"Looking for an amazing game I can relax and sink hours into...": A Study of Relevance Aspects in Video Game Discovery

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Abstract. With the rapid growth of the video game industry over the past decade, there has been a commensurate increase in research activity focused on a variety of aspects of video games. How people discover the video games they want to play and how they articulate these information needs is still largely unknown, however. A better understanding of video game-related information needs and what makes a game relevant to a user could aid in the design of more effective, domain-specific search engines. In this paper we take a first step towards such domain-specific understanding. We present an analysis of a random sample of 521 complex game requests posted on Reddit. A coding scheme was developed that captures the 41 different aspects of relevance and information needs expressed in these requests. We find that game requests contain an average of close to 5 different relevance aspects. Several of these relevance aspects are geared specifically to video games, while others are more general.

Keywords: query analysis, video games, game search, complex search, information need categorization, relevance aspects

1 Introduction

Today, the global video game market is valued at 78.61 billion USD and growing with more than half a billion people worldwide playing video games for around six hours a week on average [1]. As a result, video games are a fruitful domain for research on a variety of topics, such as the benefits and hazards of playing video games [10], analysis and prediction of player behavior [12], and recommendation of games and in-game player match-ups [20]. Given the vast monetary potential of video games, we know surprisingly little about how people discover new video games to play and what makes games relevant to them. While there is work on casual leisure search in other domains—such as books [5, 18], television [8], and movies [4, 5]—video games search remains unexplored. Yet, understanding game discovery and the aspects used to identify relevant games is crucial for building successful search and discovery systems.

In this paper, we take a first step towards a better understanding of this scenario by collecting, annotating, and analyzing a set of real-world information needs related to video game discovery[1]. We focus on requests that elaborate a searcher's information need to a greater degree than simple Web search queries would, to get a more complete view of their relevance aspects. Relevance aspects are components of stated information needs with the intent of finding relevant results. Relevance aspects, when appropriately described as metadata or features in a search system, can guide a searcher to their stated goal. If the search system uses features different from the stated relevance aspects, a mismatch and consequent search failure occurs. This work identifies those relevance aspects, which may decide between search failure or success in video game discovery.

To achieve this, we collected over 2,000 discussion threads from Reddit subreddits dedicated to game discovery and annotated a random sample of 521 video game search requests expressed in these threads. We developed a coding scheme for capturing the variety of relevance aspects and information need types expressed in these requests. Several of these relevance aspects are geared specifically to video games, while others are more general. Through a detailed analysis of our coded requests, we find that they contain an average of almost 5 different relevance aspects, making this a truly complex search scenario. Our work could thereby contribute to future development of game search and discovery systems.

2 Related work

There has been research focused on video games in many disciplines. Within IR and LIS, video games are mainly treated as part of everyday information seeking [19] or from an organizational and preservational perspective [17, 22]. With tremendous choice and growing interest in games, the design of effective information systems for search and discovery is a crucial task. However, this requires a better understanding of games as well as information needs from diverse user groups [13, 15]. Compared to other information objects like books, movies or even music, the classification and organization of games is a rather young and interdisciplinary research field [2]. Traditional metadata schemes seem only partly suitable to describe games in their complexity due to the interactive character of games. Several researchers have made an effort to include these characteristics by defining metadata elements and a standardized vocabulary for games [15]. Video game genres have also seen considerable discussion [3, 14]. Results from user appeal studies suggest that game appeal is strongly affected by complex narrative elements including engaging characters and gameplay mechanics as well as challenging tasks [13]. These would have to be described as (metadata) features in order to be incorporated successfully into search systems.

A large body of HCI research has examined players' interactions, motivations and experiences with games. From a complex search perspective, the experience of and motivation for playing video games is described widely as multi-faceted [7, 11]. For example, Yee [23] proposed 10 different sub-motivations for playing video games (advancement, mechanics, competition, socializing, relationship, teamwork, discovery,

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[1] In this paper, we focus exclusively on video games; table-top, role-playing and other game types are not considered.

role-playing, and customization), grouped into three overall components (achievement, social, and immersion).

Information science studies have focused mainly on user behavior and information needs within game playing contexts [6, 21]. Very few studies have investigated game-related information needs or seeking behavior. Accordingly, little is known about relevance aspects with respect to game search and discovery strategies. Lee at al. [16] investigated organizational principles behind the game collections of 56 users. Amongst others, participants mentioned visual metadata such as trailers or videos as well as similarity aspects as crucial information to decide, which games are relevant to them [16]. Furthermore, "price" and "platform" were mentioned by users as the most important metadata elements for games [15]. To the best of our knowledge, the work in this paper is the first attempt to analyze and categorize complex game requests from Internet fora.

3 Methodology

3.1 Data collection

In order to perform a detailed analysis of the aspects that users think they need to describe when searching for video games, we collected and analyzed a representative sample of video game search requests. To collect a realistic sample of complex game requests, we turned to discussion forums, similar to earlier work on book and movie requests [5]. We identified three dedicated discussion groups for video game-related information needs on Reddit[2], a popular discussion and social news website. Two of these subreddits, /r/gamingsuggestions and /r/gamesuggestions contained a wide variety of requests for new games to play, while the third (/r/tipofmyjoystick), is dedicated to known-item (i.e., re-finding) requests for video games. One reason to choose Reddit is that it has dedicated discussion groups, also known as *subreddits*, centered around different types of game-related search and discovery, which suggests that such requests are common enough to warrant a dedicated subreddit and signals a low threshold for users to post them. It is possible that Reddit users are not representative of all gamers, but we have no reason to believe their requests differ in any significant way from those of others. To collect game requests from these subreddits, we adapted an existing Reddit crawler[3] to continuously crawl all threads and comments posted to these three subreddits from June 2-22, 2018, resulting in 2,266 threads. Table 1 shows the distribution of these threads over the three subreddits, along with descriptive statistics of the different subreddits. It shows that /r/gamesuggestions is the least active subreddit with only 51 threads posted during our 20-day crawling window. The other two subreddits show considerably higher thread activity, but vary in terms of commenting activity. This suggests a fundamental difference between these types of needs and how they are resolved on Reddit; an analysis of this commenting behavior is left for future work.

3.2 Coding

Open coding. To develop our coding scheme for relevance aspects expressed in requests for video games, we used an open coding approach. We selected a random sample of

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[2] Available at `http://reddit.com`, last visited September 4, 2018.

[3] Available at `https://github.com/lucas-tulio/simple-reddit-crawler`, last visited September 4, 2018.

Table 1: Overview of the 2,266 threads and comments crawled from the three subreddits. Request length is the length of the first post (in words), i.e., the original game request.

Subreddit	Threads total	Comments average	total	Request length min	average	max
/r/tipofmyjoystick	1,131	4.4	4,969	1	115.5	1,137
/r/gamingsuggestions	1,084	8.2	8,925	1	80.2	1,569
/r/gamesuggestions	51	2.2	112	4	103.2	772

75 threads from our Reddit crawl to serve as development set. Three of the five authors developed their own individual coding schemes on this development set. We settled on a sample size of 75 threads as other studies have shown it balances effort with recall, so that even infrequent but meaningful relevance aspects stand a chance of being identified [4, 5]. For each thread, coders were shown the title and the full text of the first post.

Axial coding. The open coding phase resulted in three different coding schemes with a combined total of 95 different codes. Card sorting was used in the axial coding phase to produce a single, unified coding scheme to identify relationships between codes and re-arrange them into higher-level categories. Many codes were proposed by two or more annotators. We based the decision whether or not to merge to codes on the underlying purpose: developing systems that can help satisfy these complex game requests automatically. For example, the two different aspects 'soundtrack' (for music playing in the background) and 'sound effects' (for any kind of sound in the game) were grouped together under the aspect Sound design (hereafter stylized as such), denoting any game-related sound information. After the merging phase, related categories were grouped into top-level categories. The resulting coding scheme was then discussed by all five authors until consensus was reached. In general, all axial coding decisions were made with the aim of informing information systems that support heterogeneous real-life user requests with different strategies. Textual descriptions of the different aspects were added for each aspect along with prototypical examples to aid the final annotation process. Our final coding scheme is described in the Section 4.

Final coding. For the final coding phase, every author annotated their own random sample of 140 subreddit threads. Posts from the development set were not re-used. Not every subreddit thread is necessarily a search request, so each post was first categorized as a request or not, after which only the requests were annotated. This resulted in a total of 521 annotated requests. After the first round of coding, all annotators discussed their experiences, which led to small refinements of the code labels and descriptions. Each annotator then revisited their 140 requests to adjust their annotations. To examine reliability, a total number of 80 posts overlapped between pairs of authors; agreement on these posts was calculated using Fleiss' kappa and is covered in Section 4.1.

4 Results

Figure 1 shows our final coding scheme, which includes seven top-level categories: five representing different categories of relevance aspects—Content, Metadata, Experience,

Context, and Interactivity—and two representing aspects of the information needs—Search process and Information need. These seven main categories are further divided into 41 sub-categories. None of these categories are mutually exclusive; requests could be assigned more than one relevance or information need category, although at least one information need was assigned to each request.

The top-level category Content covers 11 sub-categories on what the game should be about. The majority of these sub-categories are domain-agnostic metadata elements such as Character, Design, Dialogue, Plot, Setting, Time, and Topic. In contrast, other sub-categories are highly domain-specific such as Cutscene(s), Sound design, World building, and Gameplay mechanics, which covers descriptions of the rules and rewards of a game and the tasks and choices provided to the player.

The top-level Metadata category includes a combination of traditional metadata, well-known from other domains of information resources, and categories specific to the game domain. The game-specific categories include Availability (requests for games available through a particular purchasing model, e.g., as a demo or shareware), Platform (requests specifying the platform or device, e.g., PS4 or PC), and Technical specifications (describing the user's requirements for the hardware or software the game should run on, e.g., specifying required disk space or processor power).

We identified four sub-categories under the top-level category Experience. The domain-agnostic Mood category describes the desired mood, tone, or gaming experience. In contrast, Playability and (Re)play value are domain-specific categories describing the skill level or coordination required to play the game, and the potential duration, longevity and/or complexity of the game respectively. Perspective includes requests for games played in a particular perspective (e.g., first-person view or top-down perspective).

The top-level category Interactivity and its four sub-categories are unique to the game domain and reflect a core characteristic of video games. The category Connectivity includes requests for either online or offline opportunities, Controls describes the input device (e.g., joystick, mouse, keyboard), Expandability includes requests that allow for game expansion through, e.g., downloadable content or bonus levels. Game mode specifies the desired gaming mode such as single-player, multi-player, cooperative, turn-based, or same-device versus multiple devices.

Finally, some users searching for games also describe the relevant Context, in which the requested games will be played or their purpose for playing them.

In addition to five top-level categories representing aspects of relevance, we also included two top-level categories representing the information need and the characteristics of the search process. We identified four different information need types: Choice, Discovery, Known-item, or Similarity. Discovery requests represent the typical scenario where users need help in finding games that match their desired search criteria. In contrast, the goal of Known-item requests is to re-find a specific video game. Choice requests are formulated by users who need help in deciding which of a small set of video games best match their stated relevance criteria, while Similarity-type needs always include at least one example of games that are (dis)similar in some respect.

Finally, several users included information to help support the Search process. For example, some users provided a Link to external resource, while others explicitly rule out candidate games by, e.g., title or genre (Not this one). Other users describe the

		Top-level aspect	Sub-aspect	Description
RELEVANCE ASPECTS	What should it be about?	Content	Characters	Games that identify specific characters, types of characters or character development
			Cutscene(s)	Games that feature a specific cutscene, intro, or loading screen
			Design	Games that feature particular graphics, art style(s), or special effects
			Dialogue	Games that feature a particular line or style of dialogue
			Gameplay mechanics	Games that feature particular gameplay mechanics or functionality
			Plot	Games with specific plot lines, narrative elements, or scripted events
			Setting	Games that take place in a specific setting, location, or near geographical landmarks
			Sound design	Games that feature particular sound effects, in-game music, or soundtrack
			Time	Games that are set in a particular time period or around a specific historical event
			Topic	Games that cover one or more specific topics
			World building	Games that feature a particular level design or quality of world building
	What kind of properties should it have?	Metadata	Audience	Games that are aimed at a specific audience
			Availability	Games that are available through a particular purchasing model (e.g., shareware, Steam)
			Creator	Games from a particular developer or publisher
			Genre	Games that fall into one or more specific genres
			Language	Games written in a particular language
			Platform	Games that run on a specific platform or device
			Popularity	Games with a certain level of popularity or obscurity
			Price	Games that fall in particular price range or payment model
			Properties	Games with specific physical properties (or their packaging)
			Release date	Games that were released or played on a specific date or during a specific period
			Series	Games that are part of a particular franchise or intellectual property
			Technical specifications	Games that meet the user's requirements for the hardware and/or software it should run on
			Title	Games that have a particular title
	What experience should it provide?	Experience	Mood	Games that evoke a certain mood, tone, or gaming experience
			Perspective	Games played from a particular perspective (e.g., first-person, third-person, isometric, top-down)
			Playability	Games that require a certain level of skill or hand-eye coordination
			(Re)play value	Games that offer certain levels of replay value, longevity and/or complexity
	How should the user interact with it?	Interactivity	Connectivity	Games with a desired level of online connectivity
			Controls	Games that are playable with specific input devices
			Expandability	Games that are expandable through DLC, level editors, modding, or other user efforts
			Game mode	Games with particular game modes (e.g., single-player, multi-player, co-op, split-screen)
	How is it used?	Context	Context	Games for playing in a specific context or for a particular purpose
INFORMATION NEED ASPECTS	What type of need is it?	Information need	Choice	Requests for help in deciding which of a set of games should be picked in a specific situation
			Discovery	Requests for games where the searcher is not aware of any games that match the search criteria
			Known-item	Requests for games already known with the purpose of re-finding them
			Similarity	Requests for games by listing other games that the requested games should (not) be similar to
	How is the request expressed?	Search process	Link to external resource	Link to an external resource with helpful information to aid in the search process
			Not this one	Supporting the search process by explicitly ruling out candidate games as the right answer
			Search history	Supporting the search process by describing the previous steps taken by the user
			Situation of exposure	Supporting the re-finding process by describing where the user first encountered the game

Fig. 1: The coding scheme for video game search requests.

previous steps taken in their Search history, or the Situation of exposure where the user first encountered a game (e.g., in school, watching a trailer).

4.1 Inter-Annotator Agreement

In order to calculate inter-annotator agreement, we arranged for an overlap of 20 posts between successive annotators. For instance, annotators 1 and 2 overlapped on 20 posts, annotators 2 and 3 overlapped on 20 different posts, and so on. Finally, inter-annotator agreement was calculated over a total of 80 overlapping posts. We calculated Fleiss' kappa, because agreement[4] was calculated between different pairs of annotators [9]. The subreddits that these posts were crawled from focus on requests, so almost all posts contain search requests. Of the 80 double-assessed posts, annotators agreed only on one as not being a request and disagreed on two others.

For all categories, we computed agreement based only on the posts that both annotators labeled as requests. On the top-level categories, agreement is $\kappa = 0.81$ for the Content aspect, $\kappa = 0.61$ for Metadata, $\kappa = 0.45$ for Experience, $\kappa = 0.36$ for Context, $\kappa = 0.55$ for Search process and $\kappa = 0.7$ for Interactivity. Agreement on the type of information need is mostly high: $\kappa = 0.95$ for Known-item, $\kappa = 0.84$ for Discovery, $\kappa = 0.66$ Similarity and $\kappa = 0.47$ for Choice.

For the sub-categories, generally agreement is higher for common aspects than for rare aspects. Aspects that occur in more than 50% of all posts (Gameplay mechanics, Genre, Platform, Release date, Known-item and Similarity) have an agreement of $\kappa > 0.6$ and aspects that occur in 20%-50% of requests (Character, Design, Plot, Setting, Perspective, Discovery, Not this one, and Game mode) tend to have an agreement of $\kappa > 0.4$, with the exception of Setting, which has no agreement ($\kappa = -0.06$) while primary annotators coded 27% of request posts as having a Setting aspect. Some rare aspects (less than 10% of requests) with high agreement are concrete aspects like Price ($\kappa = 0.85$), Title ($\kappa = 0.71$), Link to external resource ($\kappa = 0.85$) and Situation of exposure ($\kappa = 0.71$). In general, agreement is high for high-level aspects, common aspects and concrete aspects, but drops for increasingly rare or affective aspects.

5 Analysis

5.1 Information Need Types & Search Process Aspects

Table 2 shows the frequency and co-occurrence statistics of information need types among the 521 annotated requests. The requests fall in two large groups. The first group covering about half of all requests with a re-finding intent (Known-item), which is not surprising, because 265 requests originated in the /r/tipofmyjoystick subreddit (subtitled *"What was that game called again?"*), which was created for just this type of question. The Known-item information need is a mostly independent type, but has a slight overlap of 20% with Similarity. A typical Known-item information need would be *"Childhood Mystery PC game. I distinctly remember playing a click interactive mystery game. There's a funeral of a sort of inventor/scientist/important guy going on (I couldn't get past it for some reason) the character was staying in a hotel, i believe. It was cloudy*

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[4] Agreement scores for all aspects are available at `http://toinebogers.com/?page_id=779`.

Table 2: Co-occurrence statistics of information needs over 521 requests. Probabilities represent the likelihood of also observing the need marked in a column, given the need marked in a row.

	Frequency	Choice 23	Discovery 234	Known-item 265	Similarity 224
All	521	0.04	0.45	0.51	0.43
Choice	23	1	0.52	0	0.43
Discovery	234	0.05	1	0	0.68
Known-item	265	0	0	1	0.2
Similarity	224	0.05	0.71	0.23	1

and had a sad vibe most of the time, but that was only the beginning, I think." The other group consists of needs to discover new games, with more overlap between aspects. Particularly Similarity and Discovery often co-occur with each other: 68% of Discovery requests and 71% of Similarity requests co-occur with the other type. Similarity is rarely the sole information need of a request, but often co-occurs with some Content aspects, which adds a Discovery need. An example of a Similarity request which also includes a Discovery need is the following: *"Looking for a Mac/iOS/Xbox One game where I can create buildings/bases/homes etc. I love architecture and want a game where I can design buildings (besides Minecraft). I like the building mechanics of Rust and Raft, but my Macbook Air isn't powerful enough to run Rust and Raft is only available for PC."* Vice versa, a Similarity need is combined with a Discovery need based on previous gaming experiences. When a Similarity need is combined with a Known-item need, it is often to indicate what the sought-after game is similar to and to help others narrow down the direction(s) in which to search. Choice is not common, and only co-occurs with Discovery and Similarity.

Aspects of the Search process are described in 132 out of 521 requests (25%), and is fairly common in Known-item requests (35%) and Similarity requests (24%) (mainly in combination with Known-item), but less so in Discovery (16%). It is not mentioned in Choice requests. Search history (2%) and Link to external resource (5%) are rare, but Not this one (10%) and Situation of exposure (12%) are somewhat more common. Situation of exposure is fairly common in the group of KI requests (22%), but rare in the other group of Discovery (1%) and Similarity (6%) requests as these focus on finding new games. In contrast, Not this one is somewhat common in the group of Discovery (13%) and Similarity (15%) requests, but rarer in Known-item group (8%). For KI requests, Situation of exposure might trigger memories of forum members who experienced similar exposure to quickly zoom in on candidates for re-finding requests. Not this one is less useful, as it only excludes a few of many options. For Discovery and Similarity requests, the Not this one aspect is helpful to avoid getting obvious suggestions, but they have no previous exposure to new games.

5.2 Relevance Aspects

We do not have space in this paper to report all individual numbers for the occurrence of relevance aspects in our data, but Table 3 reports the most frequent ones per category.

Table 3: Frequency statistics of the five top-level relevance categories ($N = 521$), along with the most frequent aspect for each category.

Category	Frequency	%	Most frequent aspect	Frequency	%
Content	419	80.4	Gameplay mechanics	321	61.6
Metadata	436	83.7	Platform	311	59.7
Experience	187	35.9	Perspective	85	16.3
Interactivity	122	23.4	Game mode	93	17.9
Context	53	10.2	—	—	—

Content and Metadata aspects are mentioned in almost all requests, whereas Context is the least frequent category. Content and Metadata aspects could be more easily described in information systems, so they might be characteristics (content or metadata details) that are not yet described or that would not be described, because they are too detailed. This is certainly true for the Gameplay mechanics aspect, which contains many fine-grained descriptions of sometimes minuscule details within the games that searchers remembered. A typical example would be *"I remember you could launch warheads that exploded, bio-heads that had a green mist, seals rode in on a boat, there was like a media tower I think that you could use to do propaganda."* Perhaps search requests like this could be solved by using sophisticated content-based information retrieval algorithms that allow for searching directly within images or videos. On average, searchers mentioned 4.6 different relevance aspects in their information need statements from 2.3 relevance aspect categories on average. In 10% of our analyzed cases, searchers mentioned relevance aspects from four or all five of the categories in our coding scheme. This shows the complexity of the search requests, which cannot be fulfilled using the simple search interfaces we are used to in Web search today.

5.3 Relevance Aspects by Information Need Type

Tabulating relevance aspects by information need type shows some interesting differences (see Figure 2). Relatively speaking, Known-item requests more often contain comments about Content or Metadata aspects, whereas Discovery requests mention Context, Experience and Interactivity aspects more often than other information need types do.

The subreddit /r/tipofmyjoystick, where most of the Known-item requests come from, provides a template for relevance aspects, which searchers attempt to fill in describing their request. This template[5] contains the relevance aspects Genre, Platform, and Release date (all from Metadata); Characters, Design, and Gameplay mechanics (all from Content) as well as other comments. These relevance aspects are named at least twice as often in connection with the Known-item information need type than any of the other ones. While a more precise listing of Content and Metadata aspects can be expected for a re-finding goal, we still wonder whether their disproportionately high frequency—they are by far the most frequent in our dataset—is due to the standardization

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[5] Available at `https://www.reddit.com/r/tipofmyjoystick/comments/64i787/psa_a_guide_to_better_results`, last visited September 9, 2018.
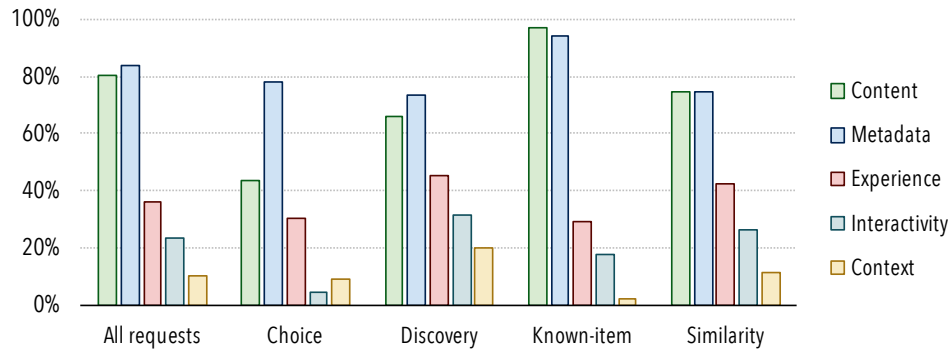
Fig. 2: Distribution of search aspect categories per information need type.

effect of the template, which forced searchers to elaborate more on their searched relevance aspects than usual.

6 Discussion & Conclusions

In this study, we developed a coding scheme for complex video game discovery comprising 33 relevance aspects. When considering that the average video game request covers close to 5 different relevance aspects, it is fair to describe video game discovery as a complex search scenario.

Our results are in line with previous findings from qualitative studies [13, 15], confirming a combination of commonly-used aspects, such as Content and Metadata (especially game-specific elements, such as Platform at 69%) as well as engagement characteristics, such as Experience (32% of all requests), Interactivity (23%) and Context (10%). In addition, the present study has identified several novel relevance aspects, including Sound design, Popularity, Playability, and Expandability. Future steps include further comparison of the identified 33 relevance aspects with existing metadata elements and vocabularies for games [15] as well as, if necessary, the extension and prioritization of (metadata) features in order to be incorporated successfully into search systems. As our annotations are limited to 521 requests from three subreddits with some relevance aspects appearing in just 1-2% of the requests, we suspect that some relevance aspects may have been more frequent, because of structured posting guidelines in one of these subreddits. More data from different sources is needed in order to fine-tune and validate our coding scheme and frequency distributions, and possibly uncover even more aspects.

Finally, although we found relevance aspects in our study that appear to be geared specifically towards video games (e.g., Gameplay mechanics), other aspects definitely overlap with previously identified relevance aspects in other genres (e.g., Plot, Character). Future work will focus on comparing relevance aspects across casual leisure domains and their relative frequency distributions, so that more general search strategies can be developed.

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