Deconstructing Cosmetic Virtual Goods Experiences in Dota 2

Ilya Musabirov[1], **Denis Bulygin**[1], **Paul Okopny**[2], **Alexander Sirotkin**[1]
[1] National Research University Higher School of Economics
ilya@musabirov.info
[2] Uppsala University

ABSTRACT
Cosmetic items do not provide functional advantages in games, but, nevertheless, they play an important role in the overall player experience. Possessing predominantly socially-constructed dimensions of value, cosmetic items are chosen, discussed, assessed, and valuated in an ongoing iterative collaborative process by communities of players. In our study, we explore the case of Dota 2 and apply Topic Modeling to community-discussions data gathered from Reddit.com. We describe social experiences related to the valuation of cosmetic items in interaction and collision of various logics, including artificial scarcity, decomposition of visual effects, and connectedness to the game lore. Our findings connect the collective experience of players in the game and on online community platforms, suggesting that non-utility-based social value construction becomes an important part of game experience.

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

Author Keywords
Games/Play; Social Media/Online Communities; Virtual Goods; Cosmetic Items; Decorative Items

INTRODUCTION AND RELATED WORK
In this work, we focus on experiences related to cosmetic (decorative) virtual goods in Dota 2, a multiplayer online battle arena (MOBA) game and eSports discipline. Examining two Dota 2 subreddits, we examine what players' discussions can explain us regarding collectively performed experiences, judgments, and valuations of cosmetic items.

Considering that sales of virtual goods are the main driving force of free-to-play game monetization models [1, 13, 9], there are several studies that investigated the value virtual goods by determining the motivations to purchase virtual goods and predicting purchase behavior [8, 11].

Lehdonvirta [12] divided virtual goods into functional and decorative (cosmetic) items depending on the following prevalent attributes: functional, social, and hedonic. The value of functional items is associated with the performance boost they give to a player in a game. Cosmetic items with prevalent hedonic (aesthetic) and social attributes are valuable due to the pleasure experience caused by the item's on-screen representation and their effects on the social status of the player.

While, in many games, these attributes are tightly connected in virtual goods, which sometimes raise questions regarding 'fairness' of advantage that functional attributes provide to their owner [14, 1], in Dota 2, there are no functional items. This limits the focus of our work to cosmetic items, which have only social and aesthetic value, and the experiences associated with them.

Studies connect the social value of an item with its rarity in association with the discriminative ability of item ownership [12], difficulty to obtain it [22, 15], which emphasizes its uniqueness [22, 12] and time and/or money invested by a player to get an item [5], and ability to demonstrate a social status via the rare item [15]. Aesthetic value is connected to the hedonistic pleasure and is associated with appearance and visual effects of virtual goods [12, 23].

We argue, that in the case of Dota 2 these values might be partially shaped by the status of Dota 2 as an electronic sports (eSports, see [10]) discipline, which is not only a computer game but also a sports discipline with appropriate attributes such as famous sportsmen and teams, even star athletes, and extending traditional mechanisms of status- and aesthetic-based value constructions from an eSports domain.

Toups et al. [22] suggested that experiences acquiring and collecting items can be guided by game mechanics or by personal goals set by players themselves. In our work, we extend this notion of personal goal setting by arguing that player experiences involve the game itself, the market, and online platforms, which results not only setting collection goals, but also in socially shaping and constructing the value of cosmetic items in community performance, such as good, bad, cool or not cool based on the judgment of others [19], via experiences of choosing goods, valuation, and consumption [4].

To demonstrate these experiences, we analyzed the user-generated content of the Dota 2 player community.

DATA AND METHODS
To look at the community experience large-scale, we used the Reddit.com API search feature to gather all threads containing names of cosmetic items in Dota 2 and associated

CHI 2017, May 06 - 11, 2017, Denver, CO, USA

ACM 978-1-4503-4655-9/17/05 $15.00
DOI: http://dx.doi.org/10.1145/3025453.3025893

Category	Cosmetics	Cosmetics	Gameplay
Topic	# 18, Monetization Model	# 82, Characters' Looks	# 6, Heroes
Topic words in decreasing relevance order	money, valve, system, pay, players, spend, months, made, big, paid, cosmetic, profit, month, paying, sales, making, start, business, change, huge	looks look color model style scheme looking cool design fit theme ugly textures made face texture art fits concept blue	morphling, morph, leshrac, lycan, lesh, edict, stun, lightning, support, replicate, split, bloodstone, agility, strength, wolves, illusion, waveform, stats, storm, earth

Table 1. Topic Examples

Category	Topic Examples	Share of Threads
Cosmetics	Monetization Model, Characters' Looks, Effects, Treasure Chests, Gems& Runes	0.240
Gameplay	Heroes, Spells, Skills and Parameters	0.211
Professional scene	Teams, Players, Autographs	0.009
Lore	Game Lore	0.004
Common lexicon	Reddit lex., Swearings, Socialization	0.429
Events	Attending Tournaments, The International	0.022
Other	Links, Regions, Other Games, Updates	0.089

Table 2. Main Topic Categories and Examples of Topics

metadata from `r/dota2` and `r/dota2fashionadvice`, resulting in more than 7,600 threads with around 280 thousand text pieces (posts and comments).

`r/dota2` has about 300 thousand subscribed users, 50 thousand of them were engaged in item-related discussions, making it a substantial source of data regarding the Dota 2 community.

We applied the topic modeling algorithm Latent Dirichlet Allocation (LDA) [3] to uncover the large-scale thematic structure of discussions. A topic model takes as input a collection of text documents, such as consumer reviews or chat sessions [7, 21], or discussion threads in our case, and produces a pre-set number of topics. A topic is determined by words occurring together in the same document. Thus, each document with some probability is assigned to (and is characterized by) each generated topic but usually with a close-to-zero probability to most of them.

We evaluated 50, 70, 100 and 150 topic models in terms of interpretability [6], relying on manual pairwise inspection of the closest topics of adjacent models in terms of Kullback–Leibler divergence. We chose the model with 100 topics, as it produces the more interpretable and stable topic structure.

The model requires interpretation of produced topics based on the most frequent words for each topic (see Table 1) and usually involves the interactive analysis of term-topic and topic-document probability matrices using visualization (LDAvis [20] and mallet [16] R packages in our case). LDA topics do not require the same basis for classification, as shown in our case in Table 2.

Our data is more complex than the review data in [7], where the authors directly associated the LDA topic with value dimensions. Thus, non-relevant aspects of discussions captured by the topic model were removed. We analyzed documents by using both categorized topics (Table 2) and metadata (i.e., appearance and co-appearance of item names in threads) to navigate the corpus.

FINDINGS AND DISCUSSION

We report our findings of players' cosmetic items-related experiences by organizing this section as follows. We focused on status- and aesthetic-related value dimensions of cosmetic items, reporting value orientations that emerge and the social devices involved in value construction. We also highlight cases in which player's experience does not match with expectations, disrupting value perception.

References to topics and categories (see Table 2) are *emphasized* throughout the text.

Status: Rarity, Brand, and Authenticity

We focused on three concepts which construct status dimension of the value of an items, and mechanisms involved in value construction.

The first concept, rarity, considers the chance of drop, uniqueness, and artificial scarcity [5, 13] as sources of value.

The second concept is brand value, which takes its place in value construction due to Dota 2 being an eSports discipline. We also discuss collecting practices in association with virtual autographs.

The last concept, authenticity, shows what might be considered as fake in the virtual world, and connects rarity- and brand-based mechanisms of valuation.

Rarity and Chance

In the case of Dota 2, the notion of item rarity is associated with the mechanism that enables players to obtain an item, e.g., treasure chests, and with the probability of getting it. A treasure chest, being bought or acquired by a player, gives an opportunity to randomly obtain one item from a pre-defined set with non-uniform probability: some items have a lower chance to drop than others. In our data, threads that belong to *treasure chests* and *trading* topics contain players' estimates of the chance of drop for an item in connection with its trade price:

I'm the kind of guy who saves a portion of his work money for video games and virtual items. You'd think this is heresy, but then again most things are sacrilegious on reddit. What with the 1 in 250 chance, who knows it could have been 400$.

Yamamoto et al.[23], discussing Counter-Strike: Global Offensive, connected such chance estimates to market logic, dictated by supply and demand. While the Steam Community Market

analysis is out of the scope of this paper, our Reddit discussion data support their findings. Moreover, our analysis shows the clash of logics: rarity as observed and calculated in drop chances is compared by players to 'fair' drop chances, and, essentially, price, likely influencing consumer behavior.

Brand and Fandom

As an eSports discipline, Dota 2 has a celebrity culture, which highly influences game's monetization.

The monetization model is discussed with topics, related to *professional scene*, such as professional *players* and *teams*, and their imprints in virtual goods domain: virtual *autographs*.

A virtual autograph is an autograph rune, that can be attached to a cosmetic item adding a signature of a famous person to the item's description. Thus, a value of an item is shaped by celebrity brand and associated character, player's preferences and allegiances.

While virtual autographs exist and can be traded as virtual goods, they are usually discussed and valuated as constituents of *sets*:

***Player A**: Hello guys. I was wondering who casters/professional players with autograph plays a lot Lina? I know that Sheever plays a Crystal Maiden a lot. So I have customized already her. Now want the same for Lina's items. Please suggest who would be good to my Lina arcana? Sincerely, noob*
***Player B**: SumaiL or Solo*
***Player A**: Thanks man, will get Solo, since Sumail one too expensive =)*

Such threads topically connect the professional scene not only with *monetization* and *trading*, but also with topics that are associated with cosmetic item *sets* and game characters (*heroes*). Toups et al. [22], discussing collectibles, noted that while they can be guided via schemes by game mechanics, players can also set their own collecting goals. In this case, these goals are co-constructed socially and combine different logics in scheme construction, such as game-defined link between a character and items, professional scene-based connection between a *player* and a *hero*, and the community-constructed notion of a cool player for a hero.

Authenticity and Fakes

The concept of authenticity, which is described in [12], emerges from discussions of fake autographs, which we trace back to the origin, which is outside our text corpus.

In July 2014, with a new version of the game, players found a software error (*bug*) that made it possible to forge ('dupe') autograph *runes* and other items. Some subtle changes in item properties were available to distinguish a forged item from the original; however, autographs of some of the most famous professionals were forged, resulting in drastic price decline, from 200 USD to 2 USD:

***Player X**: i bought some REAL autogrpahs for 2€ and not the kinetic fake things.[...]*
***Player Y**: i hope that the fake kinetic things get deleted somehow and that the real autographs rise in price again...lets see :)*

While this can be analyzed in terms of supply and demand equilibrium on the market, highlighting again the real market nature of secondary market trade in virtual games [13], we also suggest that the notion of authenticity should be considered when analyzing these experiences.

Apart from the fake virtual autographs, the question whether real virtual *autographs* are indeed real is also discussed in the community:

***Player A**: I still don't understand the point of the autographs. You haven't met them, you just purchased an one of a possibly infinite amount of something they were fine with spreading. Ultimately it just feels like a odd way to give money to a personality you like, rather than just say, sub them on twitch or something. I don't understand the reasoning behind it all tbh.[...]*

Aesthetic Value and Experiences

Perception and construction of virtual goods' aesthetic or creative value [15, 12], on the one hand, must be viewed as a holistic experience, connected to personal style and 'coolness' [4, 19]. On the other hand, the value is constructed by and assessed according to more subtle instruments, provided by the game and by players.

While there are distinct topics, related to characters' appearance (e.g., *characters' looks*, see Table 1), and *visual effects*, they are discussed and judged in connection with a particular *character's lore*, which dictates a traditional color scheme:

***Player G**: Looks cool, but I prefer Seeker items that make him look like a homeless cannibal*
***Player H**: Maybe the hero that has a predominantly red, black, and white color scheme should keep his red, black, and white color scheme instead of changing it to red, yellow and steel grey.*

Another topic, *visual effects*, separates discussions of decorating character's *special abilities* in the game from discussions of a character's *static visual model*.

These considerations, as we see from discussions, are grounded in both community imposed norms and the notion of visibility. Traditional schemes are preferred not only due to historical reasons or standards, but also as they allow one character to be distinguished from another easily, which brings us back to the concepts of utility, which means in-game efficiency and fairness in this report.

Combined in the discussions of the whole *character's appearance*, all components come into play, putting together "puzzle pieces that fit perfectly with a unique personal brand"[4, p. 904]:

***Player A**: Hi guys. What u think about my Pudge mix set? What can I change?*
***Player B**: Do you have the doomsday ripper set?*
***Player A**: Yeah, i have*
***Player B**: You could try the belt if you want. Would look very*

cool in my opinion. Could you also eqiup the back piece as well and send picture? :V

On the quest for perfection, personal style, while encompassing game affordances and being influenced by different logics (e.g., character's lore, fashion dictated by the professional scene, and in-game efficiency), is indeed personal in terms of achieving an individual's aesthetic goals.

However, the style may also be produced for public consumption, or social presentation, and sociability[15, 22]. This latter role is performed, e.g., on subreddit `r/dota2fashionadvice`, where members share their sets composed of different pieces and collectively match dress elements that are better suited.

Moreover, building on Toups et al.[22] idea of personal goal-setting in collection practices, our data suggest that social nature of the process is not limited to social presentation only. Not only does the community play a spectator's role for somebody's personal style, but also actively participates in and influences this goal-setting in dynamics by discussing, judging, and valuating looks.

Expectation Mismatch

Up to this point, we have focused mostly on experiences positively constructing items' value. In this section, we talk about the mismatches between expectations and actual experience, which we divide into *bugs*, which is when a player does not get intended effects due to an error, and perceived unfairness, which is when a player experiences negative side-effects of an item.

Dota 2 as a virtual environment that is managed in software development logic with errors being a part of development process. At the same time, Dota 2 development obeys commercial logic, which dictates higher priority of acquiring new players and introducing new features in comparison to fixing bugs.

Thus, player experience of owning an item can be severely influenced or degraded by software errors (bugs, see also [18]) leading to impossibility to use or demonstrate the item, and the value of associated items can vastly deteriorate as shown by the following comments:

***Player B**: i think people naturally will buy less and less cosmetics when they keep seeing their favorite items broken for years at a time. i know i have. i hope valve sees that their long term sustainability will be in jeopardy if they keep this up*
***Player C**: It's a big reason why I don't invest in the big time ones. The TB arcana plus a gem would be awesome, but I have no guarantee that my $45 or more purchase won't break entirely in two weeks*

As cosmetic items affect the visual representation of a player's avatar, for example, visually highlighting *character's abilities* in use or making character's appearance distinguishable on a screen, they are also judged in terms of fairness. Aesthetically appealing and high-status items, which are often more visible, can place the owner in a disadvantaged situation, driving unwanted attention to their or their teammates' actions.

Players have introduced a notion of "pay-to-lose" to describe such situations. "Pay-to-lose" in opposite to "pay-to-win" [1] means that an owner gets disadvantage from applying certain items:

***Player X**: At TI4 I had several discussions with a lot of people regarding this[pay-to-lose items], specifically the Mirana arrow. Most of the pro players agreed that it was easier to spot and dodge than the reguler arrow, yet almost every team continued to use it.[...]*

The theme of fairness of cosmetic items, recurring in our data, adds to the discussion [2, 14] of gameplay balance violations in free-to-play games, suggesting that there are more subtle ways to influence gameplay than those usually associated with functional items (see also [17] for a discussion of interface changes introduced unfairness).

CONCLUSION

We analyzed players' communication revealing collective and individual experiences of cosmetic goods value construction, consumption practices and ownership. Applying LDA, we extracted topics, which help us to navigate and structure players' opinions and discussion, localizing main themes and points of interest, related to decorative (cosmetic) goods.

We analyzed experiences associated with virtual goods' values and found that value dimensions are socially constructed in a varying degree. We highlighted main value dimensions and social practices, influencing the value of cosmetic items, focusing on status and aesthetic value dimensions and uncovering their internal structure.

When it comes to status dimension, in addition to traditional status-related mechanisms, Dota 2 is heavily influenced by its eSports-related aspects. While the direct mechanism of value formation via personal players' brands in case of virtual autographs to some extent could be anticipated, we found that other eSports-related mechanisms are more subtle, influencing practices of item-set collecting.

We also found that experiences of cosmetic goods collection goal-setting and valuation appeal to various interwoven mechanisms and logic, both in status and aesthetic dimensions, e.g., combining brand logics with game-design set schemes and with the community-produced perception of cool.

These experiences are distributed between the game itself, the market, and various online platforms.

ACKNOWLEDGEMENTS

The article was prepared within the framework of the Academic Fund Program at the National Research University Higher School of Economics (HSE) in 2017 — 2018 (grant No. 17-05-0024) and by the Russian Academic Excellence Project «5-100».

We express our gratitude to our reviewers and Dr. Anna Shirokanova, Ksenia Tenisheva, Dr. Alena Suvorova, and Alina Bakhitova.

REFERENCES

1. Kati Alha, Elina Koskinen, Janne Paavilainen, Juho Hamari, and Jani Kinnunen. 2014. Free-to-play games: Professionals' perspectives. *Proceedings of Nordic Digra* 2014 (2014). http://www.digra.org/wp-content/uploads/digital-library/nordicdigra2014_submission_8.pdf
2. Richard Bartle. 2013. The decline of MMOs. (2013). http://repository.essex.ac.uk/9091/
3. David M. Blei. 2012. Probabilistic topic models. *Commun. ACM* 55, 4 (2012), 77–84. http://dl.acm.org/citation.cfm?id=2133826
4. Anne E. Bowser, Oliver L. Haimson, Edward F. Melcer, and Elizabeth F. Churchill. 2015. On vintage values: The experience of secondhand fashion reacquisition. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. ACM, 897–906. http://dl.acm.org/citation.cfm?id=2702394
5. Edward Castronova. 2002. On virtual economies. (2002). http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=338500
6. Jonathan Chang, Jordan Boyd-Graber, Sean Gerrish, Chong Wang, and David M. Blei. 2009. Reading Tea Leaves: How Humans Interpret Topic Models. In *Proceedings of the 22Nd International Conference on Neural Information Processing Systems (NIPS'09)*. Curran Associates Inc., USA, 288–296. http://dl.acm.org/citation.cfm?id=2984093.2984126
7. Yue Guo, Stuart J. Barnes, and Qiong Jia. 2017. Mining meaning from online ratings and reviews: Tourist satisfaction analysis using latent dirichlet allocation. *Tourism Management* 59 (2017), 467–483. http://www.sciencedirect.com/science/article/pii/S0261517716301698
8. Juho Hamari, Kati Alha, Simo Järvelä, J. Matias Kivikangas, Jonna Koivisto, and Janne Paavilainen. 2016. Why do players buy in-game content? An empirical study on concrete purchase motivations. *Computers in Human Behavior* (2016).
9. Juho Hamari and Vili Lehdonvirta. 2010. Game design as marketing: How game mechanics create demand for virtual goods. *International Journal of Business Science & Applied Management* 5, 1 (2010), 14–29.
10. Juho Hamari and Max Sjöblom. 2017. What is eSports and why do people watch it? *Internet Research* 27, 2 (2017).
11. Hee-Woong Kim, Sumeet Gupta, and Joon Koh. 2011. Investigating the intention to purchase digital items in social networking communities: A customer value perspective. *Information & Management* 48, 6 (2011), 228–234. http://www.sciencedirect.com/science/article/pii/S0378720611000413$
12. Vili Lehdonvirta. 2009. *Virtual Item Sales as a Revenue Model: Identifying Attributes that Drive Purchase Decisions*. SSRN Scholarly Paper ID 1351769. Social Science Research Network, Rochester, NY. http://papers.ssrn.com/abstract=1351769
13. Vili Lehdonvirta and Edward Castronova. 2014. *Virtual Economies: Design and Analysis*. MIT Press. http://www.jstor.org/stable/j.ctt9qf5t6
14. Holin Lin and Chuen-Tsai Sun. 2011. Cash Trade in Free-to-Play Online Games. *ResearchGate* 6, 3 (May 2011), 270–287. DOI: http://dx.doi.org/10.1177/1555412010364981
15. Ian J. Livingston, Carl Gutwin, Regan L. Mandryk, and Max Birk. 2014. How players value their characters in world of warcraft. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing*. ACM, 1333–1343. http://dl.acm.org/citation.cfm?id=2531661
16. David Mimno. 2013. *mallet: A wrapper around the Java machine learning tool MALLET*. https://CRAN.R-project.org/package=mallet R package version 1.0.
17. Patrick Prax. 2012. Co-creative interface development in MMORPGs–the case of World of Warcraft add-ons. *Journal of Gaming & Virtual Worlds* 4, 1 (2012), 3–24.
18. Patrick Prax. 2016. *Co-creative Game Design as Participatory Alternative Media*. Ph.D. Dissertation. Informatics and Media, Uppsala University. http://www.diva-portal.org/smash/record.jsf?pid=diva2:923235
19. Dimitrios Raptis, Jesper Kjeldskov, and Mikael Skov. 2013. Understanding cool in human-computer interaction research and design. In *Proceedings of the 25th Australian Computer-Human Interaction Conference: Augmentation, Application, Innovation, Collaboration*. ACM, 53–62. http://dl.acm.org/citation.cfm?id=2541032
20. C. Sievert and K. Shirley. 2015. LDAvis: Interactive Visualization of Topic Models. *R package version 0.3* 1 (2015).
21. Seshadri Tirunillai and Gerard J. Tellis. 2014. Mining Marketing Meaning from Online Chatter: Strategic Brand Analysis of Big Data Using Latent Dirichlet Allocation. *Journal of Marketing Research* 51, 4 (April 2014), 463–479. DOI:http://dx.doi.org/10.1509/jmr.12.0106
22. Zachary O. Toups, Nicole K. Crenshaw, Rina R. Wehbe, Gustavo F. Tondello, and Lennart E. Nacke. 2016. "The Collecting Itself Feels Good": Towards Collection Interfaces for Digital Game Objects. In *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '16)*. ACM, New York, NY, USA, 276–290. DOI: http://dx.doi.org/10.1145/2967934.2968088
23. K. Yamamoto and V. McArthur. 2015. Digital economies and trading in counter strike global offensive: How virtual items are valued to real world currencies in an online barter-free market. In *2015 IEEE Games Entertainment Media Conference (GEM)*. 1–6. DOI: http://dx.doi.org/10.1109/GEM.2015.7377220