# You Have my Sword; and my Bow; and my Axe: Player Perceptions of Odd Shaped Dice for Dungeons & Dragons

## ABSTRACT

Tabletop RPG Games, such as *Dungeons & Dragons* (D&D) use dice in order to control the outcome actions by characters when the Game Master needs to introduce randomness. While dice are fundamental to such games, the examination of dice as objects of design has not been explored. This study examines fifty-nine participants (thirty familiar with the *D*20 set system) and asks them to examine two 7-die sets commonly used in D&D, the first set being a common set of polyhedrons, and the other set designed to replicate the objects used by a Wizard. It examines the fairness perceptions of the participants and finds that players who have experience with the polyhedral set in the past are more likely to accept the fairness of Wizard dice, and that all players are more likely to accept the fairness of the Wizard set after a play session.

## CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**; **Accessibility design and evaluation methods**; • **Software and its engineering** → Interactive games.

## KEYWORDS

Dice fairness perception, Dice design preferences, Dice Design

## 1 INTRODUCTION

While players sit about the table of the game, the character sheets are drawn, the pizza and pop are ready, and before them sits the adventure. However, the most important object in a tabletop game both substantively from the playing of the game, and the emotionally of the storytelling experience is the dice. No other game object demonstrates such a strong relationship, as fortune controls the fates of those players seated about the table.

Dice have historical links to both games and to religious divination; *Cleromancy*. As each game was a part of ritual and its outcome was in the hands of the gods, ceremonial behaviour, such as throw of the dice, was governed by fate [2]. Astragals, made from the bones of goats have been used to cast lots since antiquity. Native American tribes used dice made from the four sides bones in their rituals, while Romans and Greeks used dice made from ivory and stones. Dice with pips and symbols made from different materials such as bones, ivory, and stones, close to the ones seen today, have been found in Egyptian burial tombs [4], remains from native American tribes, and six-sided dice similar to our own have been in use since Greek and Roman antiquity[5]. Early examples dating back to 24 B.C.

Yet dice have not been well studied for their designs in an academic context. Yermolaieva and Brown[9], examined the differences in a set of dice for the time to roll to the time to have understanding of the roll based upon factors such as size, shape, pips used, etc. Further, they looked at the issues of readability in the dice rolls which demonstrated that a dice with markers other than pips or Arabic numerals was likely to be mistaken for a different role based on the symbols on the die being mistaken for the placement of pips. Hence, dice which violated preconceptions were seen as more error prone to mistaken readings. Boschi et al. [1] examine the rolls of three modified set of dice which roll a 2D6 distribution[1], one which was a normal pair of with skewed sides and the other was a set recast to make a 2*D*6 distribution. This recast set was formed in to a die which summed the numbers from a *D*3 and one die with twelve sides with the faces: 1, 2, 3, 4, 4, 5, 5, 6, 6, 7, 8, and 9. It was found that players were most mistrustful of the fairness of the remolded dice, and only after playing a game of snakes and ladders with both pairs were they likely to change their minds about fairness. However, it was generally found that players enjoyed the idea of skewed/remolded dice.

We extend upon the ideas seen in these studies above by looking a set of special purpose dice built for D&D tabletop games. The 7-die polyhedral set, used at the time as a teaching aid for mathematicians, was originally seen due to Dave Wesley's contribution to the Blackmoor campaigns [7]. Blackmoor would become an early inspiration to the first *Dungeons & Dragons* (D&D) [6]. For this examination, we look at two 7-die polyhedral sets.

Their usually seen form, selected as Chessex®model CHX27402 Ivory w/black Marble, Polyhedral™7-Die Set, and via a remolded form, in the PolyHero Dice Wizard Set in Parchment & Black Ink. These sets were selected due to their similarity in the dice colour and numbers in order to control for these aspects of variance and attempt to look only on the shape of the molding as the factor of interest. The motivation for this research is to investigate player's predilection for dice aesthetics as well as their opinion on die fairness when they see a usual die set and a remolded set. The remainder of the paper details experiment design, results and conclusions derived from the research work.

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[1]Common Tabletop RPG systems use a well known short hand for dice to be rolled of the format $xDy \pm a$ where $x$ is the number of dice to be rolled, $y$ is the number of sides of those dice, and $a$ is a modifier, usually a constant or another dice roll of a different type. We will use this convention through out the paper.

## 2 EXPERIMENTAL DESIGN

The experiment starts with playtesters filling in a questionnaire. The questionnaire consisted of questions about participant's age and average playing hours for board games over the past thirty days. Participants informed about their favourite board games and if they have ever played role playing games or not.

The observer inquired participants if they are familiar with any *D*20 system. Moreover, the participants were asked, what is a fair die in their opinion. Further, the participants were shown two sets of dice, see Figure 2 and 3. Having seen the presented dice sets, the participants chose set, which they fancy aesthetically. Furthermore, the observer asked the participants if they believe either or both sets of dice are fair.

Following the questionnaire, the participants interacted with both sets of dice through playing a game based on *Dungeons & Dragons* [8]. A set of characters and a scenario was created, See Appendix B, which allowed for a ten minute playtime. The game was played twice so that the participant gets a chance to interact with both sets of dice. The game rules were developed with consideration of participants' enjoyment. The participants are the students of a bachelors program in Computer Science in Russia.The game scenario was developed in a way that participants can relate with the game characters.

The *Dungeons & Dragons* scenario is an appeal session for student's exam. The grade has been given by the teaching assistant (TA) and student wants to get a higher grade. Game characters are Teaching Assistant of the university and a Student. The possible Student's actions include, requesting the TA to reconsider the grade, showing that there is a mistake in marking, asking TA to remark homework, or reminding TA of their promise of bonus points for attending all lab sessions, etc. The TA actions are, cancelling the exam grade appeal session, finding another mistake in the answer sheet, or finding that the student cheated, etc. Rules for the play testing can be found in the included Appendices.

The play test consisted of printed rules set, dice set and pen for counting the health points. The observer played two games using one of the two dice sets, Figure 1. The participant played the student role for both games. The observer also let participant roll die for the observer's turn to increase interaction with each die.

The observer records participants' responses and emotions such as curiosity, excitement etc. during the play session. The play session is followed by a second part of questionnaire. The participants were asked to select the dice set, they consider fair after playing with them. Furthermore, participants informed which die from the presented sets, they would prefer using for a game requiring a die roll and what is the rationale behind selecting these dice.

## 3 RESULTS AND DISCUSSION

The experiment has been conducted with fifty-nine participants. All participants were the students of bachelors program in Information Technology. The average age is twenty years. The participants have spent approximately three hours playing board games in the past thirty days. Some of the favourite board games mentioned by participants are *Chess*, *Settlers of Catan*, *Svintus*, *Uno*, *Durak*, *Evolution*, *Alias*, *Dungeons and Dragons*, and *Arkham Horror*. Thirty-seven of



**Figure 1: Observer and the Participant playing Dungeons & Dragons**

the participants have experience of playing role play games. Moreover, thirty participants have informed that they are familiar with a *D*20 system. This research work has been conducted following institutional ethics guidelines. The following subsections entail results of the experimental study.

### 3.1 Before the Play Session: Player's Perception of Fairness

The participants informed their opinion of fair die. Fifty-two participants said that, a die is fair if it has equal probability of all outcomes, three of the participants consider a symmetric die to be fair and four informed that they do not think that concept of fairness holds with a die.

While inquiring about fairness of presented sets, thirty-two participants considered both sets to be fair and twenty-seven considered only Set 1 to be fair.

### 3.2 After the Play Session: Player's Perception of Fairness

The participants interacted with both sets of dice via playing Dungeons and Dragons with the observer. To ensure interaction with each die, observer (on their turn), asked participants to roll die on their behalf. The observer selected all dice from each set to ensure participant interacts with all dice.

After gameplay, participants were again asked to select fair dice (in their opinion). The results indicate, nineteen participants considered dice Set 1 to be fair and forty considered both sets to be fair. The participants' view has been changed after interacting with the dice. Before gameplay, thirty-two participants considered both dice sets to be fair and after the game play, forty participants considered both sets to be fair. This identify that eight participants who did not consider Set 2 to be fair, changed their opinion after the gameplay. However, two participants among forty (those who considered both sets fair), informed that they do not consider all dice in each set to be fair. One participant commented that Set 1 is completely fair, but from Set 2, only *D*20 and *D*10 are fair. The other participant told

**Figure 2: Dice Set 1 — Chessex® model CHX27402 Ivory w/black Marble, Polyhedral™ 7-Die Set**
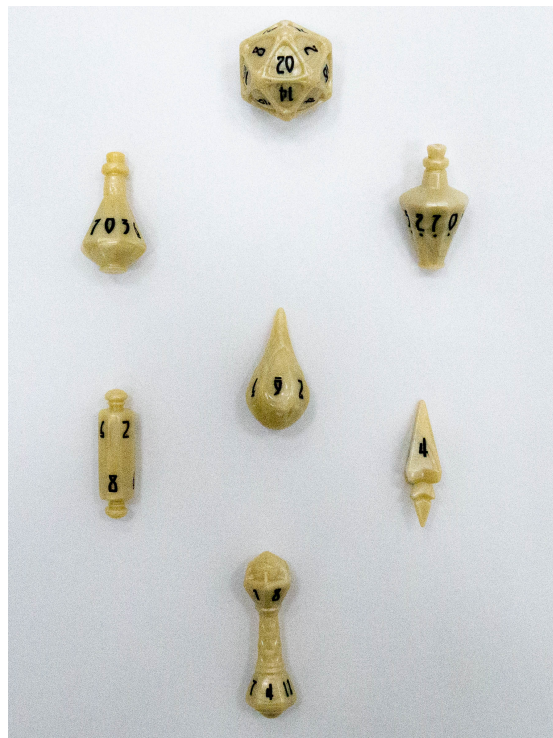


**Figure 3: Dice Set 2 — PolyHero Dice Wizard Set in Parchment & Black Ink**

that $D20$ from both sets are fair as well as $D6$, $D10$ from Set 1 and $D12$, $D10$ from Set 2 are fair.

The observer asked participants to choose dice set which they would prefer playing with. For this question, thirty-five participants opted for dice Set 1. The reason for selecting Set 1 is its comfort of usage and fairness. Nineteen participants chose dice Set 2. The participants picked Set 2 because they found it more beautiful than the other set. Furthermore, four out of nineteen participants informed that they would choose Set 2 because they are curious to use it. Five of the participants did not see and any difference and would use either of the two sets.

### 3.3 Dice Design Desirability: Player's Emotions and Object's Practicality

Before gameplay, the participants were asked to select the dice set which they prefer aesthetically. In this context, thirty-six participants selected dice Set 1, Figure 2, twenty selected dice Set 2, shown in Figure 3 and three participants selected both sets of dice.

Participants who chose dice Set 1 from aesthetics point of view informed that this set appears symmetric and simple to them. Some of them called this set perfect and accurate.

After the gameplay, thirty-five participants selected Set 1 as dice they would prefer playing with. The twelve participants selected it because of its fairness, sixteen selected because of its convenience of usage, and seven because it looked symmetric to them.

Regarding Set 2, it was selected by nineteen participants, who informed that they would play with it as it is more beautiful. Five

of the participants who selected both sets informed that they do not see the difference in fairness among these dice sets and both sets appear equally attractive to them.

Examining participants' responses regarding the preference of dice for gameplay presents frequently occurring words for dice Set 2. The words include: *interesting*, *curiosity*, *cool* and *beautiful*. The dice set, which participants were not familiar with in terms of usability was preferred because of curiosity of using and uniqueness of design. The new and unusual design invoked emotions of curiosity and interest. Moreover, the design is unusual but pleasing for the participants and they considered it worth knowing more. One participant even inquired, whether he can buy the Set 2 after the gameplay. This supports Norman's claim that peoples' preferences about things they buy is affected by emotions and sometimes emotions dominate the decision over the object's feasibility [3].

The responses from participants preferring Set 1 include words: *convenient*, *ease of rolling*, *looks familiar*, *usual*, *symmetric*, and *fair*. These responses identify that participants prioritize the practicality of the object such as a smooth roll. Furthermore, fairness of die is important for the gameplay. The participants' preference was also affected by their past experience and they felt comfortable with dice they were already familiar with.

As we had twenty-nine participants who had not seen both sets before (unfamiliar group), participants from unfamiliar group found normal polyhedron dice more aesthetically pleasing versus participants who were familiar with Set 1 (thirty participants) preferred the uniqueness of Set 2. The results are significant with $p < 0.05$,

| Preference for the Wizard set (Set 2) | | |
| Familiar (30 Participants) | Unfamiliar (29 Participants) | p-value (two-tailed) |
| --- | --- | --- |
| Before  15 | 5 | **0.00782** |
| After   15 | 4 | **0.00288** |

**Table 1: Z-score for two populations' proportions of users aesthetic perceptions of the dice. Users who had familiarity with 7-dice set preferred the Wizard dice while new players were more likely to select the original type of dice.**



**Figure 4: D20 from Set 1**



**Figure 5: D20 from Set 2**



**Figure 6: D4 from Set 2**

Table 1. This supports the claim that people when familiar with something prefer unique design because of interest and curiosity. Furthermore, when people are not familiar with a particular design, they prefer simple design when comparing simple and complex designs for the same object. The results of aesthetics preference for dice sets did not change after the game play.

Furthermore, the dice that caught participants' attention majorly were $D20$ from both sets and D4 from Set 2, Figures 4, 5, and 6. $D20$s were used more than other dice during the game, and players informed that after interacting with these dice, they are certain that both $D20$s are fair.

## 4 EVALUATION OF FAIRNESS

We had participants from two categories, who were familiar with the usual dice from Set 1 (thirty Participants) and those who were not familiar with either sets (twenty-nine Participants). This second set of participants are neutral while looking at both sets, and can be considered a control group for new players with those familiar representing the experienced players.

After interacting with both sets via gameplay, Table 2, nineteen participants in total of them considered only Set 1 to be fair and forty considered both sets to be fair. Eight out of these forty participants changed their opinion about Set 2 after gameplay (as thirty-two considered both sets fair before gameplay) and also considered it fair.

|        |        | After  |      |
|--------|--------|--------|------|
|        |        | Unfair | Fair |
| Before | Unfair | 19     | 8    |
|        | Fair   | 0      | 32   |

p=0.003906

**Table 2: McNemar's test matrix and p-value for fairness of the Set 2 — all participants**

|        |        | After  |      |
|--------|--------|--------|------|
|        |        | Unfair | Fair |
| Before | Unfair | 13     | 5    |
|        | Fair   | 0      | 11   |

p=0.03125

**Table 3: McNemar's test matrix and p-value for fairness of the Set 2 — unfamiliar with the 7-dice set**

|        |        | After  |      |
|--------|--------|--------|------|
|        |        | Unfair | Fair |
| Before | Unfair | 6      | 3    |
|        | Fair   | 0      | 21   |

p=0.125

**Table 4: McNemar's test matrix and p-value for fairness of Set 2 — familiar with the 7-dice set**

This shows a significant change ($p = 0.03906$) in the participants opinions over all about the fairness of dice. We notice that all participants from all groups stated that Set 1 was a set of fair dice, regardless of experience, this shows a large bias in players to see dice molded in balanced polyhedral shapes to be seen as fair and agrees with the findings in Boschi et al. [1].

The results we see from our unfamiliar group samples, our control, in Table 3, we find a majority of the group which is unconvinced by Set 2 being fair even after the act of gameplay. However, gameplay did have a significant effect on the belief the dice were fair after play ($p = 0.03125$)

Considering those players familiar with Set 1 but not with Set 2 as seen in Table 4. It is found that the number of those who are more likely to deem the dice sets fair to begin with was increased in the those who were familiar ($p = 0.01352$ on a two-tailed proportional test). We still find the effect of playing the game with dice increasing those who believe that Set 2 is fair, though not to a statistically significant level ($p = 0.125$). The results from familiar group of participants also indicate that Set 1 was always considered fair either alone or with Set 2.

The study gives us a useful insight into people's perception about dice design and its fairness. We identified that, simplicity in the design is a factor in making people think that design is fair. An unusual design (such as wizard set, Set 2), though appreciated for its aesthetics was considered fair too but never alone. It was considered fair along with the other usual set.

The participants from familiar group considered only Set 1 to be fair in thirty percent of the cases (before the playtest), and the participants from unfamiliar group considered only Set 1 to be fair in sixty-two percent of cases (before the playtest). This implies that the participants who were already familiar with the D20 system were more likely to believe that both sets are fair. We would continue the test with more samples from familiar population to test the hypothesis that a prior usability experience has an affect on perception resulting in considering the familiar sets fair.

## 5 PLAYTEST AND PLAYTESTER'S ENJOYABILITY

In context of playtesting, the common issue is gathering playtesters. Humans are an expensive resource and playtest are not compelling for the people because of time required, monotonous, and repedative process. This research work investigated dice design and aesthetics with consideration of playtest process's desirability for the participant.

In the process of designing playtest schema, we aimed for the process that can be interesting for the participant. In this regard, an approach is initiating a story line, a participant can relate to. The observational analysis concluded that participants were naturally immersed in the playtest. They were excited to play against observer who was playing a teaching assistant character.

The participants enjoyed cheating, such as, one participant found a breach in the game rules, which allowed winning with a big score, therefore, such rules introduced excitement for the participant, and they were pleased with the feeling of discovery for the shortcut win.

The goal of the playtest is to identify participant's experience with the object in a natural play environment. The experiment detailed in this paper successfully initiated the game play process for the observers to investigate research questions and for the participants to enjoy the process. This has been achieved mainly because of the story line which participants could easily connect with.

## 6 CONCLUSIONS AND FUTURE WORK

The aim of this research is to identify player's perception of fairness of the dice. The research work also concentrated on the aesthetics element. The two sets chosen include usual *Dungeons & Dragons* dice set and a Wizard designed set.

For future work, our current experience suggests to run playtests in parallel to accommodate as many participants possible for time optimization. As a potential solution, participants can play against each other. We would expand upon the study by increasing sample size from both group of participants: familiar and unfamiliar with the dice sets to investigate trends towards fairness perception in case of prior familiarity and unfamiliarity.

There is also a large missing area of research work from an cultural anthropology perspective to examine the roll/role of dice.

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## A  GAME RULES

There are two players in the game: one player is the participant of our research and the other player is the observer. The participant plays the "Student" character and the observer plays the "Teaching Assistant (TA)" character.

The rules were explained to the participant in the following manner:

You are about to play a game. The rules are the following: You are an unlucky Student who has always been on the lowest scholarship every single semester. Presently, there is one particular subject that you have big troubles with and you hope that if you show up on the appeal session, you will get a raise in your grade. You come to the appeal session and face the TA, who is not willing to give you grades that easy.

In the list shown below, you can see your HEALTH characteristic, and ACTIONS you can perform. You will play two times and each time, there will be several rounds. Your goal is to make TA lose all their HEALTH points before you do.

Each round is as follows:

Your move:

State the ACTION you want to perform.

Roll $D20$.

(1) If the result is greater or equal to the DIFFICULTY of the action then roll the DAMAGE die. The result will lower the HEALTH of your opponent according to the number rolled (and possibly the additions).

(2) If not, skip your turn.

TA's move:

The TA (me in this case) will state their ACTION.

You will roll $D20$ for them.

(1) If the result is greater or equal to the cost of the action, you will roll the DAMAGE die, lower your HEALTH according to the number rolled. Moreover, write your new health near HEALTH characteristic.

(2) If not, the TA skips the turn.

This will continue until one of us loses all our HEALTH.

## B  HEALTH CHARACTERISTICS AND ACTIONS

### B.1  Teaching Assistant (TA)

HEALTH: 20

ACTIONS

Magic Disappearance: The appeal session is suddenly canceled. DIFFICULTY: 14+. DAMAGE: $D10$. Can only be played once.

Reverse Appeal: The TA found another mistake in the Student's work. DIFFICULTY: 9+. DAMAGE: $D6$

Cheating Suspected: The TA thinks that the answers of Student look quite similar to some other student's answers and they already saw it somewhere else. DIFFICULTY: 12+. DAMAGE: $D6 + 4$.

Unfamiliar Face: The TA does not remember seeing the Student at all. DIFFICULTY: 10+. DAMAGE: $D4 + D8$.

MOODLE: MOODLE just does not work and there is nothing the TA could do. DIFFICULTY: 7+. DAMAGE: $D6 + 2$.

### B.2  Student

HEALTH: 25

ACTIONS

The Begging: Tell that, this is the only subject that you failed, so you really need these couple of points. DIFFICULTY: 16+. DAMAGE: No damage next move. Can only be played once.

Mistake Correction: The student thinks their answer is right and there is a mistake in marking. DIFFICULTY: 11+. DAMAGE: $D6$

"Can you check my homework again?": The Student tries to change the subject of matter. DIFFICULTY: 12+. DAMAGE: $D10$

Really Familiar Face: The TA confuses the Student with someone and suddenly remembers that they promised this Student, bonus points for attending all the labs. DIFFICULTY: 14+. DAMAGE: $D12$.

The Copy: The Student shows another Student's exam sheet with the same answers but with a different grade. DIFFICULTY: 7+. DAMAGE: $D8$