



## 2. Related Work

Progress in scientific research relies on publications in academic events devoted to the respective subject of interest. Bibliometric evaluation is needed to measure scientific activities at individual, university, and national levels, mainly by assessing statistics of publications provided. Relevant parameters include number of publications during a time period, the impact of those publications, publications trends. These criteria can be considered as indicators of the quantity and quality of research productivity. In Brazil, there is a reduced number of researchers in games area; also, there are no specific journals about video games. Most of research is published in scientific events, like SBGames. So, to know the research this trend was performed this bibliometric analysis from conference proceedings.

In international publication, there is little bibliometric research about Game Studies. Bragge and Storgards [2007] performed a research profiling in ISI Web of Science, concerning all the research on Digital Games that was found at that database, from 1985-2005. They found that the Game Studies it's a field which interdisciplinary and empirically varied in the extreme. One third of the articles were conducted at USA and United Kingdom. The digital game research is conducted by professionals providing from this science areas (in order): Health Sciences, Social Sciences and Information, and Communication technology. In the Keyword analysis, it's interesting to note that, after "video games" and "computer games", the keyword most used by the authors is "Adolescents" and "Children". Another study concerning the research in Game Studies was performed by White [2011], who says that the field receives several names: Ludology, Digital games research, Videogame studies or simply Game Studies. These names reflect the multi-disciplinary characteristic of the area. The author emphasizes that the published research on games seems to be characterized by three central antinomies: aggression x enjoyment, alienation x sociability and addiction x loyalty. The main focus of international research seen to be related to health studies.

### 2.1 Bibliometric Methods

The advent of the Internet and the possibility of availability of scientific documents in digital format changed the concept of *acquis* [Fernandes and Cendón 2010]. Therefore, it was possible to provide articles entirety on servers to query, what was the case of the SBGames (available from <http://www.sbgames.org/>), which can be consulted by identifying the year and the track (Art and Design, Culture, Computer, Industry, Tutorials, and Games for Change). This phenomenon facilitated the document query, as well as bibliometric studies.

The occurrence of the first study of bibliometrics appeared in 1917, and its concept involves the statistical analysis for the study of the characteristics relevant to bibliographic documents [Spinak 1996]. Despite that, the bibliometrics terminology was first used in 1934 by Paul Otlet's work called *Traité de documentation*. However, the popularization of this term is linked to the article by Allan Pritchard (Bibliography or Bibliometrics), published in 1969 [Vanti 2002].

The possibilities of bibliometric study can be categorized according to their goals, which in the case of this work were based on the mediation of productivity of authors and frequency of words/expressions, among others described. This makes it possible to map and establish indicators for assessing knowledge and information management and planning [Vanti 2002] of a given scientific community, and identify issues of greatest relevance and changes over time.

Furthermore, it is also necessary to differentiate bibliometrics and scientometrics. A bibliometric approach turns to quantitative analysis and aims to establish a state of the art and the evolution of a field or science, and one of its results is the mapping of research topics undertaken (case of the present paper). Moreover, the scientometrics turn to the analysis of bibliographic citation for establishing connections between areas of knowledge and scientists [Hayashi, 2004]. In other words, bibliometrics includes "more general process of information" while the scientometrics focuses on the "measurement of scientific communication" [Patra, Bhattacharya and Verma 2006].

Finally, should also point out that the bibliometric studies can be of two natures: descriptive or evaluative. The first direct their efforts to the issue of productivity, while the second focuses on the use of the documents, which means the count of citations and references involved in scientific papers [Naseer and Mahmood 2009].

In relation to bibliometric studies, from the viewpoint of the author, according to Nicholas and Ritchie [1978] the authors/researchers can be analyzed based on three criteria: productivity (related to the number of papers published by each author), multi-authored (responsible for the analysis of collaborations between authors) and vehicle of publication.

### 2.2 Social Network Analysis

The social network analysis, which is an interdisciplinary field of study, can be applied to any community, including academic, and this turns to the discovery patterns or even other significant elements [Wellman 1996, 1997]. Studies of social network analysis began in the late 30<sup>th</sup>, through the alignment of anthropology elements, when Radcliffe-Brown made

use of the network metaphor to represent the social structure of primitive societies [Scott 2001].

The social network analysis is guided by two structural elements: actors and relationships. Actors can represent people (groups, institutions, communities, etc.) and the relationships established a tie between two actors, making the formation of a graph where the vertices represent actors and edges are the ties established [Wasserman and Faust 1994].

A graph can be represented with edges oriented or not, and this will depend on the existence or absence of reciprocity between the actors (if there is reciprocity graphs will not have guidance, otherwise they will be made with oriented edges). Although it should be noted that the graphs can represent ego-centered or whole social networks'. The first, ego-centered, is ruled by the central actor viewpoint, what it means that all analysis is also made from this central vertex. The second, whole network, differently, considers all the actors that integrate a specific network, and are considered complete when all of them are contained in the relationships between all actors [Wellman 1997].

The social network analysis can also consider some network properties such as density, the geodesic distance and position. The network density is related to the amount of existing connections, and the greater the number of connections between actors, greater will be the density. The geodesic distance is the shortest distance between two vertices, i.e., between two agents, what it makes possible to setting the number of degrees needed between these [Hanneman and Ridle 2005]. Finally, the position can be worked out from the betweenness centrality and the closeness centrality, among others.

The betweenness centrality works with the potential of actors to constitute bridges that facilitate contact among other actors. The closeness centrality analyzes the interdependence of an actor than the other, i.e., the shortest path to go up the other vertices in the network [Marteletto 2001].

This study (bibliometric and social networks) is justified by the fact that their results may contribute to the visualization of elements that enable the understanding of the existing dynamics and decision making, allowing a growth of Culture Track in all its aspects, these are numerical, qualitative and innovation. Given these assumptions, the following topics are worked on bibliometric elements considered most relevant for the present study, as well as social network analysis pertinent.

### 3. Materials and methods

The data source was available online. Articles indexed between 2007 and 2011 related to the SBGame's Culture Track were retrieved. After the capture of the

articles was assembled a database of information relevant to the following criteria: Year of publication; article's type (Full paper, Short paper); authors; affiliation of the authors; Keywords; Subject Area (Games and education; Games and politics; Games and work; Games and language; Games and youth; Games and media; Games and violence; Games and sociability; Games and advertising; Games and emotion; Games and motivation; Games and body; Games and art; Games and gender; Games and psychology; Games and religion; Games and philosophy; Games and health; another subject); and Type of study (Literature review; Documentary; Experimental / implementation; Ex-post facto; Survey; Field observation – Qualitative; Field observation - Quantitative; Field observation - Qualitative and Quantitative; Participant; Action Research; Case Study; Experience Report) were recorded.

A descriptive statistical analysis of the social network data was performed with two of most used applications for that: Pajek 3.01 and NodeXL 1.0.1.218.

## 3. Results

The search for the articles between 2007 and 2011 yielded 163 articles, 110 as full papers and 53 as short papers.

### 3.1 Publication year and Articles' type (Full paper and Short paper)

Between 2007 and 2011, 163 articles were indexed with 412 authors/institutions (considering duplicated authors/institutions). The largest number of articles was published in 2009 (34 Full papers and 20 Short papers) as it can see below:

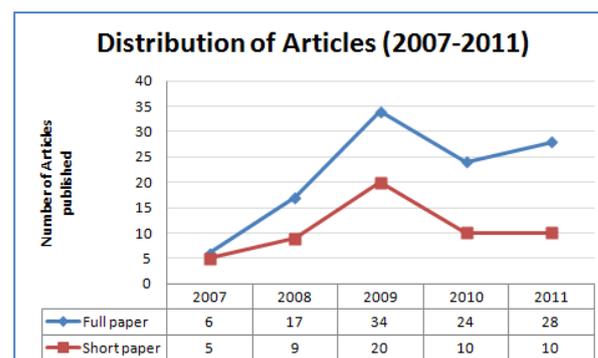


Figure 1: Number of articles published in five last years

From first to third year (2007-2009) there was a substantial increase in the number of articles published. In relation to full papers, from 2007 to 2008 there was an increase of 183.33% and from 2008 to 2009 a lower growth, still expressive, of 100% resulting in a total of 283.33% in two years. Likewise, despite a smaller scale, the short papers also showed significant growth, resulting in 202.22% in two years (80% from 2007 to 2008 and 122.22% from 2008 to 2009). After this

peak, situated in 2009, there was a decrease followed by stabilization. In relation to full papers, took a reduction in the order of almost 30% (29.41%) from 2009 to 2010 and a rising of 16.67% from 2010 to 2011, what results in a total of -12,75%. In relation to the short papers, in years of 2010 and 2011, there was a 50% reduction followed by a plateau. This scenario may indicate a period of searching for self-regulation of the track.

### 3.2 Article's language

The Culture Track, in these five years, received submissions in two languages: Portuguese and English. The expression of this relationship is present in Figure 2.

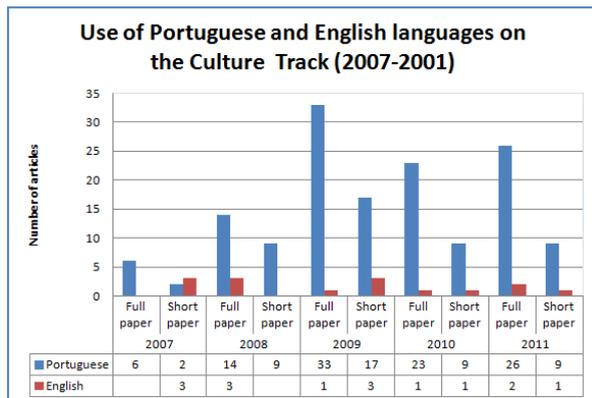


Figure 2: Languages used in Culture Track

It can be seen in the graph, there is a predominance of works published in Portuguese in Culture Track. As a result, only 9% of articles published in these five years are in English. This can be explained by the fact that a SBGames event be Brazilian, and the Culture Track have a higher participation of researches related to the humanities field. Also have the collaboration of colleagues from Portugal. This situation should change in coming years, because since 2012 articles must be submitted in English, in order to internationalization of the full conference.

### 3.3 Authors

In relation to the authors, one of the elements that sought to establish over bibliometric survey was the frequency of publication (Figure 3).

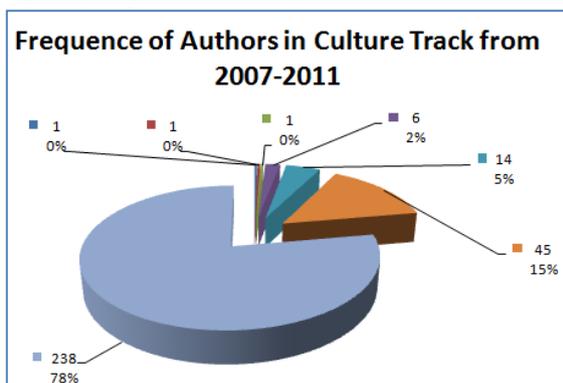


Figure 3: Authors' participation in Culture Track

From figure 3 it can be highlighted that almost 80% (78%), corresponding to 238 authors (light blue label), were related to the publication of one single article thought this five years. 15% of authors had published two articles (orange label), 5% three articles (blue label) and 2% participated in four publications (purple label). Following this trend of reduction, only one author has five articles (green label), one second has six articles (red label) and a third comprising 15 articles (dark blue label). Finally, one author has five events publication in which represents 0.32% relative to the total sample.

The most of authors had presented only one article, confirming the tendency of the social sciences observed in other studies [Mueller and Pecegueiro, 2001; Liberatore, Herrero-Solana, Guimarães, 2007]. This indicates that, possibly, as the track is still recent: regularity of publication and the relationship between authors and research groups are still under construction. However, this phenomenon is reflected in the number of co-authorship and therefore in the social network structure formed, as can be seen in figures below. It may also indicate that there are few research groups that can produce regularly. The high number of authors and the low participation of each of the track may indicate that the authors studied did not choose this event as a vehicle of their frequent publications.

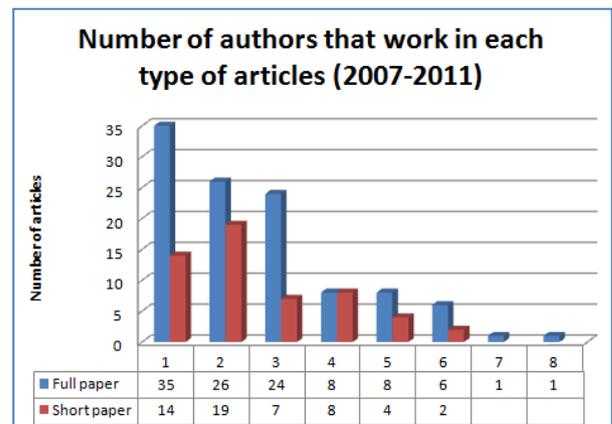


Figure 4: Number of authors and article types

Figure 4 confirms the predominance of full papers with one, two or three authors, a total of 78% (77.98% that result in 85 articles) of this type. This ratio suffers little change in the case of short papers, resulting in 74% with one, two or three authors. Because of this, the social network formed over the five years shows a low density.

The study of social networks, in this case, aimed to analyze the relationships in the community formed by the authors and co-authors who participated in the Culture Track in its five editions, what was developed with elements from the field of social network analysis [Wasserman and Faust 1994; Molina 2001]. In this sense, the agents have been identified, i.e., the authors that share one or more publications, as well as their attributes (in this case is expressed by binding

institutional) and relational ties, which corresponds to the connection entity pairs actors.

Also, it is noteworthy that this sociocentric network is a co-authorship network and is expressed by a non-directional graph (generated with NodeXL 1.0.1.218), since there is no direction in the communication process. The non-directional graph is formed by 306 vertices (306 authors or co-authors uniques) and 503 vertices without duplication, resulting in 0.01 density graph (Figure 5). Also noteworthy is that the average distance geodesic is 1.34 and that the diameter of the network has a value equal to 3. This means that any author is three degrees of separation from any other social network discussed in this article.

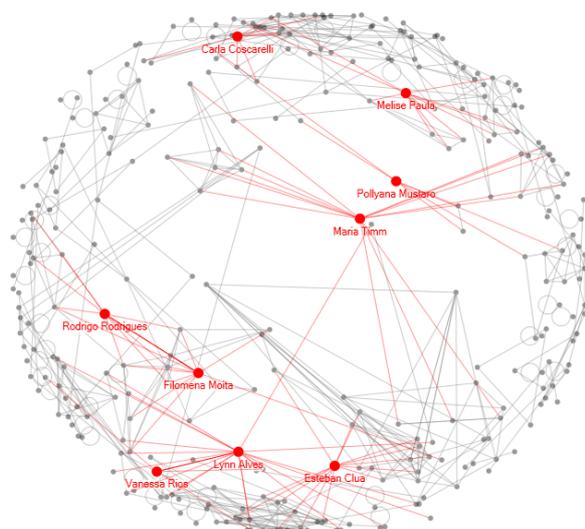


Figure 5: Social Network formed by Authors of Culture Track

The author with a higher degree in the network (Lynn Alves) has 19, resulting in betweenness centrality of 168.5 and closeness centrality of 0.048, and it should be noted that only four more authors present degree with values greater than or equal to 10. This represents 1.63% of authors in the Network. An additional information to consider are related to the authors that have betweenness centrality with more than two digits, nine authors (ranging from 16 to 168.5), what represents 2.94% of the total.

This second representation of the graph (Figure 6) formed by the authors and co-authors who published articles on the Trail Culture since its origin was generated by Pajek program [Batagelj and Mrvar, 1998] version 3.01 (2012) with the Kamada Kawai algorithm with Separate Components.

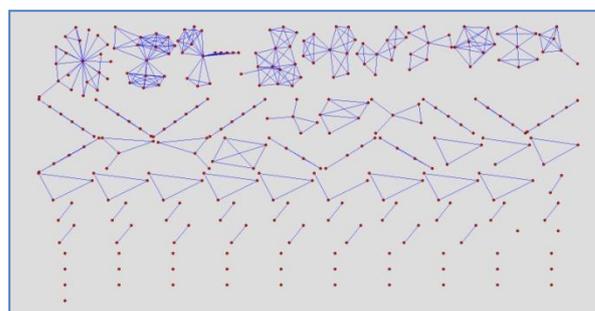


Figure 6: Social Network formed by Authors of Culture Track presented in separate way

In this view it can see the authors separately with no connection, i.e., without collaboration and the authors who have co-authored with two or other authors. The view that allows more clearly the low connectivity of the network.

### 3.4 Affiliation of the authors

In relation to the authors' institutions, were identified 81 organizations (77 academic and 4 companies). The most productive universities were, in order of productivity, UNEB (9.22%), UEPB (6.31%), UFF (5.34%), UFMG (5.10%), UFSC (3.64%), UFBA (3.40%), UFRGS (3.40%), UPM (2.91%), University of Coimbra – Portugal (2.67%), UFAL (2.67%), and UFS (2.67%). These 11 institutions are responsible for 195 (47.33%) of 412 occurrences linked to the 163 articles published (full and short papers) at five years of Culture Track.

Other analyzed aspect was the representative of authors' countries (Figure 7). Considering that the SBGames Symposium (linked to SBC) constitutes a national event, it was confirmed the most representative of Brazil, which accounting 96% (393 occurrences). Two others countries are represented: Portugal (4% with 18 occurrences) and U.S.A. (0%, corresponding just to one occurrence, i.e., an author institution).

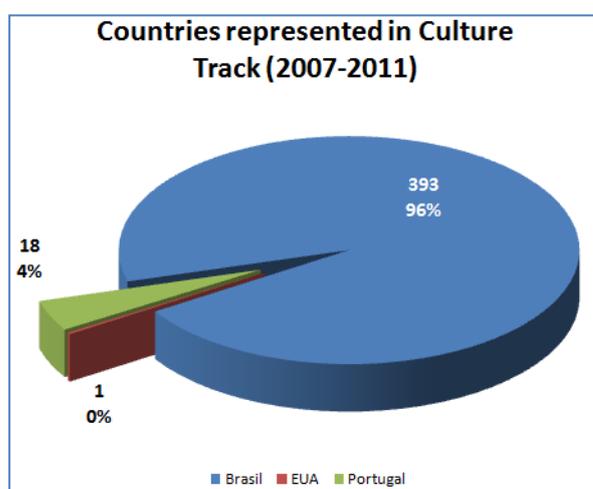


Figure 7: Countries that was published in Culture Track

If they are considered these 393 Brazilian occurrences, it is still possible to distinguish two forms of analysis: the relevant representation by state (Figure 8) and region (Figure 9).



Figure 8: Brazilian States that was published in Culture Track

The visualization of Figure 8 provides a more representative MG (15.78%) and the BA (15.62%) followed by SP (11.70%), RS (9.67%), PB (9.16%), SC (8.91%), and RJ (8.14%). When these data are organized according to the Brazilian regions, it gives the results expressed in Figure 9.

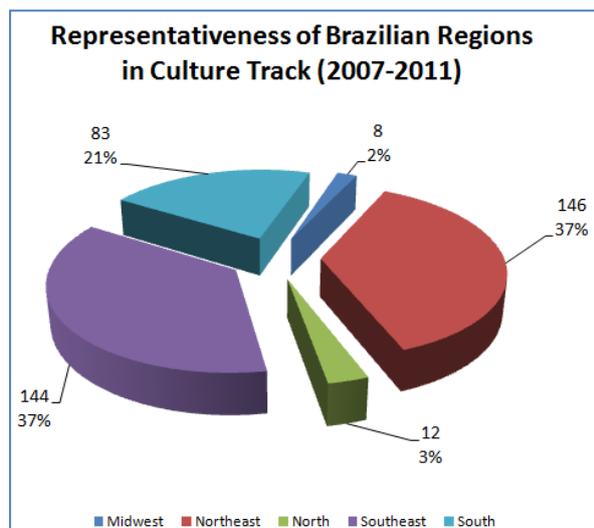


Figure 9: Brazilian Regions that was published in Culture Track

The data in previous chart are in a certain way confirmed by this result. The Brazilian region with the largest representation, by a margin of difference of only two occurrences in relation to Southeast, is the Northeast (37% with 146 occurrences). The third highest number of occurrences is linked to the South (21%). This could possibly be related to the research groups and/or researchers with greater frequency and regularity of the sample, which requires further analysis.

### 3.5 Keywords

As it is possible to visualize in the tag cloud earlier presented in this document, the term most prominently

among the 619 keywords, related to articles published in five events, is “games”.

These keywords show, among other things, that there is no precise definition of terms in Brazil, as many times “videogame” (video game), “games”, “jogos eletrônicos” (electronic games) e “jogos digitais” (digital games) are used as synonyms of “games”. Also, these words seem to be little illustrative of the articles: after all, in SBGames everything refers Games.

Other mainly words used are “Educação” (Education), “Jogos educativos” (Educational games) and “Jogos educacionais” (Educational games), showing the predominance of articles in the surveyed area of education. Although, it should be noted that the semantic differences and theoretical debates were not considered at this time, since it was attempted to raise issues for the definition of a taxonomy to carry out the analysis presented in this topic.

However, the authors used a large number of different keywords, which hindered the overall count of the same individual. It ran because SBGames does not use taxonomy. Some events using taxonomies to facilitate the indexing of articles, and systems are used in technological areas of the IEEE (2009) (where it is possible to find a specific taxonomy for the Computer Society Chapter) and the ACM (1998). Because of this, was adopted, as the methodological strategy, the analysis of keywords for theme group in 20 issues (Figure 10).

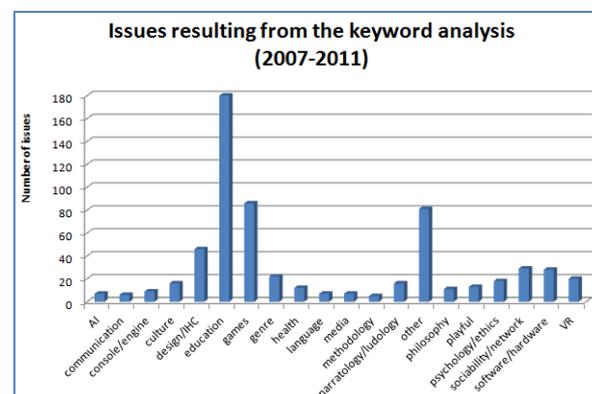


Figure 10: Keyword analysis

It can be displayed from Figure 10 four issues: “education” (29.08%), “games” (13.89%), “Other” (13.09% to represent the keywords with to represent words with a low incidence), and “design/IHC” (7.43%). Compared to the work of Bragge and Stogards [2007], Brazilians research seen to be quite different from the international big picture. Education seems to be the major interest.

### 3.7 Subject area

Among a total of 163 articles, “Games and education” were the area most commonly studied. This area has 90

articles as a whole and representativeness, in relation to the other in the five years of existence of the Culture Track. It is noticed also that in relation to the full papers, only the “Games and Education” and “Games and Media” areas remained present in all years (Figure 11).

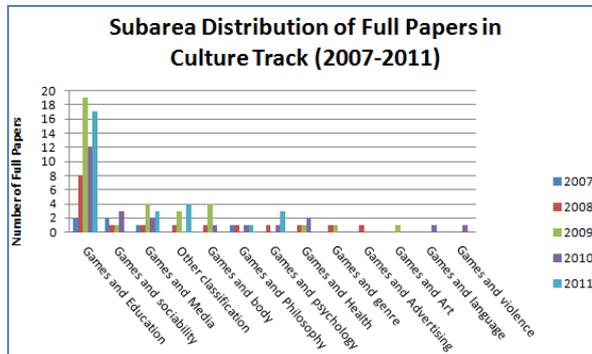


Figure 11: Full Papers Subareas' in Culture Track

It is also worth noting that not all subcategories are represented in short papers. These works do not include articles in “Games and Sociability”, “Games and Language”, and “Games and Motivation” (Figure 12). Still it should be set the fact that the relationship between games and psychology is more representative on short papers.

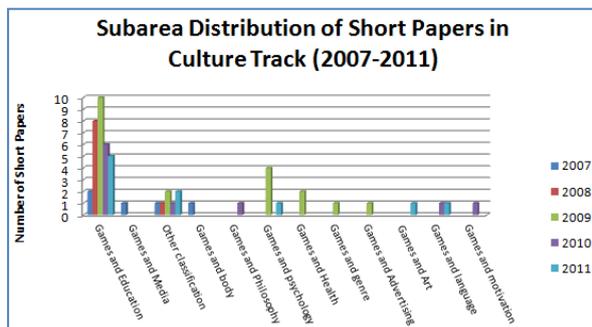


Figure 12: Short Papers Subareas' in Culture Track

Finally, the areas related to philosophy, gender, advertising, art, language and violence still have a reduced amount of work (in both modes of submission – full papers and short papers), which means that these gaps can be exploited in future on Culture Track to broaden the spectrum of relevant games discussions.

### 3.8 Type of study

The studies were mainly bibliographics (35%) (Figure 13).

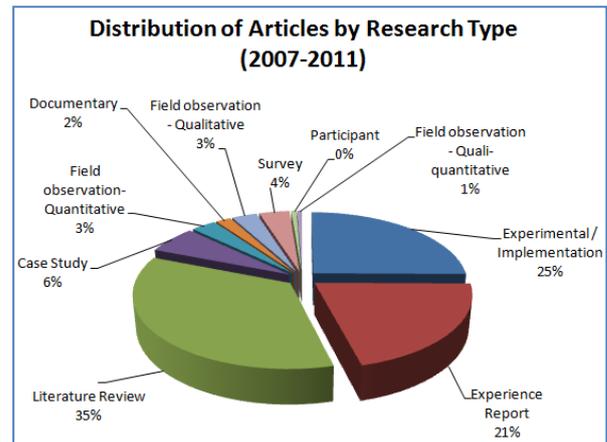


Figure 13: Articles Research Type in Culture Track

A possible explanation for this is that, as the area of games has not unified theoretical framework [Bragge and Stogards 2007], it is possible to perform various proposals and theoretical approaches. The Culture Track can fit insights from various disciplines (psychology, sociology, semiotics, etc.), and the bibliographic work reflect these different approaches to the games area. As the authors of present paper do not have experts in several areas, it is difficult to judge whether the theoretical contribution of material is relevant and if represents the current state of the art.

Furthermore, practical research requires funding, which is scarce in Brazil, while desk research is more accessible. These publications also refer to parts of larger projects in the game development, often being the theoretical foundation that supports the practical project. This is visible especially in projects whose theme is education.

Another important data refers to the high number of experimental / implementation works (25%) and reports of experience (21%). These studies refer basically to implement games and the experiences of applying these games in practical situations. Among other hypothesis, this data may show an immaturity of the field in Brazil. Other hypothesis for 25% of implementations is the interdisciplinary contributions of researches from Computer Science area and others like that.

To complement this analysis, is sought to further establish a correlation between the data type of study and type of article (Figure 14).

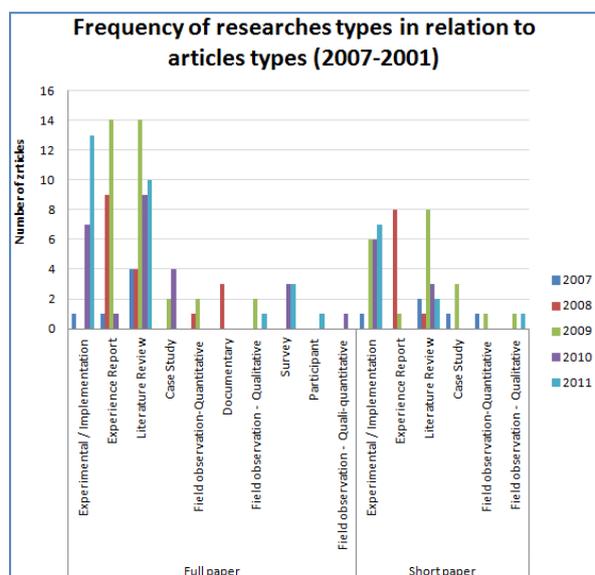


Figure 14: Relationship between Articles Research Type and Full/Short Papers in Culture Track

Literature review was the only type of research that kept regularly in five years of Culture Track. Experience report also stood out in relation to the full papers, while for short papers the second highest occurrence found was the experimental studies and implementations.

It can be seen even though the types of research Ex-post fact and Action Research are not present in the sample. Thus, in the full papers are included 10 of the 12 possible research types presented in this work. When comparing full papers with short papers, one notices also that four other research types are not present: Documentary, Survey, Field observation - Quali-quantitative, and Participant.

#### 4. Discussion

Survey results in this present article reveal some relevant aspects that will be detailed below.

Over three quarters (78%) of individuals in the universe of 306 authors signed their article as single author. Also there are a high number of authors who published only one article, as single author or in collaboration (almost 80%).

Another fact that draws attention is the large number of bibliographic researches. Another hypothesis raised to explain this finding is that there may be a large number of researchers working in isolation, without belonging to research groups. The publications may refer to the literature reviews of other works such as monographs, undergrad research, master's, doctoral, etc. This could explain the high number of individual researchers and also the high number of bibliographic works. In a random sample, 20 authors were checked at Lattes Platform (<http://lattes.cnpq.br>). It was found that 15 of 20 researchers whose theme of the article is the same as

his master's thesis or doctoral degree. This is an important data that could be better investigated in further research.

Another relevant data is that when the database was assembled, it was noticed that three articles were published simultaneously in other academic events. The authors did not respect the rule of originality of articles, publishing the full text identically. The article's theme is mainly "Games and Education", which is the major theme in all years.

The numbers related to the regions represented in the Culture Track express a reduced participation of the North and Midwest, which may indicate that a consolidation has not occurred in research groups related to games in these regions.

#### 5. Conclusions and Further Works

This paper aimed to mapping the Culture Track and analyze its dynamics over the five events in which was represented in SBGames (2007-2011). According to the data analyzed, a feature that stands out is the number of authors working in isolation: almost 80%. This fact also influenced the social network analysis, which may indicate the need for action to promote greater integration between the groups/researchers. As a complement, it is also necessary to analyze these results in relation to the number of articles that represent research to obtain grades (either undergraduate or graduate), which can be performed as further work.

As a further work, it is also relevant to analyze the groups/researchers influence in publication distribution by state and region and the large number of experimental/implementation and experience reports researches.

Other perspective of future work involves a thorough analysis of the sample with regard to content, publications critical to the scientific area, references cited, among others with centometric methods.

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