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Research on the Progress of Game Projects in Digital Collection Development in Foreign Libraries: A Postprint

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Date: 2023-04-01T16:15:54+00:00

Abstract

[Purpose/Significance] This study summarizes and synthesizes the practical characteristics and successful experiences of existing digital collection construction game projects in foreign libraries, aiming to provide reference and inspiration for domestic libraries in developing and designing digital collection construction game projects. [Method/Process] Comprehensively employing web-based research and case study analysis methods, and based on the three stages of digital collection construction—preparation, implementation, and maintenance—this paper systematically reviews the application forms and practical progress of game projects in current foreign library collection construction. Taking the large-scale open-source game service platform—Metadata Game—as an example, it conducts an in-depth analysis of the basic overview, technical foundation, implementation mechanism, and operational methods of this digital collection construction game project, thereby summarizing the main characteristics and experiential insights of foreign library digital collection construction game projects. [Results/Conclusion] Domestic libraries can draw on the experiences of foreign game projects, and according to specific construction needs and their own technical capabilities, gradually introduce game projects of different types, themes, and forms into digital collection construction projects.

Full Text

Preamble

Vol. 64 No. 10 May 2020

Research on the Practice Progress of Digital Collection Construction Game Projects in Foreign Libraries

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Abstract:

[Purpose/Significance] This study summarizes the practical characteristics and successful experiences of existing digital collection construction game projects in foreign libraries, aiming to provide reference for domestic libraries in developing and designing digital collection construction game projects.

[Method/Process] Using comprehensive web research and case analysis methods, and based on the three stages of digital collection construction (preparation, implementation, and maintenance), this paper systematically reviews the current application forms and practical progress of game projects in foreign library collection construction. Taking the large-scale open-source game service platform—MetadataGame—as an example, it provides an in-depth analysis of the project’s basic overview, technical foundation, implementation mechanism, and operational methods, thereby extracting the main characteristics and experiential insights of foreign library digital collection construction game projects.

[Result/Conclusion] Chinese libraries can learn from foreign game project experiences and gradually introduce different types, themes, and forms of game projects into digital collection construction initiatives according to specific construction needs and their own technical conditions.

Keywords: digital collection construction; games; user participation; foreign libraries

Classification Number: G250.7

DOI: 10.13266/j.issn.0252-3116.2020.10.016

Introduction

The development and innovation of Web 2.0 technologies have provided favorable opportunities for libraries to achieve “user-centered” resource construction. As an emerging service model for improving library collection resource allocation, user participation modes including crowdsourcing are being applied by an increasing number of library practitioners. By the end of November 2019, Wikipedia’s “crowdsourcing” entry listed dozens of library crowdsourcing projects, and domestic initiatives such as the Shanghai Library’s historical document crowdsourcing platform and Zhejiang University’s CADAL project platform have also adopted crowdsourcing methods for collection construction. To attract users and stimulate their enthusiasm for participation, many foreign libraries have introduced game projects with characteristics of fun, entertainment, and competition into their crowdsourcing-based collection construction efforts.

Comprehensive investigation of current practice and research findings reveals numerous benefits to introducing game models into collection construction. First, games help broaden and deepen users’ understanding of collection resources, en-

hance their interest in library resources, and allow them to relax, relieve stress, and expand their thinking during gameplay. Second, game players collaboratively complete tasks, improving their motivation and satisfaction in participating in collection construction while fostering dynamic communication and interaction among readers. Third, games optimize collection resource retrieval efficiency, service scope, and delivery methods, thereby improving resource utilization and discoverability while gathering innovative ideas from people with diverse disciplinary backgrounds to describe collection resources from multiple dimensions, 挖掘潜在利用价值, and enabling deep development and wide dissemination. Fourth, creating opportunities for public participation in library construction through games helps alleviate librarians' workload pressures, allowing them to devote limited time and energy to other business operations.

However, current academic attention to applying game projects in collection construction remains limited. By the end of June 2019, searches in CNKI, Web of Science, and Emerald databases using “games” and “collection construction” (and their English equivalents) as titles or keywords yielded no relevant results. Further comprehensive investigation of literature on library game services found that foreign scholar R. Holley systematically studied OCR content correction, tag addition, and crowdsourcing models in Australia's newspaper digitization program, concluding that game elements such as competition points and leaderboards play important roles in motivating user participation. Domestic scholars Li Shuning and Zeng Shan introduced game service projects that attract users to add tags to collection resources. Existing literature primarily focuses on using game services for information literacy education, library promotion, and new student orientation, with few studies specifically addressing game projects applicable to collection construction. Therefore, this paper examines foreign library digital collection construction practices and recent cases to analyze the main characteristics and development strategies of digital collection construction game projects, aiming to promote the practical application of game services in digital collection construction.

2 Application Forms and Practical Progress of Foreign Game Projects in Digital Collection Construction

Digital collection construction can be roughly divided into three stages: preparation, implementation, and service maintenance. Currently developed digital collection construction game projects in foreign libraries primarily target these three stages to achieve organization, description, and transcription of collection resources.

2.1 Collection Construction Preparation Stage

The preparation stage refers to the selection, planning, and evaluation of resources before collection construction, representing the initial and crucial phase of the entire process. Traditionally, resource selection, organization, and eval-

uation should be based on reader needs, but under conventional models, users and libraries remain relatively independent, making librarian-led collection construction highly ambiguous and subjective in terms of refined allocation. Game projects offer an innovative solution by attracting users to participate in resource selection, evaluation, and organization through gameplay, providing a foundation for subsequent implementation.

The most representative game project for this stage is Librarygame, developed in 2013 by Runninginthehalls Limited. This project adds game elements to the library experience, inviting users to participate in content evaluation and rating of collection resources through social interaction, providing readers with a new social discovery interface that optimizes library resource classification and retrieval processes. Based on statistics generated through user participation, libraries can then optimize collection resource allocation, streamline catalog information, and ultimately provide personalized, customized services.

2.2 Collection Construction Implementation Stage

The implementation stage relies on comprehensive support from human resources, technology, and equipment to achieve content supplementation, information resource description, and management evaluation, thereby improving the discoverability and utilization of collection resources. With the explosive growth of information resources, the implementation stage now places higher demands on librarians. Processing tasks that are simple, easy to understand, and require low professional expertise into game projects suitable for public participation with high entertainment value has become an important method for resource co-construction during the implementation stage, widely applied in library practice, particularly crowdsourcing-based collection resource description and content supplementation games.

Representative projects include:

(1) Waisda? Project. Developed in May 2009 by the Netherlands Institute for Sound and Vision in collaboration with Dutch public broadcasters, Waisda? is an audio-visual tagging game based on the theory that if a resource description tag added by a user receives consistent approval from other users, it can be considered a standardized tag. The game requires two players to simultaneously watch a 1-10 minute archived video from the library and add tags within a specified time. If both players provide identical tags, they both receive game points. Waisda? regularly publishes a points leaderboard on its official website and awards prizes to winning players to attract and motivate more users. Statistics show that within six months of launch, over 2,000 users participated, adding more than 34,000 tags to 600 archived videos. A subsequent evaluation report conducted qualitative and quantitative analysis of video tag quality, game environment usability, and user participation incentives, finding that crowdsourcing-based social game projects significantly attracted user participation in collection construction, with high-quality tags substantially improving

archived video resource utilization.

(2) Gør en Forskel (GeF) Project. The “Photo Collection 2010” within the GeF project was launched by the Danish National Library in 2010 to promote cultural heritage resource protection. Inspired by the ESP game, it invites two or more players to add tags to the same image simultaneously. If tags match, players receive points. This multi-player tagging model effectively reduces potential irregularities in single-user tagging (such as spelling errors, subjectivity, and low utility value), providing more accurate retrieval points for library OPACs. According to Danish National Library statistics, within one week of launch, 2,079 images received 22,787 tags, of which 2,516 were valid tags, demonstrating excellent results in tag generation speed and quantity.

(3) Metadata Fun and Games Project. Developed by the University of Edinburgh Library in August 2014, this game aims to enrich content descriptions in image collections. Currently, four UK university libraries participate: Glasgow University, Open University, Huddersfield University, and Manchester University. Players receive random images and add tags for people, places, and objects. The game backend evaluates tag quality and awards points to players providing high-quality tags. Statistics show that in the early stage, users added 631 tags to 264 images. To expand social impact and improve public understanding of metadata description importance, the developer introduced the game to multiple public and academic libraries in 2015, where over 50 students and staff added more than 3,500 tags, supplementing metadata fields such as author, date, and classification numbers, laying an important foundation for improving digital collection discoverability.

(4) Ivanhoe Game Project. Developed by the University of Virginia Library in 2014, Ivanhoe Game is both a game and a tool that invites users to create, develop, and design digital humanities resources. Targeting libraries and other information management institutions, it has developed nine web-based mini-games such as A Rake’s Progress and The Garden of Earthly Delights. Players collaborate to write stories for characters in different scenarios through narrative forms, transforming original texts and generating library digital humanities collection resources.

2.3 Collection Construction Maintenance Stage

Digital collection construction requires digitizing non-digital resources and then converting scanned images into text through OCR. However, due to variations in fonts, layouts, and formatting, OCR inevitably produces errors that cannot accurately present information. Manual correction is time-consuming and labor-intensive, while games provide an interesting, interactive, and fragmented approach to completing this task.

Current maintenance-stage game projects primarily focus on OCR content correction and proofreading, notably the “Mole Hunt” and “Mole Bridge” series, and the “Smorball” and “Beanstalk” series.

(1) **“Mole Hunt” and “Mole Bridge” Series.** In 2011, the National Library of Finland commissioned specialized companies to design these games under the Digitalkoot project Phase I. This crowdsourcing-based gamified project organically combines entertainment with volunteer work to protect Finnish cultural heritage resources. “Mole Hunt” requires players to quickly judge whether two words appearing on screen are identical to reveal potential errors in collection resources. “Mole Bridge” requires correct spelling of words to help moles build bridges across rivers. Crowdsourcing public participation in OCR correction and proofreading improves text resource machine readability and helps researchers retrieve needed information. After introducing these games, OCR accuracy increased from 85% to 99%, demonstrating their important role in collection resource verification and error correction.

(2) **“Smorball” and “Beanstalk” Series.** These two online games from the “Purposeful Gaming” project were established by the Missouri Botanical Garden in 2013 to help the Biodiversity Heritage Library verify and identify OCR content, making collection resources more searchable and usable. Both are simple online games presenting scanned library resource fragments. Users input the words they see, which are uploaded to digital resource storage pages. The game backend evaluates user contributions and forms standardized terminology for researchers, educators, organizations, and the public. “Smorball” is more challenging, requiring players to quickly and accurately input words to help a team win the coveted Dalahast Trophy. “Beanstalk” is simpler, requiring players to correctly input words within a time limit, with a beanstalk growing as correct words accumulate. Players with the most accurate transcriptions top the leaderboard, recognizing their important contributions to collection construction. These games effectively improve retrieval efficiency for the Biodiversity Heritage Library’s books and journal resources.

3 Digital Resource Organization and Description Practice Project—A Case Study of “MetadataGame”

As mentioned above, numerous game projects specifically developed for digital resource organization and description reflect libraries’ emphasis on collection organization and the feasibility of introducing game projects into resource description and indexing. This section further explores the application of MetadataGame—a large-scale open-source crowdsourcing game platform developed by the Tiltfactor Game Research Center at Dartmouth College in collaboration with the British Library—examining its basic overview, technical foundation, operational methods, and implementation mechanism in digital collection construction.

3.1 Project Overview

MetadataGame is a free, open-source, customizable metadata game platform funded by the US National Endowment for the Humanities. It has been applied

to 45 collection resource description practices across 11 institutions (including the British Library, Boston Public Library, and Digital Public Library of America), aiming to attract users to add metadata tags to collection resources (images, audio, video, etc.) and improve collection construction levels for cultural heritage organizations. According to official data, as of June 2019, the platform has added over 315,000 tags to tens of thousands of media resources. The functional architecture of MetadataGame is shown in Figure 1 [Figure 1: see original paper].

3.2 Technical Foundation

MetadataGame is a free and open-source software (FOSS) crowdsourcing platform comprising two web applications: the Metadata Game Application (MetadataGame-gameAPP) and the Metadata Content Application (MetadataGame-contentAPP). The game application stores and manages game content, player information, and user-added tags, while providing a publicly accessible basic search interface for browsing multimedia information from resource providers. The content application stores multimedia collection resources (images, audio, video) that organizations intend to process, encapsulating collection licensing agreements and metadata descriptions within the organizational content service interface, which connects with the game application to facilitate convenient tag supplementation, control, publication, and retrieval.

3.3 Operation Methods

To accommodate different player preferences regarding game content, format, and features, MetadataGame offers single-player, two-player, and multi-player options in both web and mobile versions, providing nine web-based mini-games on different themes. These include Tiltfactor's self-developed games: "ZenTag" for image tagging, "NexTag" for audio/video transcription, "PyramidTag" mobile single-player game, "GuessWhat!" multi-player game, "OneUp" mobile two-player competitive game, and "StupidRobot" web-based single-player game for tag quality verification. Games co-created with the British Library include "ShipsTag," "BookTag," and "PortraitTag" for tagging ship photographs, books, and portraits respectively.

3.4 Implementation Mechanism

To enable interconnection of collection resources across different organizations, MetadataGame designed a metadata game toolkit that can be embedded as a plugin into organizational resource management systems. The platform attracts users from diverse disciplinary backgrounds and professional knowledge to participate. Users can describe and classify collection resources from different perspectives and approaches based on personal preferences and expertise, breaking the conventional model of relying solely on librarians for resource organization. This leverages collective intelligence to effectively solve the imbalance between

collection organization efficiency and resource growth speed caused by limited human and financial resources, providing richer metadata tags for multimedia collection resources while stimulating players' strong interest in humanities collection resources.

4 Characteristics Analysis and Experience Enlightenment of Foreign Library Digital Collection Construction Game Projects

4.1 Practical Characteristics

The above review of foreign library digital collection construction game projects across the three stages of preparation, implementation, and maintenance reveals several key characteristics compared to existing library game services for information literacy education and functional promotion:

(1) Diverse Game Types. Digital collection construction game projects feature rich and varied designs with different themes, objectives, difficulty levels, scenarios, and interfaces to meet diverse user preferences and fully mobilize participation enthusiasm. For example, MetadataGame designed “ShipsTag,” “BookTag,” and “PortraitTag” for different British Library collections, while also developing “NexTag” for transcription, “StupidRobot” for quality verification, and various single-player, two-player, web-based, and mobile games. The “Mole Hunt” and “Mole Bridge” series and “Smorball” and “Beanstalk” series serve OCR correction at the maintenance stage but offer different difficulties and formats for player choice. Ivanhoe Game provides different story scenarios for creating and supplementing digital humanities collection resources.

(2) Strict Quality Control. Most projects implement rigorous quality control for player-added tags and OCR correction results. The primary method involves matching tags added by multiple users for the same resource to ensure high similarity, then using standardized dictionaries to evaluate tag quality, reliability, and level as important indicators for awarding points. For instance, the Danish National Library's GeF project reduces tagging irregularities through multi-player collaboration, while Metadata Fun and Games requires multiple players to tag images. Waisda? further uses terminology dictionaries to assess tag standardization.

(3) Positive Incentive Mechanisms. Projects employ positive incentives to enhance user initiative, considering user motivation and enthusiasm throughout the design process. By providing continuous positive reinforcement, they attract public contributions to collection construction, fostering strong senses of honor, belonging, and satisfaction driven by social responsibility. Librarygame incorporates social network comment elements, while the open-source MetadataGame platform leverages crowdsourcing to support global libraries and museums in metadata description, explicitly integrating user-added tags into organizational resource construction processes.

4.2 Experience Enlightenment

(1) Design and Develop Diverse Game Projects. The practical progress demonstrates that development should fully explore integration points between different resource types and game elements from multiple angles to provide practical support for digital collection construction. During the preparation stage, games can connect with social media to enable cross-platform dissemination of collection evaluation content. During implementation, game interfaces should be designed according to resource types and characteristics. Interface design and difficulty indices significantly impact user participation. Successful integration requires clear development goals based on specific collection resource types to design targeted, timely, and practical projects.

(2) Combine Independent Development with Collaborative Construction. Game projects can be developed independently or with support from professional game development companies or organizations to ensure practicality, interest, and rationality while incorporating concepts like crowdsourcing and digital humanities to facilitate resource interconnection and flexible transmission. MetadataGame includes six games developed by Dartmouth College's Tiltfactor Game Research Center and three theme games co-developed with the British Library, achieving shared collection descriptions across organizations. Finland's National Library commissioned specialized companies to develop "Mole Hunt" and "Mole Bridge."

(3) Leverage Advanced Technology Platforms as Backend Support. Tags added by the public often suffer from irregularity, subjectivity, and randomness. To achieve expected effects, advanced technologies are needed to control and standardize user-added descriptions for practical application. The open-source MetadataGame platform primarily uses natural language processing technology to optimize user-added tags and has developed a series of embeddable content applications for libraries and organizations to import resources needing description or export tagged resources to collection databases, enabling large-scale, streamlined digital collection construction operations.

Currently, foreign library collection construction game projects remain in continuous optimization and development, achieving encouraging results and gaining acceptance among increasing numbers of libraries. Since its 2014 launch, MetadataGame has accumulated over 315,000 high-quality tags added by players, greatly facilitating resource organization for information management institutions. In contrast, domestic library game projects still focus primarily on resource service promotion and specific information services, with no specialized projects for collection construction. This may stem from later start in researching crowdsourcing models and digital humanities and the time needed for practical application. Encouragingly, some domestic libraries have begun incorporating gamification elements into crowdsourcing collection construction, such as the Shanghai Library's (Historical Documents Crowdsourcing Center) Sheng Xuanhuai Archives Knowledge Base, which integrates leaderboards, point com-

petitions, task claiming, and countdown timers. As academic and professional exploration deepens, the concept and model of introducing games into collection construction will gain further promotion and recognition, driving more efficient development of library collection construction.

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Author Contributions:

Li Shuning: Topic selection, partial data collection, manuscript revision and finalization;

Zheng Xia: Data collection and organization, initial draft writing.

Article Title in English:

Li Shuning, Zheng Xia. Research on the Practice Progress of Digital Collection Construction Game Projects in Foreign Libraries [J]. Library and Information Service, 2020, 64(10): 146-152.

Note: Figure translations are in progress. See original paper for figures.

Source: ChinaXiv — Machine translation. Verify with original.