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Qualitative analysis of the reflection of the mathematical dimension of gambling in gaming online content – second technical report

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This second technical report shows some partial results for the variables of the proposed statistical analysis and a discussion about some changes in sampling. In what concerns the qualitative analysis of content, the report presents the general predominant tendencies that get contoured with the first two samples.

Introduction

Mathematics is strongly connected to gambling through the mathematical models underlying any game of chance. Mathematics is reflected not only in games' design/characteristics and their outcomes, but also in gamblers' perception and knowledge of the mathematics-related facts of gambling – which influence their gambling behavior.

The math-indispensability principle (Bărboianu, 2013) applies not only in problem-gambling research, but also in the gambling industry. The structural, informative, strategic, psychological, pathological, and ethical aspects of gambling have been identified to be grounded in the mathematics of games and gambling (Griffiths, 1993; Bărboianu 2014, 2015; Turner & Hobay, 2004; Harrigan, 2009, and others).

Gambling cognitive distortions, language, and miscommunication

Gambling-specific cognitive distortions (in the form of misconceptions, misunderstandings, reasoning fallacies, biases, false or irrational beliefs, or illusions, alone or mixed) are believed to be an important cause of the development of problem gambling and are considered as major risk factors (Lambros & Delfabbro, 2007; Leonard & Williams, 2016, and others). We have analyzed these cognitive distortions in relation to the mathematical dimension of gambling and found that most of them are mathematically related (Bărboianu, 2022, pp. 219-221).

An important element that shapes and influences the aspects of gambling mentioned above, especially cognitive distortions, is language. The language of gambling can be intentionally or innocently misleading, confusing or conflicting, largely due to the mathematical nature of the essential concepts governing gambling, but also to the nature of language itself. The language of gambling unavoidably uses mathematical and mathematically-related terms and as such is a mixed language and therefore predisposed to semantic conflicts. This language may aim toward descriptions of the games, of their associated strategies, for communication between gamblers and between gamblers and

experts, and to express any observations or research results in regard to this phenomenon. The fact that some specialized terms belong or are tightly related to probability theory accounts for their conflicting potential in the gambling language, since the concepts of probability theory are sensitive to interpretation, despite their mathematical nature (Bărboianu, 2022, pp. 203-218).

The problematic gambling language manifests in the activity spheres of developers, operators, gambling communities, information providers, experts (including problem-gambling experts), and gamblers' relationships with these people. This language affects the descriptions of games and gambling that the players actually use to become informed about the phenomenon; also affected are the communication between gamblers, and between gamblers and people from the gambling industry or experts as well as gamblers' own conceptual judgments related to gambling.

Goals and outcomes of the study

In this theoretical framework, research is able to derive concrete norms and criteria to adequately reflect the mathematical dimension of gambling in the communication and texts associated with the gambling industry. These norms and criteria of adequacy will be further communicated to policy and decision makers in both governmental and private sectors, with the recommendation for implementation.

Our study aims to evaluate qualitatively the reflection of the mathematical dimension of gambling in the content of gambling websites. This analysis is necessary in order to have an objective and concrete image of the actual state of this matter in the online industry and of the challenges that such research and application would face in the real world of gambling.

A minimum number of 120 gambling websites will be reviewed annually for their content in that respect. A statistical analysis will record the presence of the mathematical dimension of gambling and its forms in the content of participating websites, and a qualitative research will analyze and assess the quality of the content with respect to that dimension.

Methods and technical description of the instruments

The current study is a combination of quantitative and qualitative analysis, in which the latter is predominant and is given the central role.

The participants in the study (gambling websites, through their webmasters) were recruited through online advertising and direct invitations. Given the focus on the qualitative aspect of the study, the sample is not representative for the entire population. Besides, representativeness cannot be established with respect to the specificity of the population (gambling websites) and of the targets of the study.

The criteria of eligibility for participation that we have applied are:
- not having legally prohibited content or advertising;
- meeting the gambling legal requirements;
- having informative content besides the games and games' rules
- being fully operational and navigable.

The quantitative analysis will use basic descriptive-statistics methods, summarizing the data recorded from the sample by standard statistical indicators, with the following main specific variables:

v_1 - the presence of structural descriptions of the games in parametric terms (valued yes/no);

v_2 - the presence of informative sections ('How to' articles, blogs, guides) (valued yes/no);

v_3 - the presence of sections dedicated to odds/probability/math (valued yes/no);

v_4 - the usage of essential math terms specific to gambling (odds/probability, expectation, average/mean, etc.) (valued yes/no);

v_5 - the presence of the definitions of the math terms used (valued yes/no);

v_6 - the correctness of the math definitions used (valued on a scale from 0 to 5)

v_7 - the presence of game strategy topics (valued yes/no);

v_8 - the presence of math-based game strategy topics where applicable (using notions of probability theory, statistics, and game theory) (valued yes/no);

v_9 - the presence of systematic-learning or advanced content of gambling math (lessons, academy-style sections, in-depth guides, etc.) (valued yes/no);

v_{10} - the mentioning of author for math-related articles (valued yes/no);

v_{11} - the match between the math-related articles and their authors' declared expertise (valued on a scale from 0 to 3);

v_{12} - in-text presence of awareness on possible misconceptions, fallacies, and irrational beliefs in regard to gambling (valued yes/no);

v_{13} - the correlation of the above awareness with the mathematical aspects of gambling (valued on a scale from 0 to 3).

The values are conditional on each other as follows:

v_3, v_7, v_9 conditional on v_2; v_5 conditional on v_4; v_6 conditional on v_5; v_8 conditional on v_7; v_{11} conditional on v_{10}; v_{13} conditional on v_{12}.

The qualitative analysis will use as methods discourse analysis, content analysis, thematic analysis, conceptual interpretation, semantic analysis, doubt about sense, and analysis of arguments. It will have a strong component of linguistic-conceptual-logical analysis, targeting the following main elements:

1 - the usage of terms with non-uniform semantics;

2 - the contextual usage of math terms;

3 - the conceptual linkages relative to the relevance for the topic;

4 - the soundness of arguments based on applied math;

5 - the association between game strategy and the concepts of probability theory and game theory;

6 - the presence and contextual impact of "mathematically prohibited" or misleading terms (such as 'winning strategy', 'how to win', etc.).

Although the qualitative analysis is independent of the quantitative one, correlations will be made between the conclusions of the former and the variables of the latter.

Representation of the mathematical dimension of gambling may or may not be adequate in the content of gambling websites. The main goal of the qualitative analysis is to establish the disciplinary areas, as well as their individual roles, which can contribute to the theoretical framework that will derive the norms and criteria for such adequacy in the content of the websites and of the gambling communication. These disciplinary areas

entitled for involvement include mathematics, psychology, linguistics, philosophy of language, epistemology, and philosophy of mathematics.

Content and roles of the technical reports

Monthly technical reports describing the partial results of the qualitative analysis will be published on academic channels, preceding the main publication at the end of the study.

Each technical report will cover the review and recording of data from a minimum of ten websites. Some of the websites reviewed during the project are nominated in the section titled *Appendix*, along with brief descriptions from their owners.

We found such technical reports necessary, first because the current study is atypical in what concerns the statistical analysis and the qualitative analysis, as well as the objects under investigation. Therefore, the main role of the technical reports is to detect and define any methodological and technical difficulties encountered during this study and any challenges they may pose, for them to be analyzed and surmounted in both the continuation of the current study and any future similar research.

Besides presenting these difficulties and challenges, the technical reports will also contain unpredicted observations regarding the analyzed content that might require the revision or change of the methods and instruments used.

The results of the technical reports will be gathered, and general conclusions will be drawn in the main publication.

Observations and conclusions from the review of the second sample

The partial results of the statistical analysis confirmed most of our expectations in regard to content, although conclusive results for various hypotheses cannot yet be stated due to the small size of the sample reviewed thus far.

The only variables receiving zero (no) value for all reviewed websites (100%) are v_1 and v_9.

It worth noting that even those websites with gambling-math content detected do not have structural descriptions of the games in parametric form, although this is a requirement for explaining how the math was applied to describe them, the behavior of their outcomes, or the effectiveness of any gambling strategy presented. Even the simplistic descriptions for the game of slots did not refer to their structural parameters, except the number of reels (symbol distribution, weighting of the reels, etc.), which account for each version of the game before considering the mathematical facts associated with them.

Although we did not expect much systematic-learning content (variable v_9), as the partial statistics confirmed, we expected more strategic content, even in a "how to win" approach, not necessarily math related. About 30.7% of the reviewed websites have strategic sections (variable v_7), of which 75% have math-based game strategy topics (variable v_8).

Of the reviewed websites, 23.07% touched on the subject of gambling misconceptions and fallacies, of which 66.66% related them to some extent to gambling mathematics.

All of the websites reviewed thus far have links to online casinos and are affiliated with the games in one form or another, so it is fair to hypothesize that making profit from

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these games is their main aim. This profit motive might be a reason for these websites to have little interest in informative content, although content is a factor in SEO performance. As we know, sites dedicated exclusively or mostly to gambling information do exist, and such sites are higher ranked in Google searches than the small-to-medium gambling affiliates. Our advertising approach for the current program has targeted forums and online communities most suited for this latter category of gambling websites, and hence the informative sites have not been reached. However, as we stated, the main aim of our study is a qualitative analysis of the content, and while randomness is somewhat ensured by the method of collecting participants, the sample is not required to be representative for the entire population. In light of this principle, we propose to review separately a number of sites in the category previously described just in the qualitative aspects without extending the current statistical analysis to include them.

For the few gambling websites detected with gambling-math content thus far, we noticed that their articles are not systematized relative to each other regarding delivery of expert knowledge to the general public – they are conceived to be read independently. The general tendency that we detected in regard to organization of content and content itself is a struggle for SEO performance. This approach obviously affects content as to its expert dimension and epistemic goals. Just to mention a few factors: the excessive repetition of some keywords, unnecessary descriptions in the detriment of technical content with specialized terms, incomplete arguments, etc. We have even detected articles claimed as "expert", some of them with gambling-math content, showing "mathematically prohibited" or misleading terms (such as 'how to win'), which hypothetically can be related to SEO strategies.

Some general predominant tendencies from the first sample get contoured with this second sample:
- the SEO approach at the expense of poor quality of content;
- the lack of qualified experts for some topics;
- not indicating (let alone explaining) the importance of the roles of the mathematical dimension of gambling.

Most of the reviewed websites have links to responsible-gambling organizations. Some of them have responsible-gambling sections. The presence of such links or sections was not a variable to measure in the statistical analysis, but it is worth analyzing it in relation to other variables (v_7, v_{12}, v_{13}). One site has reflected in their responsible-gambling page the mathematical dimension of gambling relative to a healthy attitude about gambling, including ethical aspects.

Appendix – Selective list of the websites reviewed during the project

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onlinecasinos24.nl
Casino portal that provides information about online casinos in the Netherlands that are in possession of a valid casino license from the Dutch Gaming Authority.

instantwithdrawals.org
Expert casino reviews and ratings based on withdrawal speed and stability. Details of fastest cashout casinos per country, software and payment method.

allfreechips.com
Online gaming informational site delivering both user and professional reviews about online gaming.

casino-professor.com/en
Online casino comparison domain that lists licensed casino sites from around the world. Featuring reviews with real tests, videos, user comments, guides, and in-depth content.

gamblermaster.com
Site featuring a wide variety of guides, reviews, and articles about gambling online with real money, primarily in the online casino space.

onlinecasinosfinder.com
Provides reviews of a selection of online casinos, online casino gambling guides and tips for beginners and seasoned pros, and free online casino games.

gamble-usa.com
Licensed and trusted source for all things gambling. The site reviews and compares online casino operators and Sportsbooks in every US state. Its gambling guides include tips, tricks, and strategies.

casinorankings.com
Casino reviews and rankings provided by experts. Beginner's guide to casino gambling in both local and online casinos.

jeffbet.com
Fully licensed online casino and sportsbook offering a wide range of games and betting markets. The casino educates its players with gambling guides and game reviews.

References:

Bărboianu, C. (2013). Mathematician's call for interdisciplinary research effort. *International Gambling Studies*, 13(3), 430-433.

Bărboianu, C. (2014). Is the secrecy of the parametric configuration of slot machines rationally justified? The exposure of the mathematical facts of games of chance as an ethical obligation. *Journal of Gambling Issues*, Vol. 29, 1-23.

Bărboianu, C. (2015). Mathematical models of games of chance: Epistemological taxonomy and potential in problem-gambling research. *UNLV Gaming Research & Review Journal*, 19(1), 2.

Bărboianu, C. (2022). *Understanding Your Game: A Mathematician's Advice for Rational and Safe Gambling*. PhilScience Press.

Bărboianu, C. (2022). Qualitative analysis of the reflection of the mathematical dimension of gambling in gaming online content – project. *Philscience*. Retrieved from http://www.philscience.org/pages/gammathqa.html .

Griffiths, M. (1993). Fruit machine gambling: The importance of structural characteristics. *Journal of Gambling Studies*, *9*(2), 101-120.

Harrigan, K. A. (2009). Slot machines: Pursuing responsible gaming practices for virtual reels and near misses. *International Journal of Mental Health and Addiction*, *7*(1), 68-83.

Probability Theory Guide and Applications. http://probability.infarom.ro/

Lambros, C. & Delfabbro, P. (2007). Numerical reasoning ability and irrational beliefs in problem gambling. *International Gambling Studies*, *7*(2), 157-171.

Leonard, C. A., & Williams, R. J. (2016). The relationship between gambling fallacies and problem gambling. *Psychology of Addictive Behaviors*, *30*(6), 694.

Turner, N. E., & Horbay, R. (2004). How do slot machines and other electronic gambling machines really work? *Journal of Gambling Issues*, Vol. 11.