Harmony: A Game to Teach Transitive Game Balance

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ABSTRACT

Transitive game balance – balancing a set of game objects so that they all have the same cost/benefit ratio –is a difficult subject to teach effectively. While the theory behind it is straightforward, the games that would make the most practical examples tend to be too complicated for classroom analysis, and they often have some imperfections in their balance (there is no "perfect example" of balance). Furthermore, assessing balance in student projects is subjective (whether the game "feels fair") and time-consuming. To address these problems, a custom game was created. The game is simple to learn, small in scope, and the design "knobs" that a student designer can change within the game are constrained, so that it can provide a useful example of a real-world game balance problem while still being short enough of an experience to be suitable for use in a game design class. Assessment is done via automated AI-vs.-AI play, where the various game elements are played against one another in a large series of trials, providing the player with a Monte Carlo analysis of the relative power of each game element.

Categories and Subject Descriptors

I.2.1 [**Applications and Expert Systems**]: Games; K.3.1 [**Computer Uses in Education**]: Computer-assisted instruction (CAI); K.8.0 [**Games**]

General Terms

Design

Keywords

Game design, Game balance, Game education, TCG, AI

1. INTRODUCTION

Game balance has many meanings, but is used here to describe the act of balancing multiple objects within a game (cards, player abilities, units, etc.) against each other, such that they each offer a comparable net benefit relative to their cost. Transitive game balance describes systems where some game objects may be strictly better than others (*e.g.* higher stats or more damage) but in return are more costly. Trading-card games, realtime strategy games, turn-based wargames, and roleplaying games all make common use of transitive mechanics, and the game designers working on these games must then balance them.

Meanwhile, there is a paucity of resources on how, exactly, to balance transitive mechanics (or balance games in general). Few schools have even a single full-length course in game balance, there are no textbooks exclusively about game balance, and general game design courses and textbooks tend to mention balance only in passing. One may find the occasional Gamasutra article, GDC lecture, or blog post on the subject, but these tend to be highly focused and do not form a coherent whole. Game balance in general, and transitive game balance specifically, are thus a common deficiency in game design education.

Furthermore, transitive game balance presents a number of challenges for a game design instructor. Games like TCGs, RPGs and MMOs have so much content and so many systems that they are too unwieldy for a deep and complete balance analysis. Even if one were to find an existing COTS game that was sufficiently simple, there are likely to be some imbalances in it (often created on purpose [2,3]), so attempting to reverse-engineer the game's balance formulas will present some outliers and edge cases that can confuse novice students and complicate the derivation of the game's underlying math. Asking students to develop their own TCG, RPG, or RTS is too much work; these games are naturally complicated, and keeping the project within a reasonable scope for a class requires a deep understanding of the genre that is unfair to expect of novice students.

Even if the instructor makes their own custom game that is suitable for a balance exercise in all other respects, assessment presents additional problems. A single set of game objects may have multiple, equally valid designs that could be considered "balanced," so simply checking a student design against an answer key is not possible. Playtesting to assess balance is time-consuming, subjective, and also not very fun if the instructor must play dozens of variations on the same core rule set.

2. THE HARMONY TCG

To address the issues of teaching transitive game balance, a card game called *Harmony* was developed. This game offers a transitive game balance exercise that is similar to the design of a professional game, but small enough in complexity and scope and sufficiently constrained to be suitable for classroom use. *Harmony* therefore provides useful experience in putting theory into practice. This game was developed in Flash, and thus only requires a computer or laptop with a current Flash player installed in order to provide a live demo at FDG.

2.1 Mechanics

Harmony is a game for two players, with simple rules and only four key mechanics. Players start with a constructed deck of fifty cards and draw an opening hand of ten. On a player's turn, they first draw two cards, then play or discard two cards (one Power card that provides resources, and one Action card that performs some game effect but requires a certain amount of Power cards in play). Action cards do some combination of the following: draw more cards, move cards from the discard pile back to the bottom of the draw pile, discarding cards from the top of the deck, or discarding cards from hand (the mechanics are termed Draw, Heal, Damage, and Discard, respectively). The goal is to force either the opponent's hand or draw pile to be empty.

Figure 1: A game of *Harmony* in progress

2.2 Balance

Once the student is familiarized with the mechanics of *Harmony*, they are allowed to modify the Power requirements of the Action cards. Essentially, this means that the student can control how early or late in the game an Action card can be played.

The game consists of four fixed, pre-constructed decks. The student's goal is to change the cards such that the four decks are balanced against each other, *i.e.* when played with a comparable level of skill, each of the four decks is equally likely to win.

Figure 2: Modifying the Power requirements of a card

2.3 Assessment

To allow for objective assessment of the balance between the decks, an expert system AI was developed to play the game at a reasonable level of competency. The AI has some nominal value in providing a computer opponent for the student while they learn to play *Harmony* or while they are playtesting, but the greatest asset of the AI is to play against itself in repeated trials. In this way, each deck can be played against each other deck many times, and the collective win/loss record of each deck provides an objective, numerical measure of balance. If imbalances exist, the student sees the source of the imbalance: which decks are too powerful or too weak relative to the others. Limits were placed on the number of AI trials allowed, to prevent a naïve brute-force approach to the problem.

3. RESULTS AND DISCUSSION

Three graduate students and nine undergraduate students enrolled in game design programs were recruited for playtesting. The students had no prior exposure to the concept of transitive game balance. While *Harmony* was designed to be an exercise to be introduced in conjunction with a classroom lecture or other live instruction, these students were only given minimal direction ahead of time and left to learn through the game's tutorial (a worst-case scenario). The students were then asked for feedback.

Student comments were relatively consistent. Overall, virtually all testers could immediately see the value in *Harmony* as a learning exercise, and found the exercise interesting and enjoyable. All students were able to learn the mechanics of the game quickly and progress to being able to balance the game, once they took the time to read through the tutorial text. While there was a higher learning curve for students who had no prior experience playing TCGs, these students were able to overcome their knowledge deficit quickly, and actually performed better on the assessment (perhaps due to their taking a more methodical approach to the task because of a lack of confidence).

It was apparent that some students simply ignored the tutorial text and did not read it, and then quickly became lost and confused within the game. In the future, this could be mitigated by a greater level of introduction during class time.

4. CONCLUSION

This work shows that it is possible to teach transitive game balance, not just as an abstract theory but also as a set of practical, actionable skills, while also providing an objective assessment through automated AI play of a student's game balance solution. The results, while preliminary, are promising, and suggest that the methods used to create *Harmony* could be utilized to give practice with other game genres or other game balance topics.

5. REFERENCES

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