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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

The first thing to note is that reading and navigation time exceeded our expectations. A first issue needing optimization is that the content was actually double-checked – first for the measurement of the variables of the statistical analysis, and second, with the reading for the qualitative analysis. Some sections were cross-checked two times or more, depending on how they are linked to the main content. This technical issue is due to the fact that content is not linearly exposed (as in a written paper), but tree-like with not all branches displayed at once, which is actually how any website is essentially organized. Hence the issue applies to all the reviewed websites, no matter how effective their navigation menus are.

The search for specific terms is made somewhat easier by using the text search tool of the browser; however, this can work without reading the entire text only for measuring some variables in the statistical analysis – variables v_4, v_{10}, v_{12} and to a lesser extent, variables v_7, v_8, v_9 – and checking element no. 6 in the qualitative analysis. The search tool is no longer effective for the variables if the checked sections are also subject to the qualitative analysis and as such need extensive reading.

As expected, the largest amount of time per section is consumed with the review of the math-related targets of the qualitative analysis (no. 2, 3, 4, 5).

A website having expert gambling-math articles was detected, but it does not mention the name of their author or authors.
The articles having the largest amount of applied math are those with poker topics. This is explainable since poker is described by the largest number of combinatorial and probabilistic models among all games of chance, and the objective strategies in poker are probability- and statistics-based.

There are more similarities than differences among the websites reviewed. Although content is organized differently, at its core it is very similar, at least for those websites having affiliate casinos and no expert or advanced content. They label their sections with almost the same names, which have been adopted in gambling slang, and apply a general

label for their main content, namely “guide.” The websites call themselves “guides,” regardless of the level of expert contribution in their content (which can be seen right from their brief descriptions in the Appendix) and regardless of any taxonomy for this expertise. (They are just seen as ‘guides to *gambling*’ in general).

Although not included as a target of the qualitative analysis, it worth mentioning that several websites provide ‘reviews’ of the casinos. Such reviews are not based on comparisons, but rather, are individual reviews, looking together like advertising lists.

The main conclusion to be drawn after the first review pertains to the technique of reviewing, which must be optimized with the aim of saving time to be dedicated to more reviews over the unit time. The main processes to be optimized are reading and searching. It should be investigated how software may help in this respect and what software would be applicable and available for this task.

Appendix – Selective list of reviewed websites

bc.game (reviewed in October 2023)
Full-service online casino and sportsbook that supports deposits and withdrawals in many different currencies, both fiat and crypto.

betterworldcasinos.com (reviewed in January 2024)
Website focused on guiding players to environmentally and socially responsible online gambling entertainment, while also encouraging the iGaming industry to prioritize sustainability and ESG standards.

casinos.com (reviewed in December 2023)
Expert guides to legit online casinos, casino games, and bonuses based on experience and in-depth comparison data, plus the latest casino news and gaming trends.

academiadeapostas.com (reviewed in January 2024)
A source of gambling information for Brazilian players: strategies, reviews, and rankings of betting houses and casinos.

gamblingbaba.com (reviewed in January 2024)
Extensive gambling guide for Indian residents, reviewing gambling sites and providing useful information via news articles and guides. It covers online casino, sports betting and lottery.

fastestwithdrawalcasino.co.uk (reviewed in January 2024)
Platform guiding UK players to online casino sites that process players' withdrawal requests the fastest. It also offers casino centric news and guides.

sportfogadas.org (reviewed in January 2024)
Hungarian betting community portal with guides, HowTos and forum; some forum members contribute with content. It provides reviews of many betting sites and a blacklist.

chipy.com (reviewed in January 2024)
A source of online gambling information aiming to help players learn about any casino game and online gambling in general. In-depth guides written by industry experts.

slotsmate.com (reviewed in January 2024)
A source of user-generated casino and game reviews with focus on online slots. Gameplay video gallery and editors opinions on games.

cricket-betting.com (reviewed in January 2024)
An exhaustive guide covering every facet of cricket betting, featuring a vast array of betting tips, today's match predictions, and betting odds tailored for all major tournaments and leagues.

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