

Gamifying piracy: functions and users of the Z-library

Functions and
users of the
Z-library

Zakayo Kjellström

Department of Culture and Media Studies, Umeå Universitet, Umeå, Sweden

351

Abstract

Purpose – This paper aims to show how an illegal repository of literature, the Z-library, relates to and influences its users and how this relation is unique due to the illegal nature of the platform. The paper utilizes the idea of gamification to exemplify how to motivate users to contribute to a large shadow library in order to create the “world’s largest e-book library,” sans “librarians.”

Design/methodology/approach – The study makes use of an ethnographic approach. It interrogates the functions of the website through intensive use—a close reading of sorts. The data provide a foundation for illustrating how illegal text repositories function at a surface level and how their design appeals to their user-base.

Findings – The paper provides a thorough and non-biased overview of how a “black open access” or “shadow library” site provides its users with pirated literature. It suggests that the lynchpin sustaining their functionality is a gamification of piracy designed to motivate a fragmented collective of individuals who work primarily for personal reward, rather than altruistic goals.

Research limitations/implications – Due to the design of the study, the findings are not universal or applicable to all illegal repositories of text. Readers and researchers are encouraged to apply the concept introduced here to other cases.

Social implications – This paper includes implication on the perception of literature piracy, how pirated literature is distributed and who performs the labor required to sustain illicit text repositories.

Originality/value – This paper provides a novel conceptual basis to study literature piracy.

Keywords Z-Library, Book piracy, Shadow library, Black open access, Gamification

Paper type Research paper

Received 6 September 2021

Revised 4 April 2022

Accepted 7 April 2022

Introduction

Shadow libraries are large illicit repositories of text. Websites such as Sci-Hub and Libgen are among the largest of the shadow libraries, containing tens of millions of academic articles and books (Karaganis, 2018). Their message is one of resistance: against a publishing oligopoly (Larivière *et al.*, 2015), and for the free dissemination of information and knowledge to those in need, beyond paywalls. Both Sci-Hub and Libgen are clear about the reasons for their existence; they do not host ads or give privileges to donors, instead they strive toward an ideal through illicit participatory culture.

Henry Jenkins argues that efforts, particularly within fan culture, that border upon the illegal, can be commercialized within the purview of the market sector and thus push the possibilities of new markets (Jenkins *et al.*, 2013). In many ways, this vision has been fulfilled. From the perspective of piracy, the introduction of Netflix, Spotify and Steam has been instrumental in offering alternatives to illegally distributing music, film and games. For academic texts, solutions are available through deals between scientific publishers and university libraries; however, these cannot compete with their illegal counterparts such as Sci-Hub and Libgen. But what happens when the logic is inverted, and the aesthetics of the market are subsumed into and utilized in illicit spaces?



© Zakayo Kjellström. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at <http://creativecommons.org/licenses/by/4.0/legalcode>

Journal of Documentation
Vol. 78 No. 7, 2022
pp. 351-370
Emerald Publishing Limited
0022-0418
DOI 10.1108/JD-09-2021-0174

The Z-library overlaps with parts of Libgen’s collection but is removed from Libgen’s design and administration; the only quality that they share is part of their catalog. The Z-library offers a variety of functions for users requiring electronic literature. Its catalog consists of 6.6 million books and 80 million articles. The Z-library is by no means a website on the margin, a Similarweb search shows that it averages more than half a million visits a month, and that is just on one of the many domains it hosts [1]. The design of the Z-library front page is inviting and ensnaring, and its esthetic does not reveal illicit, immoral, or revolutionary dimensions (see Figure 1).

Sci-Hub, on the other hand, openly displays its goals “. . . to remove all barriers in the way of science,” including what the site has already achieved: becoming “the first website in the world to provide mass and public access to research papers.” Further down the website there is a further clarification of Sci-Hub’s intentions: knowledge free to all, no copyright and open access (Figures 2 and 3).

Libgen’s front page does not immediately display its goals or ideas in the same fashion as Sci-Hub; however, it does provide a direct link to a “letter of solidarity,” which contains similar arguments to those found on the Sci-Hub webpage: “We have the means and methods to make knowledge accessible to everyone, with no economic barrier to access and at a much lower cost to society” (*In Solidarity with Library Genesis and Sci-Hub, n.d.*) (see Figure 4).

In this article, the Z-library’s technical functions will be interpreted to show what the “world’s largest e-book library” looks like from the inside. The purpose is to examine this platform as a particular medium within the illicit library sphere. One objective is to show how the esthetics of the mainstream Internet and the look of commercial platforms can be subsumed into illegal projects, and to reveal what kind of users the technologies on the platform are designed for. Another objective is to show how the technological composition of a shadow library mediates the experiences of users and librarianship through its various

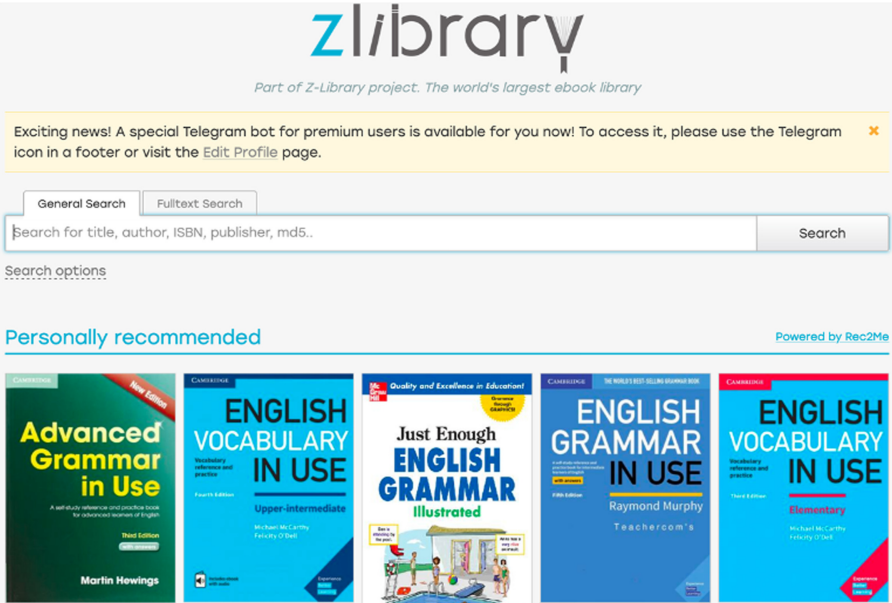


Figure 1.
Frontpage of Z-library

Source(s): No distinct messages regarding ideals, instead a news blurb describing the addition of a new feature, a search field, and personal recommendations based on previous interactions



Source(s): Clear goals and moral stand points on landing page: “... to remove all barriers in the way of science”

Figure 2.
Frontpage of Sci-Hub



Figure 3.
Sci-Hub's section
on ideas

concessions. The paper proposes, and develops, the notion of gamification *in relation to book piracy in order to elucidate how the interplay between design, technologies and users is enabled and supported by the specific arrangements of functions and technological expectations in the case of the Z-library.*

Methods for understanding shadow libraries

This article takes inspiration from previous research aiming to describe the inner workings of shadow libraries. Quantitative studies on the patterns of use (such as [Bendezú-Quispe et al., 2016](#); [Bodó et al., 2020](#); [Bohannon, 2016](#); [Cabanac, 2016](#); [Machin-Mastromatteo et al., 2016](#)) are common when studying shadow libraries. If [Cabanac's \(2016\)](#) study laid the groundwork for understanding how collections were sourced, then Bohannon developed this research,

Figure 4.
Libgen's Frontpage

Source(s): Above search bar a link to a “Letter of Solidarity” describing the ideals of Library Genesis (and other shadow libraries)

revealing the collection and distribution of the shadow library Sci-hub, and establishing that the usage was spread throughout the world, a fact later confirmed by [Bendezu-Quispe et al. \(2016\)](#), and [Machin-Mastromatteo et al. \(2016\)](#). Through these studies, valuable insights into the workings and usage of shadow libraries have been achieved. This paper builds on previous research, but takes a more qualitative perspective based on the walkthrough method developed by [Light et al. \(2018\)](#), as well as technographic methods inspired by [Kien \(2008\)](#), [Bucher \(2012\)](#) and [Eriksson and Johansson \(2017\)](#).

The basis of the walkthrough method is to navigate and surf the functions of an application or website through documented use. This process is marked by an interrogative relationship with the available functions, using and describing them ([Light et al., 2018](#)). The technographic method is an ethnographic derivative lending credence to the discursive elements of technology, rather than people and usage ([Kien, 2008](#); [Bucher, 2012](#)). In this paper, technography and the walkthrough method are applied in order to understand how technology reproduces experiential sets of functions through their mediating feature as an interface between humans and the world ([Eriksson and Johansson, 2017](#)).

The technologies that interest me here are the functions available on the Z-library website. Hence, in the following sections, I am concerned with quotidian tasks such as downloading, searching and metadata augmentation. I have studied these functions using different modes of participation to uncover how they shape the interactions between users, non-users and the platform. The modes of participation refer to the intensity of the user for whom the function is designed. Understanding the spectrum of users, and the intensity of usage, involves a series of relations with technology and functions. This is inspired by Christina Lindsay’s work on the degrees of users and how users are understood from the perspective of designers ([Lindsay, 2003](#)). To understand how the Z-library platform works, I provide an insight into the myriad different functions available on the website. I achieved this insight by interacting closely with the website for approximately two months; additional testing was conducted until no new insights were gained. Nearly all of the interactions took place through an account with a previous history of use. To ensure that the use of the functions was not affected by only employing one account, I also conducted probes using a dummy account, as well as accessing the platform without an account at all.

To enrich and engage with the material found through the walkthrough and technographic methods, the idea of gamification will guide our understanding of the processes on the Z-library platform. Gamification refers to the various processes that simulate the experience of playing a game in a non-game environment or “provid[e] affordances for gameful experience” (Hamari, 2013, p. 237) or “the use of game thinking and game mechanics to meet non-game ends” (Folmar, 2015, p. 2). In the context of this paper, these definitions are applied in order to enable an understanding of how, taken together, the Z-library’s functions form a framework of game mechanisms. Most commonly, gamification is used within education to stimulate student participation and commitment to their studies, and the literature on the topic largely reflects this tendency (Alsawaier, 2018). Using gamification to conceptualize the structures and proliferation of online piracy is not unfamiliar; Martin Eve uses the concept to describe how the Warez [2] scene has developed by comparing it to an alternate reality game (Eve, 2021). Throughout the analysis, these perspectives will show how the Z-library borrows ideas from gaming, and specifically concepts identified by gamification researchers such as Hamari (2019), Folmar (2015), and Zichermann and Cunningham (2011) to show how the Z-library utilizes a gamified system to motivate users and enable the proliferation of the site. This paper concludes with a discussion of how the gamification of functions enables the breadth of the Z-library.

Users, functions and categories

To make the investigations of the platforms clearer, I made a categorization of the intentionality of the functions once all the observations had been collected. The categories are not entirely trivial, but illustrate how the functions relate to their intentionality in the context of the Z-library. Intentionality refers to how the functions are intended to work, partially through their design, but also through engagement. These categories are the main findings of the paper and identify what type of user they are directed toward and how a user should act to follow the design of a particular function. At first, I had three categories indicating degrees of use (prolific use, intermediate use and bare-minimum use). Once all the functions of the Z-library had been tested, I found that these functions represented the types rather than degrees of use. This led to a thematization based on each function’s intentionality. Consequently, I established three different categories: (1) Manual functions, which are functions that require a user to actively input information and the commitment of a user-base to provide any value. These are functions that facilitate the bulk of the worth on the Z-library platform and refer to acts such as uploading, searching and editing. (2) Automatic functions, which refer to the Z-library’s three-tier system for users and how they unlock certain aspects based on different users; this category also includes explanations of functions that only require partial involvement by the user. (3) Social functions, which are aspects of the platform that are formally set to be shared, primarily in contexts where the Z-library facilitates a basis from which the sharing can be implemented, and not a formal space of sharing situated on the actual platform, such as a forum.

Table 1 gives an overview of the three analytical categories and how they are envisioned. These categories were inductively derived after interaction with the Z-library platform via the walkthrough method. As explained above, the walkthrough process can be described as an interrogation of the discursive or design qualities that guide user behavior or the functions’ intentionality. Each category is given between three and five attributes which must be completely fulfilled by a function for it to be designated within the given category.

Table 2 gives a brief overview of how the categorizations were determined for functions. This includes the abovementioned user-based, rather than function-based, categories: bare-minimum, intermediate and prolific user. The search bar, for example, is designated as a manual function because it almost entirely corresponds with that categorization’s attributes. Manual functions should be understood as functions that require a user to actively input information for them to work. The search bar also corresponds with the bare-minimum user as

Table 1.
Describes the
categories of functions
used in the analysis
and how they were
defined

Category	Defining characteristics
Manual	• Pragmatic • Requires users to actively input information • The amount of active information input affects the degree of intensity required • Incomplete without other users
Automatic	• Continues to function in the background after, or without, initial interaction • Does not require active input of information • Low degree of usage intensity throughout • Information gathered through manual functions may be required prior to using automated functions but are separated
Social	• Complete without other users • Socializing • Built on interactions between users • End-product of use is sharing • Creates spaces for discussion

the purpose of visiting the Z-library is almost always to download a book—which corresponds with the needs of an infrequent user. Additionally, use of the search function provides high compensation for the commitment required. A function that corresponds with a bare-minimum or an infrequent user will always correspond with both intermediate and prolific users as well.

Booklists correspond with all the attributes of a manual function but do not qualify as one due to the purpose of the function—or its intentionality. Where the search bar has the function of retrieving information for the user, the booklist is designed to be shared. When the booklist function was introduced by the Z-library team, it was even presented as something to “share with your community.” Due to this clear intention, it is designated as a social, rather than a manual, function. As booklists require quite a lot of commitment from each user, bare-minimum users are not likely to use or even discover this function, while intermediate users may experiment with it. Meanwhile, prolific users are very likely, as presented in the table, to utilize all the functions available on the site.

Rec2Me, on the other hand, does not possess any of the manual attributes due to the absence of active information input. It is designated as automatic because the function is intended to work in the background without active user interaction. For the same reason, Rec2Me cannot be understood as a social function. More on each of these functions will be presented in the coming sections.

In general, categories are a reflection of the type of user toward whom they are aimed. These categories, as such, are also the findings of the article; they correspond to the degree of use in different ways and reflect how the Z-library understands and rewards its users. This demonstrates the degree of use, the design of the functions and the foundation for developing the notion of gamification in literature piracy. The categories and their designations also work as headings devoted to the findings about each function.

Manual functions

This section provides an overview of a few fundamental manual functions. These are functions that, in different ways, require active information input by users (see Table 1 for a more detailed description of manual functions).

Search

The most frequently sought-out function on the platform (and any digital library) is the search bar: (see Figures 5 and 6).

Function	Manual	Automatic	Social	Bare minimum	Intermediate	Prolific
Search bar: Used to retrieve information on titles based on, for example: Keywords, Author Name, Title	Requires active data input Amount of active information affects degree of intensity Does not work without user interaction	Does not fulfill any characteristics of automated functions	Does not fulfill any characteristics of social functions	Yes, requires commitment, but only minimal if title is known Reward of commitment high for degree of use	Yes	Yes
Booklist: Used to create thematic lists of books available on the z-library website	Requires active data input Amount of information affects degree of intensity Does not work without user interaction	Does not fulfill any characteristics of automated functions	Built on interaction between users End-product of use is sharing Creates space for discussion	No, requires significant commitment Reward of engagement low	Yes, Depending on the size and breadth of the booklist	Yes
Rec2Me: Recommendation algorithm on the Z-library site. Organizes previous searches and downloaded titles into recommendations	Does not fulfill any characteristics of manual functions	Fulfills all characteristics of automated functions	Does not fulfill any characteristics of social functions	No, requires an account Minimal reward for engagement required	Yes, some commitment is required	Yes

Table 2.
A brief overview of the process of defining and categorizing a function and how it corresponds with user degrees

At first glance, the search field is similar to that of any major library. It has two search tabs: “General Search,” and “Full-text Search.” The General Search tab invites users to perform a search on a title, author, ISBN, publisher, or md5. The final suggestion is followed by two dots, displaying the breadth of possibilities for the various format and content searches. Just below the General Search tab, the words “search options” are displayed in a lighter font, dotted and underlined. Clicking the search options button opens up four more options for users to utilize. These options mimic the purpose of those in legal digital libraries, effectively giving alternatives for those users who are unfamiliar with Boolean search operators. Most of the options also reflect the ones available on legal (and illegal) counterparts, albeit not as extensively. Year spans, exact matches and language specifications correspond to the norm. But, instead of giving the option of availability, or medium (such as article, book, report, physical or digital copy, etc.), the fourth option allows users to choose between formats, or as the Z-library creators choose to name it: extension. The esthetic and practical factors that constitute the basis of the search function reveal an alluring invitation to prospective users. As a function, the search bar’s intentionality is constructed around the need for active information input to be of any worth, and thus the function requires a user to be fully realized. The search bar serves on the general basis of manual functions as envisioned in the aforementioned thematization.

The full-text search tab differs in purpose; here, the design of the search bar urges users to simply “search for phrase or words.” Lacking a distinctive button for additional options, the tab instead openly displays options to condition user searches. As well as those found under General Search, this section also offers a matching function for single words in a sentence or a phrase in its entirety. Both of the tab’s search fields conclude with the simple request: search.

So, what does the search field, as the introductory function on the front page, reveal about the Z-library? Its most obvious function is the instrumental one, leading users to their requests. Apart from this fundamental purpose, the search field on the Z-library platform is one of several user interface choices that together form the basis for a bare-minimum user. Such users are likely to form the majority of users. These are the people who use the Z-library as a means to an end, displaying little or no interest in the other functions that the platform offers. Instead, they approach the “library” with a distinct goal in mind: downloading a specific title. They are satisfied and leave the site once that goal has been achieved. Furthermore, its placement lends

Figure 5.
Search bar on Z-library’s frontpage showing some of the delimiters that can be used

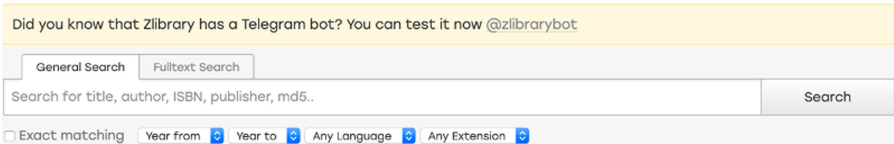
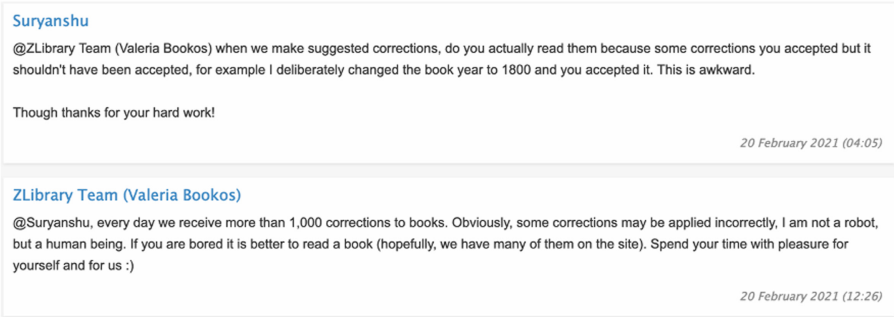


Figure 6.
Comment exchange on Z-library blog between user and administrator on the topic of corrections



credence to the esthetic of legality by mimicking the established conventions found in legal counterparts. Accordingly, these users are less likely to participate in the segments of the platform that have a more alluring and “game-like” aspect to them.

Uploading

Uploading books to the Z-library is a guided process. The first step is a simple drag-and-drop function, where the book is “dropped” and subsequently uploaded. Once the upload is complete, a button displaying the words “click to publish” appears. This button itself is also an indicator of how far in the process the uploading user has progressed. This depends on the book in question, as uploaded books have differing amounts of metadata embedded in the text itself. Within the editing menu, the option to load information from an ISBN code is given, which adds information such as the book cover, title, author, publisher and publishing year. If there is no ISBN, or if the tool is unable to fetch metadata (where from is not specified), the uploading user is given a series of fields to fill out manually. Every step toward the completion of an exhaustive book post is negotiated through the guidance of the information window.

In general, the Z-library’s interface is similar to that of a major university’s or national library’s cataloging interface. Compared with the National Library of Sweden’s cataloging tool LibrisXL, for example, the Z-library shares several similar esthetic components, with the main difference being LibrisXL’s extensive options for metadata modification. The likeness to other cataloging tools does, however, reveal that the website administrators have an awareness of metadata work in traditional library contexts. The difference lies in the significantly simplified steps, differentiating it from more qualified cataloging. What uploading does provide, however, points toward the rewards system established by the Z-library. Using points to motivate an end-user to commit to an act that they would otherwise not regularly undertake is a strong indication of a gamified system (Zichermann and Cunningham, 2011). I explore this rewards system further in the section on automatic functions.

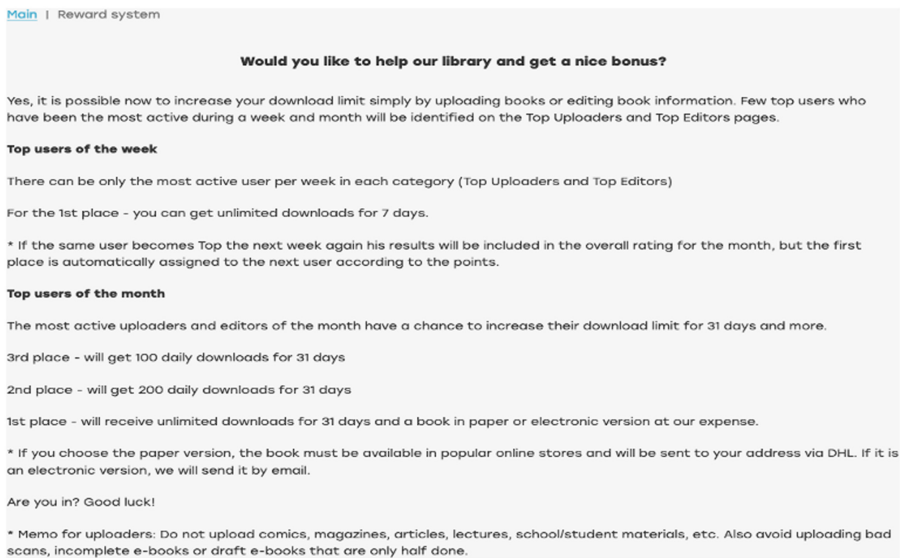
Editing

The editing functions give users the ability to correct the work of others who have previously (and erroneously) uploaded to the website. To test the function, I purposefully misspelt the name of an author when uploading a book (freely available with a CC-BY 3.0 license) through a dummy account. I then used the function to correct it, prompting a similar window as the one that appears when an upload is made. Once the correction was complete, a message was displayed saying that the edit had been taken into consideration and would be updated in the future. Hence, users contribute, the Z-library completes.

Under the tab “suggested corrections” in the profile menu, I could see the status of the corrections I had made, and to further push the function, I added some faulty additions to the books I had uploaded. Once the pending period was over—approximately 24 h in total for all corrections—the status had shifted. All of my corrections had been approved, apart from the ones where I had intentionally made an error. In short, someone is reading the corrections quite closely before releasing them back into the shadow library wilds. The approval process for corrections is not flawless, however. When double checking my edits, I found a spelling mistake. I am, seemingly, not the only one who has tested the functions extensively, because user Suryanshu stated: “I deliberately changed the book year to 1800 and you accepted it. This is awkward” (see Figure 7).

Clearly, the administrators of the Z-library read most of the corrections made by users, but considering the frustrated answer above, this is a tiresome and labor-intensive process. Much like the uploading function, editing gives users points in the rewards system. Moreover,

Figure 7.
Description of Z-
library's reward
system including how
to receive additional
downloads



gamifying aspects such as editing alleviate much of the work required of the administrators in keeping the Z-library up to date and correct.

Using gamification to motivate the support of individuals unaffiliated with a specific project is not original to the Z-library. It has also been used in citizen science; for example, for geographical mapping or tracking the biological processes of flora (Bowser *et al.*, 2013; Kapenekakis and Chorianopoulos, 2017). Suryancschu's comment and my intentional faulty entry also illustrate some of the consequences associated with employing the public to crowdsource support for projects: the need to sift through "malicious data [and] ... the rewarding of constructive behavior" (Kapenekakis and Chorianopulos, 2017, p. 1).

Automatic functions

This section deals with functions that require minimal or no active input from users to be active. Functions found within this category are designed to simplify or improve the user experience of the Z-library, mostly by working in the background.

Tier system

The Z-library offers users three tiers, in each of which an increased number of functions becomes available. The first tier (Guest) is available to anyone visiting the platform, and with this tier a user can download five books per day at a rate of up to one megabyte per second. The second tier (Basic Member) becomes available upon creation of a user account, and allows a user to download ten books a day at a rate of up to five megabytes per second. Further functions include download history, the ability to send books directly to a linked email inbox or a Google Drive, and personal recommendations. Linking to established legal sources, such as Google, adds to the esthetic of legality by extending the Z-library into the toolbox of common Internet use. The second tier also gives access to the booklist function, the ability to make book requests and various social functions and the ability to save books on

the user's Z-library profile. The third and final tier (Premium) gives users up to 999 downloads per 24 h, depending on the size of the donation, with unrestricted download speed. In addition to all the functions given to basic members, premium members can also send books directly to their Kindle, convert files to a wide selection of formats before downloading, have an ad-free experience and access to their "premium domain." The tier system unlocks the experience by simplifying and improving parts of the Z-library. This is achieved by introducing features that make interactions with the website more effective, as well as giving users a stable and dependable domain. It is classified as an automatic function due to its low degree of active information input after the initial sufficient donation/work by contribution.

To access the premium functions, a user can also make contributions of corrections and uploads, which feed into a points system offering rewards. The top user each week, and the top users each month, receive premium tier membership and increased download limits. These are the users whom I previously referred to as prolific users. As shown in Figure 8, certain prolific users are rewarded for their actions by receiving increased downloads and gifts from the Z-library administration. The points system and its corresponding rewards signal gamification *par excellence*, as the association between the work required to keep the Z-library functioning as a website and users' personal goals become perfectly aligned. This indicates the Z-library's success in gamifying piracy. Points systems, leaderboards and rewards are essential in a gamified system because they provide users with a feedback mechanism for their continued contributions (Barata *et al.*, 2013; Leaning, 2015; Zichermann and Cunningham, 2011).

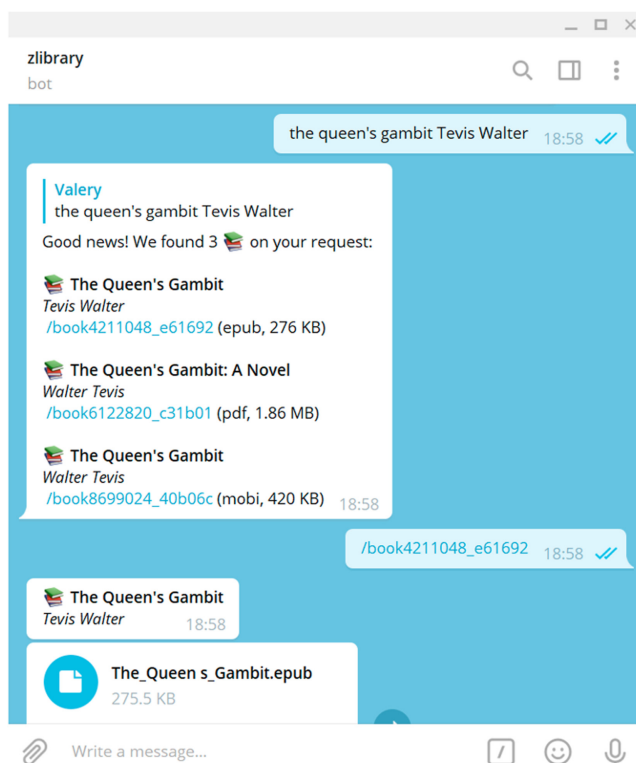


Figure 8.
Chat and download
using the Z-library bot

A user can also access the premium tiers with a minimum donation of one dollar. Donations can be made through direct payment by Visa or MasterCard, Amazon gift cards, Alipay, WeChat, or a bitcoin transfer. The size of the donation affects a user's ability to download more books/articles per 24 h. Curiously, premium tier membership lasts for 31 days, regardless of donation size. Interestingly, this too can be associated with an aspect found in game design: free-to-play and microtransactions. These elements of game design allow access to some content for everyone, with an opportunity to access increased amounts of content for those willing to pay (Davidovici-Nora, 2013).

I made a one-dollar donation to test the functions given solely to “contributors,” the name given to premium members and prolific users. What first struck me was the ineffectuality of the premium domain: the link provided in the thank-you letter redirected me to the regular Z-library site but with a .org domain. Attempting to reach this domain without a premium account results in a redirect to one of many mirrors. Hence, the “premium domain” is in this regard largely useless. Additionally, ads have never been a part of the Z-library, making the ad-free perk of premium membership pointless. The only real benefit of the premium domain is stability—something that might motivate bare-minimum and intermediate users to donate. As their interactions with Z-library may be frequent but brief, a premium domain with consistent stability could be a sufficient incentive to motivate further interactions with the platform. However, a bare-minimum user only interested in quickly accessing a single book every once in a while is very unlikely to consider the donation at all.

Additionally, the tiers bring with them a sliver of legitimacy, as they provide esthetic suggestions that the website is a legitimate business rather than a space of piracy. This further distinguishes the Z-library from the more forthright moral statements found on other similar websites. Tiers provide this legitimacy due to their similarity to legal services such as those provided by Spotify or YouTube, as well as the engaging aspect of a gamified experience and association with “legitimate” companies such as Amazon and Google.

Rec2Me

Rec2Me is a third-party tool that collects data from partner sites (such as Z-library), processes and analyses the data and sends it back as personal recommendations. Since each recommendation is unique to a particular user, logging in is required to receive these recommendations. Rec2Me, which connects the metadata from books to make links between content, gives suggestions (if you like this, try this) and compiles previous searches into a distinct profile visible on the front page of the platform.

Finding information on Rec2Me is complicated and its descriptions offer little transparency. Furthermore, traces of use are usually associated with cookie-tracking, leading to dubious motivations for its inclusion on the platform—especially due to the Z-library's questionable legal status. A guiding algorithm such as Rec2Me may at first glance be of little importance in relation to the gamified aspects of the Z-library platform. However, using these types of systems to train a user's interactions with the website creates a meaningful correspondence between them and the platform, especially when paired with a reward, in this case the possibility of personalized content, which is an important aspect of onboarding new active users (Zichermann and Cunningham, 2011). Despite Rec2Me's opaque nature, it should be regarded as the automatic function *par excellence*. Beginning to use the function is quite easy (simply create a user profile and log into the Z-library), and thereafter it works entirely in the background. It may even be used without any interaction at all by simply clicking through recommendations that are aggregated through other users' interactions with the site.

Telegram bot

The Telegram bot, a tool built into the encrypted messaging platform Telegram, which functions as an extension of the search, gives users the ability to access the Z-library's most essential functions through an intermediary within another platform. The Telegram bot is a chat tool that gives users the option to request a book. In return, the bot answers with a few hits connected by individual identifiers for the specific hit, and from there the user answers the bot with the identifiers, prompting a download link. The Telegram bot does not have the full availability of the Z-library (such as format conversion, or sending to email); rather, it offers users the opportunity to compound basic and vital functions of the platform into an already encrypted space, furthering anonymity and flexibility without regard for unstable URLs—a sort of integrated personal librarian. In the context of automatic functions, the bot may seem a bit like an outlier, primarily due to the somewhat extensive information input required for it to function. Its classification, however, hinges upon the automation of several processes and functions of the Z-library that are then externalized through Telegram. Essentially, utilizing the bot automates aspects of search and browsing, optimizing and streamlining manual functions in a condensed format (see [Figure 9](#)).

Social functions

In this section, functions that aim to generate increased socialization are presented. These are functions made with the express intention of being shared, or functions that facilitate interaction between users, or between users and the platform administrators.

Book request

A vital part of the design of the Z-library is to promote various social functions catering to the needs of users. Book request is one of these. As the name suggests, the “book request”

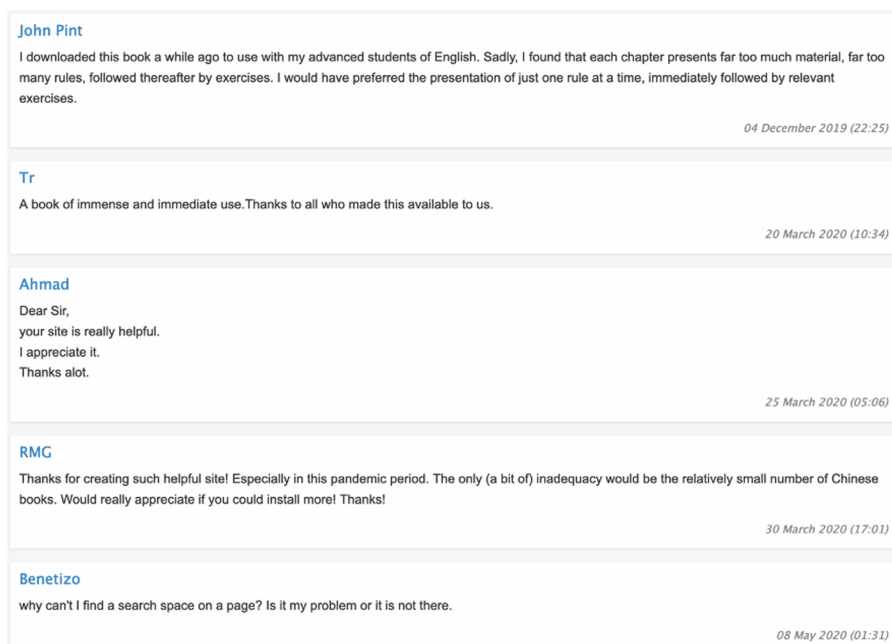


Figure 9.
Excerpt from book
reviews, opinions are
mixed between actual
reviews, praise for the
website and questions
regarding functions

function allows users to request books. On the landing page of this function, the initial display is the tab “all requests.” Here, users may browse requests made by others, with the option of filtering them through the qualifiers: date added, language and popularity. The popularity filter shows the number of users waiting for a specific request to be fulfilled. The remaining qualifiers are largely self-explanatory.

To request a book, a user must fill in the ISBN code. Once this number has been recognized, the function processes it and, depending on the database, retrieves a picture and a title. Author(s) are filled in by the user making the request. The function is not flawless; whilst I was attempting to request books that are freely available in a digital format, a message was displayed requesting me to “Enter a correct ISBN in the field above. Before using this feature, please check the book ISBN.” Furthermore, the function comes with a caveat explaining that the request function does not guarantee fulfillment, because it depends on the work of other users. To fully understand how the function works at both ends, I set up a dummy account and requested a book that is available in the public domain: *From Seven to Seventy: Memories of a Painter and a Yankee* written by Edward Simmons and published in 1922. Once I had made the request, I downloaded the book from the Gutenberg Project webpage. Using the main account, I filtered the request page to display recent requests and found the request I had made using the dummy. After a few hours, the request had been filtered in some way, and the dummy account received a notification that the request had been fulfilled. No update or specific information regarding the fulfillment of the request was given to the account from which I uploaded the book.

This serves as a testament to the somewhat altruistic motivations of the users who fulfill requests, as no rewards are given to a user who aids others and contributes to the Z-library experience. As such, it may be presumed that this function does not necessarily add to the idea of the Z-library as a gamified system, but this is not the case. Socializing between “players” and socializers as “players” are important features of gamification (Folmar, 2015). In Folmar’s categorization of different players, he describes the socializer as a player who “derive pleasure from influencing others” (Folmar, 2015, p. 13).

Book requests alone do not sufficiently describe the Z-library project’s pursuit of truly living up to its mission of becoming a universal e-book library; rather, it exhibits the same essential functions as are present in its legal counterparts. Essentially, it is a simple tool that allows users to range beyond the already immense collection of books hidden on the digital shelves of a server in an undisclosed location. Much like the booklists, an account is required to access this function.

Booklists

The Z-library’s booklists give users the option to create small, topic-based collections of books available via a shareable link. Due to the immensity of Z-library’s collection, almost everyone is certain to have a niche that they can develop, be it fishing, geometry, or romantic fiction. As the subject box is free-text, the options are endless. Once the subject has been set, a brief description may be added to fully clarify the content of the list. I chose to make a small list devoted to media archeology, adding the descriptor “A dive into ‘German media theory’ and Media Archaeology.” Once the title and descriptor are in place, users are taken to a new interface with the option to add books. Pressing the add button brings up the search field in a miniature picture-within-picture format. Unlike the search field on the main page, this one is designed mainly for known objects, offering search options for ISBN, keywords, titles, or authors. Once a book has been added, it appears on the list, and the process can be repeated until a user is satisfied with the depth and breadth of the booklist.

While designing my booklist, I was reminded of my previous job as a librarian in a small public library in western Stockholm. The library I worked at had ready-made book bags for children and young adults based on different subjects. These book bags were extremely popular; as I see it, mainly because they brought out the essences of the library in a condensed

form: serendipity, literature and interest. Parents with a fantasy-loving child could pick a book bag in their child's absence, in the knowledge that their child would be guaranteed at least one literary experience that would leave them wanting more. Hidden in those bags was the potential for a new successful relationship between reader and book, and their success was due to the meticulous work of my colleagues in the library section for kids – leading the way to serendipity through careful design.

The Z-library's booklist is reminiscent of the same work process, ready-made packages created by experts in areas of their own choosing, who develop and curate a small collection of books. If a user compiles a list of which they are particularly proud, they can send it to the administrators, who in turn will create a selection of topics to post in a separate menu, thus bringing the digital book bags to everyone within the Z-library. This is also the main reason why book requests and booklists have received the categorization "social" rather than "manual," as the mediation of both functions relies on a communicative act between users, mediated through the platform and adding to the important socializing dimensions of game design. Hence, the booklist, much like the book request function, is similar to equivalent functions found in legal counterparts.

Book reviews and the Z-library blog

If the booklist is one way to create interaction, two other functions with a similar appeal for interaction between users on the Z-library platform are the book review function and the blog. Book reviews are left under the individual page for each title. This fairly straightforward function opens up space for interaction between users in relation to specific titles. Most of the reviews contain off-topic comments regarding the functionality of the platform, praise for Z-library's creators and bitter criticism (see [Figures 10–12](#)).

we

I saw the Booklists feature and find it amazing !! It easy and beautiful. I already did create 2 collections on mastering 3D and Visual effects.

I imagine some ways to improve it.

1 - would be to add custom covers for collections. or by default, showing 4 covers of the books contained in the collections.

2 - would be to add a play button on every books to be able to listen a "resume" of the book. There are many ways to implement this. but thought that, Linux don't have great voice synthesis and online AI Voices works well, but are subscription based..

*p.s.: For those who are interested in 3D & VFX, go to my collections of books... I thinks that will help you through your journey too !! :)

<https://book4you.org/booklist/196/e4eb3a>

<https://book4you.org/booklist/200/021860>

27 December 2020 (20:01)

Figure 10.
Excerpt from the comment section on a blogpost, user "we" displays a wish to interact through the sharing of booklists

ArtisanShrew

Just when you think Z-Lib couldn't possibly get ANY better, you come up with even MORE amazing options!!!

👉 As far as ideas go, there have been several occasions where a user has left a question in the comments section I wish I could quickly answer for them or offer a tip or handy solution to their problem but (as far as I know) there's no way to tag or directly communicate with other users in the comments section... It would be AMAZING if we could utilize @User for more experienced users to answer common questions and share thoughts, ideas & our mutual LOVE for Z Library!?

Over the years I have also wished I could connect with or befriend users who seem to have much in common with my fav genres or interests. Though many people may enjoy their anonymity, maybe you could give us an option to share our social media name/links in our profile > or preferred contact info? 🐼

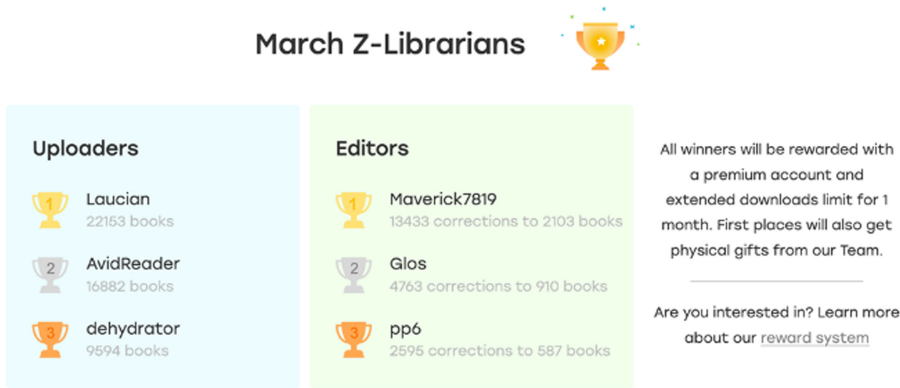
Perhaps you have already considered this and opted not to for reasons I never considered but - for what it's worth, I just wanted to make mention. 🐼

👉👉

28 December 2020 (00:41)

Figure 11.
Excerpt from the comment section on a blogpost, user "ArtisanShrew" submitting a request to further streamline discussions on blogposts by including a tagging function

Figure 12.
A list of the rewarded
prolific users of March,
both in uploading and
editing



Note(s): Note the use of “Librarians” to designate their status

Here, users discuss the functions of the site as well as the title itself, revealing a desire for interpersonal communication about the actual platform. This tendency is reflected in the blog posts: short, information-rich texts explaining new functions and additions to the Z-library, which also come with the opportunity for users to comment. Like the book reviews, this section is peppered with “off-topic” commentary, reflecting the potential of discussions that could become rampant with an adjacent Z-library forum, or with a chat function.

The downside of the social functions is the inability to create social commons on the actual platform. Rather, the purpose is to provide a stable location from which the sharing can be conducted, primarily through URLs. Relegating the actual act of sharing to other spaces diminishes any attempt to qualify the Z-library project as a distinct social space; instead, it acts as a starting point and archive for the potentiality of sharing.

The esthetic aspects of the booklist and book request functions lend further credence to the, almost manipulatively, feigned legality of the Z-library platform. The design of both functions is simple and straightforward, adhering to principles of UX design that guides the user forward through every step of the interaction (Hartson and Pyla, 2019). What the Z-library achieves here is to create the opportunity for users to engage in acts of solidarity within an illicit space without the feeling of committing a crime, primarily because the logic of social gamified design is both inviting and shrewd, and because they are not rewarded in the same way as they are for uploading or editing a book. How could a user possibly be expected to differentiate between the legal status of sharing a thematic list of their favorite books from Z-library or Goodreads? [3]

Users in the shadows

The users who are, arguably, the most important for the Z-library project are those who fall into the category “prolific.” These are the users who commit to the most labor-intensive functions of the website. Prolific users upload books, add and edit metadata to existing book posts, ask questions that lead to changes, create booklists, write book reviews, use the Z-library bot on Telegram and actively tailor the Rec2Me recommendation system for their own needs (and by extension improve the effectiveness of the algorithm). Prolific users are the ones who create value for the Z-library (in the form of content), effectively making them net contributors to the site.

From the intensified usage that comes with being a prolific user, different outcomes can be identified. These outcomes depend solely on the kind of functions in which a given user is prolific. A prolific user might be active at uploading, and use metadata functions such as

editing and correcting. They may also be active in the social functions, such as discussing new additions to the platforms, writing book reviews, or designing booklists. There may be users who are active and prolific throughout all three identified categories of functions. The different outcomes refer to the previously mentioned reward systems for prolific users, some of whom are deemed more valuable than others. Being a prolific user is not rewarded equally. The administration of the Z-library rewards those users who contribute to making the collection larger and the catalog correct, giving rewards to those who are most committed (see [Figure 13](#)).

Madeline Akrich has discussed the notion of the “projected user,” who is the model user for whom the creator of a technology is designing. Such a user is understood to have a specific set of skills and preferences which are suited to the service the technology offers ([Akrich, 1992](#)). These users might also be inclined to intensify their use of a website due to being insiders or experts. This kind of user has created a relationship with the functions that serve their own needs, simultaneously increasing overall download amounts through their uploads and corrections ([Lindsay, 2003](#)). The design and setup of the Z-library propose a projected user, with a corresponding reward system. Prolific users who specifically upload and edit have identified with this system through their close relationship with the platform. This sort of use may have been developed as a result of extensive usage, or as an immediate understanding of the reward system, i.e. “gaming” the system.

Intermediate users are, as the name suggests, the users who exist between those who are most prolific and the users who only commit to the bare-minimum of functions. Intermediate users may occasionally be prolific in certain aspects but are more likely to be casual users who enjoy some or all of the functions to a limited extent. The intermediate user can also be seen as the preliminary phase of higher or lower usage. This user may have previously only used a bare-minimum of functions but have been enticed to engage further through a campaign promoted by the administrators, or due to finding a function they like. Once this has been established, a more intensified relationship can be developed from that point. They may also have previously been very prolific and gained a premium tier, but are now in the process of returning to a bare-minimum style of use.

The majority of users are likely to be those who come to the platform to download a text which they have already identified, not to browse. This set of users is designated as bare-minimum users. A Similarweb search showed that the average duration of a visit is five minutes. Many of the functions available on the Z-library platform are designed for users who are either not familiar with other options or, more likely, use Z-library more intensively than the bare-minimum user. As their relationship to the website is more intimate, presumably these are individuals who are more likely to contribute in other ways as well (probably through comments on blogs, donations, or book reviews). Their willingness to contribute is inextricably bound together with their willingness to remain on the website.

The user degrees should not be viewed as fixed positions; rather, users may intensify or reduce their use of the Z-library during different periods. Fluctuating between these degrees also shows that, as Lindsay also argues, the “projected user” can never be a static position ([Lindsay, 2003](#)). If that were the case, it would mean that prolific users were spending most of

User statistics

Overall Rating Top Uploaders Top Editors

Source(s): Uploaders and Editors are the two most valued prolific users, perhaps because their interactions with the website add to the contents of the Z-library

Figure 13.
Headers of statistics
for overall rewarded
contribution to
Z-library

their waking hours using the Z-library—an unlikely and somewhat unhealthy relationship to the platform. User degrees, their fluctuating status and their relation to functions ties into the previously mentioned relationship between the Z-library as “the world’s largest e-book library” and the corresponding need to have the world’s largest working body of librarians.

Conclusion – toward a gamified piracy

In its quest to convert the complex task of running the self-proclaimed “world’s largest e-book library” into a successful and long-lived shadow library, the Z-library has utilized various techniques found in gamification design to crowdsource administration from its user-base. This is especially apparent in the section on metadata. Editing, uploading and tagging are the most basic aspects of metadata work for a functioning library catalog. Because this work is referred to the collective of the user-base instead of a sole individual, checks and balances are erected to ensure that the quality of each post is up to a minimally acceptable standard, i.e. searchability. In this case, gamification has been a lucrative measure to sustain a shadow library unlike any others.

In this sense, the technology present in the gamification acts as an interface between the prolific users, or rather the prolific user-base, and a full-fledged pirate “digital library.” By gamifying the experience of administration, through the mediation, segmentation and tangibility of technological design, the Z-library has consolidated its intermediate and prolific users into a collective workforce. Technology plays an essential role in this process, as its affordances provide the intermediate key component in mediating the experience. In this context, technology refers to the elements that together constitute the functions that fulfill the actions of users, such as booklists, commenting, editing, etc. From this perspective, functions as technology constitute a transformative experience of inclusion by gamifying website administration into a more digestible format, inviting the potentiality of experience through relations and rewards.

Martin Eve, in his investigation of the Warez scene, discusses in depth how gamifying piracy adds a dimension of prestige to the process of pirating (Eve, 2021). This is evident in the Z-library as well, with its frequently updated weekly, monthly and overall leaderboards, displaying the pseudonyms of the most prolific users and the primary winners of the Z-library “game.” This veneer of prestige bridges the individual motivations of users and the collective good of the shadow library and user-base. Tensions between individualistic social, relational and material gains and the collective good are common in the shadowy regions of the Internet. The majority of bare-minimum users probably view the site as a simple way to consume literature. This means that the bare-minimum users (and, hence, the majority of users) do not contribute to creating a space where a community can flourish; they are there for a specific item: consume and then leave. In the sections where any sort of “community” can be glimpsed, such as in the comments to blog posts or book reviews, the Z-library has no reward system in place to motivate the proliferation of a communal experience. Instead, the rewards are focused on those social aspects that increase the time spent on using the platform for sharing books—such as booklists and book requests. Eve goes so far as to call this tension “a system that reproduces the logics of contemporary capital and exchange within its own competitive frameworks” (Eve, 2021, p. 35).

Nevertheless, the gamified, Z-library style of piracy corresponds to Jenkins’ perception of how an online community can flourish through participatory acts (Jenkins *et al.*, 2013). If the mission of the Z-library is to be the world’s largest e-book library, then there is a corresponding need to have the world’s largest working body of “librarians”—a feat that is only feasible through the collective work of technology, gamified systems design and a large user-base. Oudshoorn and Pinch argue that a user’s interaction with technology rarely correlates with the projected user of the designers, and that the imagined user is much more multifaceted than the user representations given (Oudshoorn and Pinch, 2003). The Z-library’s functions and their intentionality are thus vital for orchestrating the user-base in directions that are fruitful for the prolonged lifecycle of the platform.

Currently, this interplay is not fully actualized, considering that the majority of the user-base, the bare-minimum and intermediate users, seemingly do not engage with everything that the platform has to offer. The Z-library, like all illicit libraries, was born of both a library and a pirate movement, and a tension persists between its relation to either. The technological functions and the ways in which users interact with them lend some support to Henry Jenkins' perspective on participatory media. On the other hand, participatory media were primarily envisioned within a legal framework [4], making the Z-library, and shadow libraries in general, a "participatory crime" of sorts. Neglect of formal legal structures is a vital aspect of how shadow libraries are ordered, and conveys similar traditions of community found on other pirate sites, specifically in relation to the transmission, collection and dissemination of media.

Notes

1. Similarweb (2021). Overview of traffic to one of the Z-library's many domains "b-ok.cc" <https://www.similarweb.com/website/b-ok.cc/#referrals> saved copy in author's possession.
2. Eve describes the Warez Scene as a "worldwide, underground, organized network of pirate groups specializing in obtaining and illegally freely releasing digital media ..." (Eve, 2021, p. 21).
3. Goodreads is a social cataloging site where users can share book recommendations and book reviews.
4. Jenkins has previously voiced support for pirates. http://henryjenkins.org/blog/2008/10/speaking_of_pirates.html

References

- Akrich, M. (1992), "The de-scription of technical objects", in Bijker, W.E. and Law, J. (Eds), *Shaping Technology/building Society: Studies in Sociotechnical Change*, MIT Press.
- Alsawaier, R.S. (2018), "The effect of gamification on motivation and engagement", *The International Journal of Information and Learning Technology*, Vol. 35 No. 1, pp. 56-79, doi: [10.1108/IJILT-02-2017-0009](https://doi.org/10.1108/IJILT-02-2017-0009).
- Barata, G., Gama, S., Jorge, J. and Goncalves, D. (2013), "Engaging engineering students with gamification", *2013 5th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES)*, pp. 1-8, doi: [10.1109/VS-GAMES.2013.6624228](https://doi.org/10.1109/VS-GAMES.2013.6624228).
- Bendezú-Quispe, G., Nieto-Gutiérrez, W., Pacheco-Mendoza, J. and Taype-Rondan, A. (2016), "Sci-Hub and medical practice: an ethical dilemma in Peru", *The Lancet Global Health*, Vol. 4 No. 9, p. e608, doi: [10.1016/S2214-109X\(16\)30188-7](https://doi.org/10.1016/S2214-109X(16)30188-7).
- Bodó, B., Antal, D. and Puha, Z. (2020), "Can scholarly pirate libraries bridge the knowledge access gap? An empirical study on the structural conditions of book piracy in global and European academia", *PLOS ONE*, Vol. 15 No. 12, e0242509, doi: [10.1371/journal.pone.0242509](https://doi.org/10.1371/journal.pone.0242509).
- Bohannon, J. (2016), "Who's downloading pirated papers? Everyone", *Science*, Vol. 352 No. 6285, pp. 508-512, doi: [10.1126/science.352.6285.508](https://doi.org/10.1126/science.352.6285.508).
- Bowser, A., Hansen, D., He, Y., Boston, C., Reid, M., Gunnell, L. and Preece, J. (2013), "Using gamification to inspire new citizen science volunteers", *Proceedings of the First International Conference on Gameful Design, Research, and Applications*, pp. 18-25, doi: [10.1145/2583008.2583011](https://doi.org/10.1145/2583008.2583011).
- Bucher, T. (2012), *Programmed Sociality: A Software Studies Perspective on Social Networking Sites*, University of Oslo, available at: http://tainabucher.com/wp-content/uploads/2009/08/Bucher_Ph.D.diss_.pdf.
- Cabanac, G. (2016), "Bibliogifts in LibGen? A study of a text-sharing platform driven by biblioleaks and crowdsourcing", *Journal of the Association for Information Science and Technology*, Vol. 67 No. 4, pp. 874-884, doi: [10.1002/asi.23445](https://doi.org/10.1002/asi.23445).
- Davidovici-Nora, M. (2013), "Innovation in business models in the video game industry: free-To-Play or the gaming experience as a service", *The Computer Games Journal*, Vol. 2 No. 3, pp. 22-51, doi: [10.1007/BF03392349](https://doi.org/10.1007/BF03392349).

- Eriksson, M. and Johansson, A. (2017), "Keep smiling!"; time, functionality and intimacy in Spotify's featured playlists", *Cultural Analysis*, Vol. 16 No. 1, pp. 67-83.
- Eve, M.P. (2021), *Warez: The Infrastructure and Aesthetics of Piracy*, 1st ed., Punctum books, doi: [10.53288/0339.1.00](https://doi.org/10.53288/0339.1.00).
- Folmar, D. (2015), *Game it up! Using Gamification to Incentivize Your Library*, Rowman & Littlefield, Lanham, Maryland.
- Hamari, J. (2013), "Transforming homo economicus into homo ludens: a field experiment on gamification in a utilitarian peer-to-peer trading service", *Electronic Commerce Research and Applications*, Vol. 12 No. 4, pp. 236-245, doi: [10.1016/j.elerap.2013.01.004](https://doi.org/10.1016/j.elerap.2013.01.004).
- Hamari, J. (2019), "Gamification", in Ritzer, G. (Ed.), *The Blackwell Encyclopedia of Sociology*, John Wiley & Sons, pp. 1-3, doi: [10.1002/9781405165518.wbeos1321](https://doi.org/10.1002/9781405165518.wbeos1321).
- Hartson, R. and Pyla, P. (2019), "Chapter 30—affordances in ux design", in Hartson, R. and Pyla, P. (Eds), *The UX Book*, 2nd ed., pp. 651-693, Morgan Kaufmann, doi: [10.1016/B978-0-12-805342-3.00030-8](https://doi.org/10.1016/B978-0-12-805342-3.00030-8).
- In solidarity with Library Genesis and Sci-hub (n.d.), available at: [Http://Custodians.Online](http://Custodians.Online) (accessed 14 June 2021).
- Jenkins, H., Ford, S. and Green, J. (2013), *Spreadable Media: Creating Value and Meaning in a Networked Culture*, New York University Press, New York, New York.
- Kapenekakis, I. and Chorianopoulos, K. (2017), "Citizen science for pedestrian cartography: collection and moderation of walkable routes in cities through mobile gamification", *Human-Centric Computing and Information Sciences*, Vol. 7 No. 1, p. 10, doi: [10.1186/s13673-017-0090-9](https://doi.org/10.1186/s13673-017-0090-9).
- Karaganis, J. (Ed.) (2018), *Shadow Libraries: Access to Knowledge in Global Higher Education*, The MIT Press, International Development Research Centre.
- Kien, G. (2008), "Technography = technology + ethnography: an introduction", *Qualitative Inquiry*, Vol. 14 No. 7, pp. 1101-1109, doi: [10.1177/1077800408318433](https://doi.org/10.1177/1077800408318433).
- Larivière, V., Haustein, S. and Mongeon, P. (2015), "The oligopoly of academic publishers in the Digital Era", *PLOS ONE*, Vol. 10 No. 6, e0127502, doi: [10.1371/journal.pone.0127502](https://doi.org/10.1371/journal.pone.0127502).
- Leaning, M. (2015), "A study of the use of games and gamification to enhance student engagement, experience and achievement on a theory-based course of an undergraduate media degree", *Journal of Media Practice*, Vol. 16 No. 2, pp. 155-170, doi: [10.1080/14682753.2015.1041807](https://doi.org/10.1080/14682753.2015.1041807).
- Light, B., Burgess, J. and Duguay, S. (2018), "The walkthrough method: an approach to the study of apps", *New Media and Society*, Vol. 20 No. 3, pp. 881-900, doi: [10.1177/1461444816675438](https://doi.org/10.1177/1461444816675438).
- Lindsay, C. (2003), "From the shadows: users as designers, producers, marketers, distributors, and technical support", in Oudshoorn, N. and Pinch, T. (Eds), *How Users Matter: The Co-construction of Users and Technologies*, MIT Press.
- Machin-Mastromatteo, J.D., Uribe-Tirado, A. and Romero-Ortiz, M.E. (2016), "Piracy of scientific papers in Latin America: an analysis of Sci-Hub usage data", *Information Development*, Vol. 32 No. 5, pp. 1806-1814, doi: [10.1177/0266666916671080](https://doi.org/10.1177/0266666916671080).
- Oudshoorn, N. and Pinch, T. (Eds) (2003), *How Users Matter: The Co-construction of Users and Technologies*, MIT Press.
- Zichermann, G. and Cunningham, C. (2011), *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*, 1st ed., O'Reilly Media.

Corresponding author

Zakayo Kjellström can be contacted at: zakayo.kjellstrom@umu.se

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgroupublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com