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Computational Performance of Game Theory

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Abstract:
The main objective of this paper is to evaluate the game of chess and how complex aesthetics is useful for performance of a chess game. The other aspect is that it can directly improve the performance of a using the proposed model, more weight can manually be associated with the formalizations for certain aesthetic principles or themes to suit a particular user's aesthetic preferences. In this manner we can directly improve the game performance.

1. Introduction:

The research has shown that computational evaluation of aesthetics in the game of chess is not only possible but also generally reliable within a reasonable scope. This might go against preconceived notions or old adages such as 'beauty is in the eye of the beholder'. In light of the reasonable progress that has been made with regard to aesthetics in other domains such as art and music, it is not surprising that results are as good (if not better) for a zero-sum perfect information game like chess, given its nature. The 'mechanics' behind aesthetic appreciation in the game are no mystery. Human players have essentially known what they are for some time and the evidence is in the literature. While there may be many 'dimensions' of beauty to the human eye that perhaps cannot be exactly quantified, there is no scientific evidence to suggest that the sort of approximation of beauty achieved in this research cannot account for 'true' beauty partially or indirectly, and in a comparative way that is generally consistent with human aesthetic perception. Analogously, the aesthetic principles and themes evaluated in this research might not necessarily exclude the beauty of more complex ones not explicitly accounted for. Unfortunately, it is difficult to demonstrate if the dynamics of more complex aesthetic principles and themes are somehow dependent upon simpler ones, such as those used in this research, i.e. the former cannot or seldom occur otherwise. If so, this would imply the need of only a 'critical set' for aesthetic evaluation.

2. Principle:

The basic fundamental used should exhibit similar experimental results. The given that data has 'common ground' of aesthetics between compositions and real games has been examined and tested, it is difficult to imagine otherwise unless there was an unintentional but significant bias toward either domain by using a different set of principles and themes. This could very well happen if one is not careful to differentiate (at least to a reasonable degree) between composition convention, brilliancy characteristics and the area in which they overlap. An interesting application of the proposed model, as it stands, might be for computers to effectively simulate the human player ability to often 'sense' the difference between a real game combination and an artificial or composed one. This would nevertheless require further experimentation. There is probably no imperative to 'reinvent the wheel', e.g. by looking for other aesthetic principles aside from what has been repeatedly described in chess literature, and weighting them based on certain data sets (if any). The fundamental metrics and properties of the game are also sufficient as building blocks for representing aesthetic principles and themes, formally. Meaningful complexity can, perhaps, emerge from the relationships between much simpler components that may themselves have little or nothing to do with aesthetics. This implies that if analogous metrics and properties could be found or established in other domains, the approach used in this thesis might be applicable there as well. Even so, personal taste in aesthetics is still relevant and can be accommodated computationally. There are at least two ways. First, using the proposed model, more weight can manually be associated with the formalizations for certain aesthetic principles or themes to suit a particular user's aesthetic preferences. Second, an aesthetics computer program incorporating the model could train itself over a period of time based on say, a log of the user's selection of preferred aesthetic combinations. Using this information, it could automatically present combinations that would most likely appeal to said user. Looking even further, a computer could perhaps be designed to possess or develop a taste of its own, however rudimentary its fundamental design was. For instance, it has been shown that human-like features exhibited by a machine, tend to lead humans to believe it has a brain. This would likely improve human-computer interaction.

Enabling computers to recognize aesthetics in games and other domains should not be seen as a threat to humanity, or necessarily as a step toward simulating 'feelings' in machines. While the latter may be a potential application, the main intention is usually for the immediate benefit of humans. Computers, in principle, can analyze and 'see' much more than humans ever could in their lifetimes. A great deal of this information disregarded by machines in their typical tasks. It would be of conceivable benefit to humans, for example, if computers could identify items that might be of aesthetic interest to them. In the game of chess, at least, aesthetics recognition technology can be used as an additional tool for 'data mining' aesthetic and educational material from growing table bases.

3. Basis of Selection the aesthetic assessment:

The different consideration for assessment are Precision of computational aesthetic assessment ,Themes with no aesthetic distinction, Shorter, longer and inconclusive move sequences, Enhanced automatic problem composition, Aesthetics in chess variants and similar games, Aesthetic evaluation functions as game heuristics.

The first issue has to do with precision of computational aesthetic assessment. This research focused on aesthetic recognition in the game of chess within the scope of direct mate-in-3 combinations. While a strong positive correlation with human aesthetic assessment was demonstrated, the level of precision for computational aesthetic evaluation that correlates *best* with human assessment was not, due to resource limitations. Discrete aesthetic scores for combinations, e.g. with differences of at least 1 point between them was suggested but this remains to be confirmed experimentally. So does the 'minimum' computational score that qualifies as 'beautiful'. Precision might help establish a reliable scale for aesthetics in the game that can be used to *assist* judges in composition tournaments and to award brilliancy prizes to real games. Even though the maximum aesthetic score attained for a combination from the 21756 analyzed was 5.5, it is an open question whether this is the aesthetic 'ceiling' for a combination or even close to it. It would be interesting to demonstrate what the ceiling, based on the proposed model, might be; and even more so, the sort of combination that would qualify. Beauty in chess has, after all, been described as having its basis in pure mathematics. As a rough estimate of the highest aesthetic score, the maximum a combination could score based on the model would be around 17 points, given that each aesthetic principle and theme has a theoretical limit of 1.However, that limit can sometimes be exceeded. Also, it is unlikely that a single combination could contain all 17 aesthetic principles and themes. The actual aesthetic 'ceiling' would therefore be constrained by what is possible in the game; a value that is probably quite different from the rough estimate.

3. Conclusion:

A difference is expected between domains because one has the benefit of a composer while the other does not. In short, this experiment attempts to validate the individual formalizations for the aesthetic principles in terms of their ability to capture them.

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