interactive playthings, people, and contexts and happens in spaces designed for play (Sicart, 2017).

Moreover, the Magic Circle is described as the barrier between the playful make-believe and the mundane worlds (Huizenga, 2016). D&D has, in other research, been described as one of a few practices for exploration and creativity with a forgiving attitude (Sidhu, 2022), and it could be a result of it embodying the concept of the Magic Circle. Interaction Design, on the other hand, being the opposite of a game while still being a creative practice, was described as a more rigid methodology, serious and strategic practice. Multiple interview participants suggested that interaction design can be inspired by the playful approach to the creativity inherent in D&D—suggesting that the Magic Circle as a
concept should be brought into interaction design. The question that follows is, naturally, how.

Play primarily happens in an environment designed for it (Sicart, 2017), and the designer could design the Magic Circle to infuse their design process with play. Two interview participants were discussing dice rolling as compared to sketching, where rolling dice in D&D often takes a more risk-filled approach to explore options and learn by doing, which can be compared to sketching, which is a method for working through ideas by externalizing them (Buxton, 2010). Sketches are disposable unfinished expressions reflecting ideas that exercise imagination to understand the materials used (Buxton, 2010) in a design space. Similarly, actions in D&D are rarely performed with a complete idea of the situation and are sometimes shots in the dark to test ideas to solve problems in the make-believe world. Applying the Magic Circle to sketching could set designers free to creatively express themselves by engaging in a make-believe world where they can engage with ideas, technology, people, and context by adopting characters, roleplaying, and improvisation in make-believe worlds. Moreover, roleplaying is described as an iterative process of playing a character to define and re-define the state, properties, and contents of a make-believe world (Lankoski & Järvelä, 2012), which is a description very similar to the nature of sketching.

Although roleplaying and improvisation are already part of design methodologies to facilitate, e.g., ideation and prototype testing (Medler & Magerko, 2010), the Magic Circle can empower these methods with play and judgment-free design space. Multiple interview participants highlighted these qualities as essential in D&D and important in interaction design. The Magic Circle may be applied to other design methods that make use of roleplaying, improvisation, and make-believe characters and worlds, such as Design Improvisation (Laurel, 2003), Bodystorming (Márquez Segura et al., 2016; Medler & Magerko, 2010), Design Games (Brandt & Messeter, 2004), Persona, and Scenarios (Hanington & Martin, 2021). Design Improvisation, proven helpful in capturing and mimicking real-world user actions, could be expanded to make-believe actions and worlds, as shown in this project—mimicking spellcasting. Furthermore, Bodystorming allows the designer to understand users’ relationship to artifacts and their context (Medler & Magerko, 2010), and encapsulating this method inside a Magic Circle, facilitating creative and playful expression and make-believe may enhance the creative engagement with technology, users and the context. Both Design Improvisation and Bodystorming were mentioned by interview participants as design methods that were relatable to D&D. Personas are often used to characterize users and their behaviors and values and are often combined with a scenario, a narrative form of envisioning future user experiences through stories (Hanington & Martin, 2021). The apparent connection between these two methods and D&D is the core part of D&D—roleplaying characters in a make-believe story. While Personas and Scenarios often remain pretty general and impersonal, the Magic Circle could bring the methods and the designers into a more playful world where they can roleplay their characters and narratives and develop a deeper bond to users’ context and the artifact.

Moreover, this seems like an appropriate application of the Magic Circle in interaction design as narrative tools aiming to build human connection through experiences are at the core of the practice (Mcentee, 2017)—something interaction designers can take inspiration from D&D players. Furthermore, D&D might be a practice that gives designers new perspectives on a design by employing roleplay and improvisation as skills, which not everyone is comfortable with, as discussed previously. Also, some interview participants mentioned that D&D had affected their creativity and collaborative problem-solving skills, which may also benefit design.
The Magic Circle can be implemented practically in interaction design by taking essential aspects of play and make-believe to heart. Play is contextual and performative, including rules and goals in a delimited space (Sicart, 2017). Additionally, make-believe facilitates play by interacting with objects, technology, people, and contexts (Sicart, 2017). Moreover, playthings put the body in the center of experience (Sicart, 2023), and because play and games are experiential (Salen & Zimmerman, 2003) and participatory (Fullerton, 2009), movement-based interaction becomes crucial to establishing a Magic Circle. Interaction Design can take inspiration from qualities of D&D, such as imagination, randomness, determinism, discovery, cooperation, and competition. More, applying D&D's pillars of adventuring–exploration, social interaction, and combat (Dungeons & Dragons, 2014)—and giving space to spontaneous and improvised creativity.

7.3 Critical Reflection on Design Methodology

This project applied R&D as a methodological approach, which values building artifacts as a method of knowledge contribution (Gaver, 2012). It was an appropriate approach to meet the aim of this project—building interactive tangible playthings. Moreover, several different methods were applied to achieve the project's aim.

User Interviews are suitable for understanding people's experiences, values, and behavior (van Boeijen et al., 2020). The method struggled a bit when used to compare D&D and interaction design. However, whether the method was inappropriate or a complex topic for the interview participants needs to be clarified. Design Improvisation is a method that captures real-life interaction in the video to mimic it to learn about the experience (Laurel, 2003). Although this method was initially designed for user actions in real life, it can easily be applied to make-believe actions taken from, e.g., movies, as shown in this project, revealing that the method is super flexible. This was the first time the designer applied the method in a project, and it was easy to implement and gave important insights into the bodily experience of performing the make-believe actions. Bodystorming is an ideation method for movement-based interaction that allows designers to learn about the design space's physical, relational, and social aspects (Márquez Segura et al., 2016). A crucial decision for the success of this method in the project was to appropriate it for D&D—sitting around a table. The roleplay-driven Bodystorming workshop was situated around a table to mimic the typical gameplay experience, resulting in more realistic ideas of movement-based interaction for the design concept.

Moreover, when sketching ideas for tangible and embodied interaction, one must use more than a pen and paper to explore ideas. This project employed multiple sketching approaches to explore electronics, material qualities, and drawings of the ideas. Sketching the electronic and material qualities were critical to gain the understanding needed to decide on tangible and interactive qualities. A potential trap identified in this project when sketching electronic and material qualities is an inclination to get too advanced and precise before building a prototype which may result in getting stuck, e.g., trying to implement machine learning to get interaction working instead of choosing a more straightforward option that achieves the same result. Moreover, it is essential to explore options in sketching as long as it does not hinder the project.

Additionally, the same goes for prototyping functionality. This project applied functional prototyping for the designer alone to iteratively build the interactivity and tangibility of the artifact. When the prototypes had enough functionality to be tested, the focus transitioned to experience prototyping, focused on understanding the impact on the
experience of using the prototypes in the context of D&D. The experience prototypes was deemed critical to be tested in a D&D play session with D&D players to have the artifacts tested in a natural environment, not separate from the game. The prototype testing results would be completely different if the immersion of the D&D game were not encapsulating the test. The combination and progression of the prototyping worked well in this project for designing interactive tangible playthings.

Finally, ChatGPT was used in two brief instances to generate 1) interview questions and 2) code for one of the prototypes. The best way to describe ChatGPT is as a speedrun for inspiration, helping the designer to generate initial ideas to build on and edit. Both the interview questions and code require much human work to adjust to this specific project, and ChatGPT should not be considered more than another tool in the designer's toolbox. Both tasks used for ChatGPT could be solved by the designer alone but would have required additional work, especially the coding part, to get started. While a designer may possess the ability to complete the task alone, there is value in collaborating with AI to speed up some tasks in the design process or gain inspiration.

### 7.4 Implications on Society

D&D provides a safe and immersive space to explore make-believe game experiences that impact real life (Sidhu & Carter, 2021). D&D has the opportunity to provide a safe space for people to experience and reflect on different aspects of life, culture, and society. Furthermore, suppose interaction design adopts the Magic Circle concept and takes inspiration from how these issues are addressed in the make-believe worlds of D&D. In that case, interaction design can evolve its design practices. Overall, D&D has the potential to set people's creativity free from shackles to unleash it upon the world by roleplaying make-believe characters in make-believe worlds.
8 CONCLUSION

This project aimed to gain a deeper understanding of how interactive tangible playthings affect the roleplaying experience in D&D, and the results suggest that interactive tangible playthings enhance roleplaying in D&D in several ways. First, the interactivity of the plaything enhances the sensory experience by implementing sensors and actuators that produce output based on the player's actions in the game. Second, the tangibility of the plaything increases the connection between the player and their character, enhancing their roleplaying experience. Furthermore, the interactive and tangible aspects of the playthings bridge the physical and make-believe worlds.

Moreover, by juxtaposing D&D with interaction design, this project has examined their relationship and found potential aspects of D&D that can contribute to interaction design. The results suggest that the Magic Circle could be introduced into the interaction design process. D&D was described as a unique space, embodying the qualities such as being a safe space for expressing creativity and play without judgment, which stood out when compared to interaction during the project. Furthermore, even though roleplaying can be found in some design methods, the results of this project suggest that it can be beneficial to incorporate more in the process for designers to gain a deeper understanding of the design space.

While the amount of participants in the project limits the generalizability of the results, the project provides insights into how interactive tangible playthings can be designed for roleplaying in D&D and what effects they may have. Furthermore, this project suggests a relationship between D&D and interaction design as practices and that there are contributions to be found in juxtapositioning them. However, the limited study raises the question of what effect or result these insights may provide. Based on these conclusions, designer researchers should consider further researching interactive tangible playthings in the context of D&D to gain a deeper understanding of the design space. Moreover, to better understand the implications of incorporating insights about D&D into interaction design, future studies could identify further potential contributions between the practices and their implication.

This project’s main contribution to the field of interaction design is the design of an interactive tangible plaything that enhances roleplaying in Dungeons & Dragons named Weapons of Microcontroller Destruction. The first knowledge contribution is the artifact itself, embodying considerable insights and decisions based on the methods conducted during the design process. The second knowledge contribution is the juxtaposition of D&D and interaction design and the discussion about the potential use of the Magic Circle. The third and final knowledge contribution is the design methodology and process used in the project, which presents an RtD approach to designing interactive tangible playthings, emphasizing play and movement-based interaction as essential aspects.
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**APPENDIX 1: INFORMATION LETTER AND CONSENT FORM**

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**Information Letter**

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<th><strong>Project title:</strong> Thesis Project 2 – Max Angenius</th>
<th><strong>Period:</strong> April 10 to April 21</th>
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<tr>
<td><strong>Study manager:</strong> Max Angenius</td>
<td><strong>Studying at Malmö University,</strong></td>
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<td></td>
<td><strong>Faculty of Culture and Society,</strong></td>
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<td><strong>Education:</strong> Interaction Design</td>
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<td><a href="mailto:Max.angenius@gmail.com">Max.angenius@gmail.com</a></td>
<td><strong>Level:</strong> Master</td>
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**Presentation:** This is a master thesis project by Max Angenius, studying Interaction Design at Malmö University.

**Aim:** The aim of the thesis project is studying the user experience of playing Dungeons & Dragons experiment with applying interactive elements to the experience. The study will contribute to insights in how interaction design and play can make playing Dungeons & Dragons more interactive through the use of electronics.

**Implementation:** The study will conduct 30-minute interviews to understand the activity of Dungeons & Dragons as it is today. Participants have been selected based on having some form of experience playing Dungeons & Dragons.

**The voluntary requirement:** Your participation in the study is completely voluntary. You can stop participating at any time and no explanation is necessary. The researcher strives to guarantee confidentiality in the study in that no unauthorized person may have access to the material. The material is stored so that it is only accessible for the individual leading the study. In the reporting of results in the form of a degree project paper at Malmö University or in another form of publication, the respondents will be unidentifiable, and it will not be possible to link the results to individuals.

**Right of use:** The thesis project will be published in the Diva database and other forums required by Malmö University.

You are hereby asked to take part in this study.
### Informed consent

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<th>Project title: Thesis Project 2 – Max Angenius</th>
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<tr>
<th>Study manager: Max Angenius</th>
<th>Studying at Malmö University, Faculty of Culture and Society, S-205 06 Malmö</th>
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<tr>
<td>Your E-mail: <a href="mailto:Max.angenius@gmail.com">Max.angenius@gmail.com</a></td>
<td>Phone +46 40 665 70 00</td>
</tr>
<tr>
<td></td>
<td>Education: Interaction Design</td>
</tr>
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<td></td>
<td>Level: Master</td>
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I have been verbally informed about the study and read the accompanying written information. I am aware that my participation is voluntary, and that I, at any time and without explanation, can withdraw my participation. The person leading the study will strive to guarantee confidentiality in that no unauthorized person may have access to the material. The gathered material will be stored properly and used for research purposes only.

I hereby submit my consent to participate in the above survey:

Date: .................................................................

Participant’s signature: ..............................................
APPENDIX 2: INTERVIEW QUESTIONS

ChatGPT Prompts:
1. “Can you give me some inspiration for interview questions aiming to understand people experience of playing Dungeons & Dragons?”
2. “Can you suggest some more questions?”
3. “Maybe some questions related to Dungeons & dragons and technology?”
4. “Maybe some questions related to my research question: In what way can a close examination of Dungeons & Dragons contribute concepts, methods, and practices to Interaction Design, thereby reinforcing the bridge between interaction design and game design?”
5. “Can you give me some questions about the player experience of performing attacks with weapons or spells and performing ability checks in the game?”

Warm-up
1. How old are you?
2. How long have you been playing Dungeons & Dragons?

General Dungeons & Dragons
1. How did you first become interested in playing Dungeons & Dragons?
2. Can you describe a particularly memorable moment or adventure that you experienced while playing Dungeons & Dragons?
3. What do you think makes Dungeons & Dragons different from other types of games or activities?
4. Do you think playing Dungeons & Dragons has impacted your creativity, imagination, collaboration, or problem-solving skills?
5. How do you feel about the role-playing aspect of Dungeons & Dragons? Is it important to you, and why?
6. How do you feel about the social aspect of playing Dungeons & Dragons and has it impacted your social life?
7. How do you feel about the balance between combat and non-combat encounters in the game? Do you prefer one over the other, and why?

Weapons, Spells, Ability Checks
1. Can you describe a particularly memorable or exciting moment when you performed an attack, used a spell or an ability check?
2. How do you approach the use of ability checks in the game?
3. How do you approach teamwork when it comes to performing attacks or ability checks?
4. How do you think the experience of performing attacks or ability checks in Dungeons & Dragons compares to other types of games or interactive experiences?
5. How do you feel about the level of complexity or simplicity involved in performing attacks or ability checks in the game?
6. What do you think about the opportunity to have props that enable you to perform your weapon attacks, spells and ability checks with your body?

Dungeons & Dragons and Technology
1. How do you feel about the use of technology in playing Dungeons & Dragons?
2. How do you think technology has impacted the way people play Dungeons & Dragons?
3. Have you ever played Dungeons & Dragons remotely or online? How did that experience compare to playing in-person?
4. What do you think about the use of apps or other software to help manage character sheets, spells, or other game mechanics?
5. Are there some ways that technology could be used to enhance the overall experience of playing Dungeons & Dragons?

**Dungeons & Dragons and Interaction Design**

1. Are there any similarities or dissimilarities between interaction design and Dungeons & Dragons?
2. Reflecting on the gameplay mechanics of Dungeons & Dragons, how does that compare to concepts in interaction design?
3. Can you think of any specific examples from Dungeons & Dragons that could be applied to interaction design?
4. How would you compare the social and collaborative aspects of Dungeons & Dragons with the same in Interaction Design?
5. Do you think the role-playing aspect of Dungeons & Dragons could inform interaction design practices?

**SWEDISH**

**Uppvärmning**

1. Hur gammal är du?
2. Hur länge har du spelat Dungeons & Dragons?

**Generellt Dungeons & Dragons**

1. Hur kom det sig att du blev intresserad av att spela Dungeons & Dragons?
2. Kan du beskriva en specifikt minnesvärd händelse eller äventyr som du upplevde när du spelade Dungeons & Dragons?
3. Vad tycker du skiljer Dungeons & Dragons från andra typer av spel eller aktiviteter?
4. Tror du att spela Dungeons & Dragons har påverkat din kreativitet, fantasi, samarbetsförmåga eller förmåga att lösa problem?
5. Hur känner du för rollspellsaspekten av Dungeons & Dragons? Är det viktigt för dig, och varför?
6. Hur känner du för den sociala aspekten av att spela Dungeons & Dragons och har det påverkat ditt sociala liv?
7. Hur känner du för balansen mellan strid och icke-strid upplevelser i spelet? Har du en preferens, och varför?

**Weapons, Spells, Ability Checks**

1. Kan du beskriva en specifikt minnesvärd eller spännande händelse när du genomförde en attack, använde magi eller en ability check?
2. Hur går du tillväga när du använder ability checks i spelet?
3. Hur närmar du dig samarbete när det kommer till att utföra attacker eller ability checks?
4. Hur tycker du att upplevelsen av att utföra attacker eller ability checks i Dungeons & Dragons är jämfört med andra typer av spel eller interaktiva upplevelser?
5. Hur känner du för komplexiteten involverad i att genomföra attacker eller ability checks i spelet?
6. Vad tycker du om möjligheten att ha rekvisita som gör det möjligt för dig att utföra dina attacker, magier och ability checks med din kropp?

**Dungeons & Dragons and Technology**

1. Hur känner du för användningen av teknologi när du spelar Dungeons & Dragons?
2. Hur tror du teknologi har påverkat sättet människor spelar Dungeons & Dragons?
3. Har du någonsin spelat Dungeons & Dragons remote eller online? Hur var den upplevelsen jämfört med att spela i samma rum?
4. Vad tycker du om användningen av appar eller annan programvara för att hjälpa med att hantera character sheets, spells, eller andra spelmekaniker?
5. Är det några sätt som teknologi can användas för att förbättra den övergripande upplevelsen av att spela Dungeons & Dragons?
APPENDIX 3: ROLEPLAYING
BODYSTORMING WORKSHOP PROMPTS

Prompt #1: Dragonborn Wizard casting Magic Missile

Race

*Dragonborn*: Born of dragons, as their name proclaims, the dragonborn walk proudly through a world that greets them with fearful incomprehension. Shaped by draconic gods or the dragons themselves, dragonborn originally hatched from dragon eggs as a unique race, combining the best attributes of dragons and humanoids. Some dragonborn are faithful servants to true dragons, others form the ranks of soldiers in great wars, and still others find themselves adrift, with no clear calling in life.

Class

*Wizard*: A scholarly magic-user capable of manipulating the structures of reality.

Action

*Cast Magic Missiles at one or multiple enemies*: You create three glowing darts of magical force. Each dart hits a creature of your choice that you can see within range. A dart deals 1d4 + 1 force damage to its target. The darts all strike simultaneously, and you can direct them to hit one creature or several.

*Duration*: Instantaneous.

*Components*: Verbal, Somatic.

*Type of Magic*: Evocation (creating powerful elemental effects)

*Effect*: Force.

Prompt #2: Dwarf Fighter swinging a two-handed maul

Race

*Dwarf*: Bold and hardy, dwarves are known as skilled warriors, miners, and workers of stone and metal. Though they stand well under 5 feet tall, dwarves are so broad and compact that they can weigh as much as a human standing nearly two feet taller. Their courage and endurance are also easily a match for any of the larger folk.

Class

*Fighter*: A master of martial combat, skilled with a variety of weapons and armor.

Action

*Swing your two-handed maul at an enemy.*

Prompt #3: Elf Warlock casting Banishment
Race
Elf: Elves are a magical people of otherworldly grace, living in the world but not entirely part of it. They live in places of ethereal beauty, in the midst of ancient forests or in silvery spires glittering with faerie light, where soft music drifts through the air and gentle fragrances waft on the breeze. Elves love nature and magic, art and artistry, music and poetry, and the good things of the world.

Class
Warlock: A wielder of magic that is derived from a bargain with an extraplanar entity.

Action
Cast Banishment at an enemy: You attempt to send one creature that you can see within range to another plane of existence. The target must succeed on a Charisma saving throw or be banished.
Duration: 1 minute (Concentration).
Components: Verbal, Somatic. Material (an object distasteful to the target)
Type of Magic: Abjuration (magic that blocks, banishes, or protects)
Effect: Banishment

Prompt #4: Gnome ranger shooting an arrow
Race
Gnome: A constant hum of busy activity pervades the warrens and neighborhoods where gnomes form their close-knit communities. Louder sounds punctuate the hum: a crunch of grinding gears here, a minor explosion there, a yelp of surprise or triumph, and especially bursts of laughter. Gnomes take delight in life, enjoying every moment of invention, exploration, investigation, creation, and play.

Class
Ranger: Warriors of the wilderness, rangers specialize in hunting the monsters that threaten the edges of civilization.

Action
Shoot an arrow with your Shortbow (two-handed) at an enemy.

Prompt #5: Half-elf Cleric casting Mass Heal
Race
Half-Elf: Walking in two worlds but truly belonging to neither, half-elves combine what some say are the best qualities of their elf and human parents: human curiosity, inventiveness, and ambition tempered by the refined senses, love of nature, and artistic tastes of the elves.

Class
Cleric: Priestly champion who wields divine magic serving a higher power.

Action
Cast Mass Heal to save friends: A flood of healing energy flows from you into injured creatures around you. You restore up to 700 hit points, divided as you choose among any number of creatures that you can see within range. Creatures healed by this spell are also cured of all diseases and any effect making them blinded or deafened.
Duration: Instantaneous
Components: Verbal, Somatic.
Type of Magic: Evocation (creating powerful elemental effects)
Effect: Healing.

Prompt #6: Half-Elf Bard casting Earth Tremor

Race
Half-Elf: The diminutive halflings survive in a world full of larger creatures by avoiding notice or, barring that, avoiding offense. Standing about 3 feet tall, they appear relatively harmless and so have managed to survive for centuries in the shadow of empires and on the edges of wars and political strife.

Class
Bard: An inspiring magician whose powers echoes the music of creation.

Action
Cast Earth Tremor where an enemy is standing: You cause a tremor in the ground within range. Each creature other than you in that area must make a Dexterity saving throw. On a failed save, a creature takes 1d6 bludgeoning damage and is knocked prone. If the ground in that area is loose earth or stone, it becomes difficult terrain until cleared, with each 5-foot-diameter portion requiring at least 1 minute to clear by hand.
Duration: Instantaneous (10 feet area of your choice)
Components: Verbal, Somatic.
Type of Magic: Evocation (creating powerful elemental effects)
Effect: Bludgeoning

Prompt #7: Half-Orc Paladin Casting Searing Smite and swinging sword

Race
**Half-Orc:** Half-orcs exhibit a blend of orcish and human characteristics, and their appearance varies widely. Grayish skin tones and prominent teeth are the most common shared elements among these folk. Orcs regard battle scars as tokens of pride and ornamental scars as things of beauty. Other scars, though, mark an orc or half-orc as a former prisoner or a disgraced exile. Any half-orc who has lived among or near orcs has scars, whether they are marks of humiliation or of pride, recounting their past exploits and injuries.

**Class**

**Paladin:** A holy warrior bound to a sacred oath.

**Action**

**Casting Searing Smite on your sword and hitting an enemy:** The next time you hit a creature with a melee weapon attack during the spell’s duration, your weapon flares with white-hot intensity, and the attack deals an extra 1d6 fire damage to the target and causes the target to ignite in flames.

- **Duration:** 1 minute (Concentration)
- **Components:** Verbal.
- **Type of Magic:** Evocation (creating powerful elemental effects)
- **Effect:** Fire

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**Prompt #8: Human Monk attacking with their quarterstaff.**

**Race**

**Human:** In the reckonings of most worlds, humans are the youngest of the common races, late to arrive on the world scene and short-lived in comparison to dwarves, elves, and dragons. Perhaps it is because of their shorter lives that they strive to achieve as much as they can in the years they are given. Or maybe they feel they have something to prove to the elder races, and that’s why they build their mighty empires on the foundation of conquest and trade. Whatever drives them, humans are the innovators, the achievers, and the pioneers of the worlds.

**Class**

**Monk:** A master of martial arts, harnessing the power of the body in pursuit of physical and spiritual perfection.

**Action**

**Use your quarterstaff to attack your enemy.**

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**Prompt #9: Tiefling Rogue making a Sneak Attack**

**Race**

**Tiefling:** Tieflings are derived from human bloodlines, and in the broadest possible sense, they still look human. However, their infernal heritage has left
a clear imprint on their appearance. Tieflings have large horns that take any of a variety of shapes: some have curling horns like a ram, others have straight and tall horns like a gazelle’s, and some spiral upward like an antelopes’ horns. They have thick tails, four to five feet long, which lash or coil around their legs when they get upset or nervous.

**Class**

*Rogue:* A scoundrel who uses stealth and trickery to overcome obstacles and enemies.

**Action**

*Make a Sneak Attack with your two daggers on an enemy:* You know how to strike subtly and exploit a foe’s distraction. Once per turn, you can deal an extra 1d6 damage to one creature you hit with an attack if you have advantage on the attack roll. The attack must use a finesse or a ranged weapon.