The reflection of the mathematical dimension of gambling in iGaming content: A qualitative analysis - Technical report no. 3 -

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The current technical report of the research project investigating how the mathematical dimension of gambling is reflected in the communication and texts associated with the gambling industry raises the problem of the adequacy of sampling and proposes a new approach in this respect.
The qualitative analysis of the reviewed websites is extended to a deeper analysis of language and also to the organization and structure of websites' content. Although not stated as a goal of the initial project, the research will also try to identify relationships between the specificity of content relative to the mathematical dimension of gambling, and the management and marketing of the website. An overview of the results of the statistical analysis of the current sample is also presented.

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 ten websites, which 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 current sample

In regard to both the qualitative and the statistical analyses, we initially adopted a random approach to sampling (not representative for the entire "population"), and motivated it through the focus on the qualitative aspect of the study. In fact, representativeness cannot be established for gambling websites as relative to any statistical study of their content. When we investigate the adequacy, consistency, language, and objective information of website content in a certain niche, we must not forget that such investigation indirectly targets the *users* of the websites. Therefore, when inquiring about the adequacy of representativeness, we should start from how users reach those websites rather than the criteria by which gambling websites can be categorized.
The main means by which users reach gambling websites is Google search. It is known that the Google search engine returns websites for a certain query (keyword) in what is called the Google ranking: Sites ranked higher by Google algorithms appear in the top of the search results. Google ranks websites by criteria of content – the more relevant the content of a website as determined by Google with respect to a certain keyword, the higher in the search results (by that keyword) that website will appear.

Therefore, it is fair to hypothesize that gambling websites ranking higher in Google's metrics will be reached more often by the users searching for gambling keywords than other gambling sites. This is the motive through which we decided to introduce, as participants to the study, gambling websites that rank high in Google searches. Among the general keywords used in searches were *gambling, gambling strategy, rules of […]* (each casino game mentioned per keyword), *gambling guide, casino guide*, and so on.

We have not established a specific share of these sites among all the sites reviewed as being representative, as we have no measure of which sites are reached more than others. Other search engines exist and are used as well, and more particular keywords are available for searching. Furthermore, there are other means by which users can reach gambling websites of a lower Google rank, such as gambling/casino forums or groups in social media.

On the other hand, it is expected that high-ranked websites have reached a certain level of professionalism in regard to their content (for example, due to a higher operating budget, they can afford to hire expert writers), which raises again an issue of representativeness for the statistical study.

However, with the review of the current sample, which includes high-ranked websites, we found, surprisingly, that such websites do not jump much afar of the tendency contoured with the review of the previous samples with respect to the reflection of the mathematical dimension of gambling: Although expert content was detected (strategy guides, myths & facts, questions & answers, and even learning hubs), the qualitative analysis of the content of these sections showed that the mathematical dimension of gambling is still far from being adequately reflected. For instance, even in articles signed by experts, we found no definitions of the math terms used (counted by variable v_5), and in general, the presentation of the mathematical facts of the topic was not systematic.

With the current sample, it became obvious that investigating in greater depth the language of the content is essential, since language is responsible for several cognitive distortions related to gambling-math. The mixed content (using both mathematical and non-mathematical terms) continues to lack both references to the formal definitions of the math terms and their adequate interpretation in the real world of gambling.

The organization and structure of websites' content is important in directing the user to the right path for acquiring and understanding the needed information (e.g., some topics must be read before others, especially when gambling math is concerned); they are important even in saving the user's time, as an adequate organization and structure visible from the homepage may let the user know from the start that the website is not what they are looking for. From our analysis, it follows that in general, those websites with inadequate organization and structure show poor content as well.

A new finding was a correlation between the profiles of the head team members of the websites (those presenting their staff) and the mathematical content present in the website. Mathematical content and a certain approach to the expert topics were detected for websites whose head team members indicate a technical-economic-mathematical background in their bio; that content and approach were not detected otherwise. (There are a few exceptions for websites using expert writers other than their staff.)

As detected in previous samples, the marketing policy of the websites impacts their content, especially when talking about affiliate sites. Such websites' content is focused on casino reviews and advertising the games they offer, to the exclusion of an expert description of the games and gambling.

The statistical analysis confirmed again the tendencies contoured with the previous samples. Variable v_1 – the presence of structural descriptions of the games in parametric

terms – remained null after over 50 websites reviewed, including those high-ranked and with expert content. Only three sites showed an in-text presence of awareness of possible misconceptions, fallacies, and irrational beliefs in regard to gambling (variable v_{12}), of which two correlated this awareness with the mathematical aspects of gambling (variable v_{13}).

The analysis will continue with the next samples by using the new (keyword search) approach to sampling and putting greater emphasis on language.

Appendix – Selective list of reviewed websites

uusi-pikakasino.com (reviewed in May 2024)
Focuses on a special type of casinos popular in Finland. Quick-access casinos or casinos without registration using fintech to speed up client signups.

renomowanekasyno.pl (reviewed in August 2024)
Everything about Polish online casinos and playing at them, including casino ratings and reviews, as well as information about bonuses, games, and payment methods.

casinospotfr.com (reviewed in August 2024)
Website providing information to help players learn about games, payments, bonuses, ratings, strategies, and tips. It contains in-depth guides written by experts.

nostrabet.com (reviewed in June 2024)
Platform where punters get to know the basics of betting by evaluating and exemplifying trending gambling practices. It covers authoritative guides, tested strategies, and in-depth bookmaker reviews.

cardplayerlifestyle.com (reviewed in August 2024)
Poker media platform showcasing live poker event coverage, news, strategy guides, poker training site reviews, interviews, and lifestyle features that cater to poker enthusiasts of all skill levels.

pl.topkasynoonline.com (reviewed in September 2024)
Portal dedicated to legal casinos in Poland, including reviews of different types of gambling and their providers, exclusive bonuses, and convenient payment methods for Polish players.

onlinecasino.amsterdam (reviewed in September 2024)
Online casino resource site in Dutch, offering expert information on games, responsible gambling, legal updates, and the latest casino news. It focuses on safe and legal gambling, tailored to players in the Netherlands.

intikkertje.nl (reviewed in October 2024)
Website about legal online casinos in the Netherlands with information about online slots an casino bonuses.

billionairegambler.co.uk (reviewed in October 2024)
Informative platform focused on licensed UK casinos, exclusive bonuses, and notable promotions, exploring the gambling habits of billionaires and high-stakes players.

slotswise.com (reviewed in November 2024)
A gambling resource featuring expert comparisons of online casinos and casino bonuses, predominantly focussed on online slots for UK players.

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.

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.

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

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