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In Depth: Interactive Copyright Education for 3D Objects

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In Depth: Interactive Copyright Education for 3D Objects

Many libraries have or plan to have makerspaces and related services. These services may be focused on creating 3D objects using computer-assisted design (CAD), using designs from a repository site (e.g., Thingiverse n.d.), or scanning an object to create a virtual rendering. Generally, the collaborative and experiential learning in a physical space is emphasized when making copyright considerations.

Research Question 1: What copyright considerations for 3D objects exist in libraries right now?

Although little case law exists for these services, best practices are observed based on established protections (17 U.S.C. § 102). Exemptions for libraries in Section 108 of copyright law are the cornerstone of policy for makerspaces. Section 108 allows libraries and archives to provide copiers, scanners, and printers with unsupervised use without liability of infringe-

ment as long as a copyright warning is displayed (17 U.S.C. § 108). Also, 3D printers are included in this exclusion (McCord, Minow, & Lipinkski 2016). Staff members managing a mediated service may need to be trained to recognize when they might be infringing material or practices.

Since 3D printing in libraries is often a mediated service, some professionals believe that considerations beyond public space policy should be made for assessing infringement risk, such as the right to refuse a request or the possibility of fair use (Chan & Enimil, 2015). Requirements for users to sign the terms of agreement for each print could also be implemented. However, this may be hard to enforce and appear as a barrier to access for the user. Even further, enforcement of terms of use is not effective copyright education because they are often bypassed without careful consideration.

Through often face-to-face interactions with a mediated service, there may be educational opportunities for each user. However, as 3D technology becomes more accessible, users may be making things on their own and outside the library. In printing, copyrightable subjects fall under the categories of sculptural or architectural works. Files, however, can be categorized as pictorial, graphic, or literary works, including software (Chan & Enimil, 2015). Files raise questions about whether a copy needs to be considered physical or if it is feasible to offer any copyright protections to a scanned copy versus a handmade copy (Weinberg, 2013).

Table 1. A comparison of the properties of 3D objects and files.

Expression of the work	Objects	Files
Copyright Category	sculptural or architectural works	pictorial, graphic, or literary works
Environment	Physical	Digital
Example	Plastic model of an elephant	.stl

Some have implemented watermarks to enforce copyright compliance (Zafeiriou et al., 2005). Museums have been concerned with the replication of files in comparison to objects for some time. A handful of museums have examined 3D objects and files as a means of preservation and access points for discovery (Johnson, 2016). Johnson pointed out how little consideration is given to public access. Considerations for access and use mostly focus on extending museum or library collections and creating accurate renderings. Developing a role for libraries within maker communities is one viable option, especially with local and/or proprietary 3D printing spaces. Another is to provide multiple points of access to copyright information for 3D objects.

Discussions External to Libraries

Research Question 2: What other considerations might libraries need to make?

a. What copyright considerations for 3D objects are being made in other fields?

b. What needs can libraries fill?

Wide access to 3D printing, trademarks, and patents has been discussed by some researchers, but the focus of this paper is only on copyright. The conversation for library practitioners and maker communities centers on assessing risk (Minnow, Lipinski, & McCord, 2016). Manufacturers and law professionals are concerned with how 3D printing, also called "additive manufacturing," fosters the ease of infringement (Macik, 2015). Outside of the library profession, those seeking to control access within a shared, collaborative community should look to the music industry as an example. A common parallel is drawn to Napster. After *A&M Records, Inc. v. Napster, Inc.* caused more lockdowns and enforcement of restrictive copyright, many customers were alienated, which was not helpful to creators (*A&M Records, Inc. v. Napster*, 2001). Only now is there a proactive, rather than reactive, approach to streaming music (PBS Idea Channel, 2016).

To be proactive, we discuss some of the needs identified. Some would even argue that derivatives created by fans of a particular media (e.g., film, video games, or board games) in the same format could be considered transformative fair use (Walliss, 2010). Others consider the "digitization of things" as purely a threat to manufacturing patents (Desai & Magliocca, 2014). One centralized network proposed was the World Intellectual Property Organization (WIPO), a part of the United Nations, due to its intergovernmental structure (Macik, 2015). Looking to public or government entities is a proactive and logical approach, as is seeking measures that include makers or do-it-yourself communities but support patentee's rights.

Various needs and solutions have been proposed within the library literature as well as in other fields and public forums:

Needs:

- End users need tools that verify the source of the object and desire a trusted source (PBS Idea Channel, 2016; Weinberg, 2013).
- Best practices are needed from the maker community to establish norms and expectations.

- Users should be encouraged to create their own designs or obtain designs from reputable sources (Chan & Enimil, 2015).
- Often, makerspace education emphasizes reputable platforms to retrieve 3D files for printing, but not the process of vetting for provider quality or copyright compliance.

Proposed solutions:

- Unique object identification numbers
- A global database
- Copyright or patent verification before printing (Weinberg, 2013).
- Digital Rights Management is not favored. Limited editions (also mentioned as a modicum of creativity, or a small batch of a particular thing, or singularly, by McCord, et. al.) and certificates of authenticity (Macik, 2015) are options.

Background on Copyright, Interlibrary Loan, and SHAPES

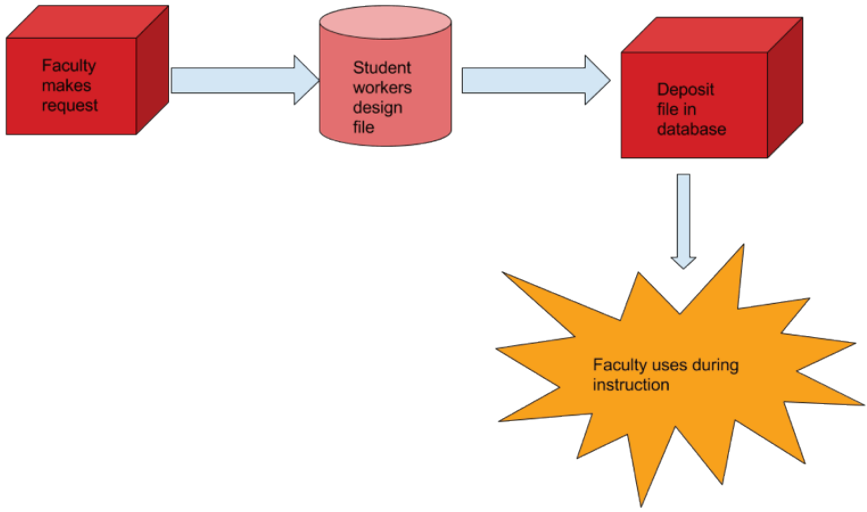
Sharing and Helping Academics Prepare for Educational Success (SHAPES) is a project created by Texas Tech University and the University of Houston for sharing 3D files among libraries (3D Printing Inter-Library Loan at Texas Tech, 2016). The project was created to meet the growing need of users to obtain eBooks, data sets, and 3-dimensional objects, which are rapidly becoming crucial to teaching, learning, and research. It was also created to encourage collaboration and resource sharing, as libraries seek sustainable ways to meet the technology needs of users. SHAPES consists of a model in which Texas Tech University and the University of Houston have created a database and metadata schema to share files among InterLibrary Loan (ILL) departments to then print objects for users. Current users are instructors looking to use objects in their teaching. Requested items are designed by student staff who are hired specifically for the grant-funded project.

When making copyright considerations for this project, contributors built on exemptions that are already employed by traditional ILL services. Continuing ILL best practices for traditional items (i.e., books and articles), the borrowing institution holds the specific copy of the file for 90 days and then deletes the lending copy. The master file of the rendering stays in the central SHAPES database.

Table 2. A Comparison SHAPES service and Library Makerspace service

	SHAPES	Makerspace
Space	Library staff space	Public physical space
File Access	Database accessible to library staff	Files in repositories on open web; User creates new files
Requests	Faculty requests only	Any campus requests
Printers	Stratasys Uprint SE and SE Plus (more fine-tuned and costly)	PolyPrinter (more robust and affordable for public use)
Material	ABS plastic	ABS or PLA plastic
Use of Resources	Library creates new resources	Users find or modify existing open resources; Users create new resources
Purpose	Sharing among institutions, Use in teaching	3D Printing, 3D scanning, software, technology and resources for maker projects on campus for students, faculty, and staff
Department	Interlibrary Loan and Document Delivery	Makerspace

Figure 1. Workload for workers uploading new models to SHAPES.



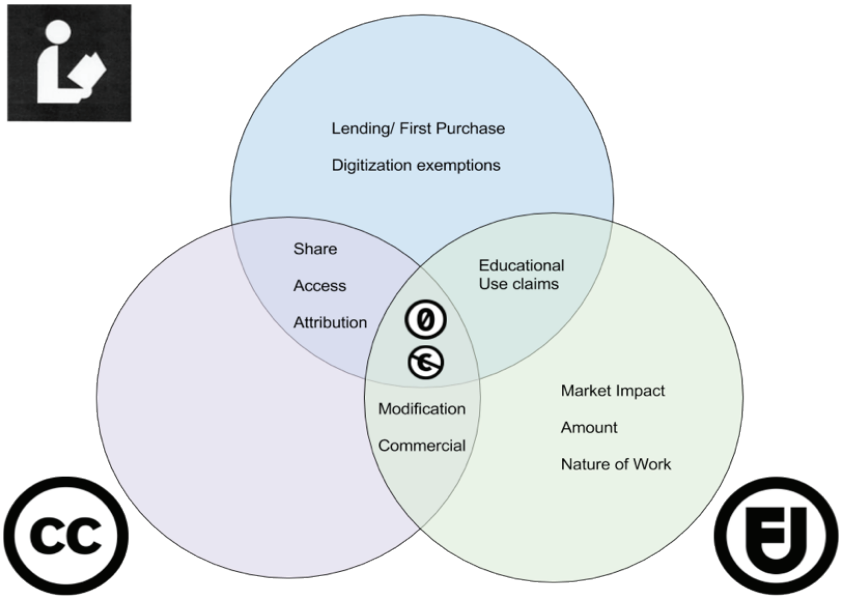
Section 109 of the Copyright Act further allows nonprofit libraries and educational institutions to lend, rent, or lease computer programs and sound recordings for nonprofit purposes (17 U.S.C. § 109). Additionally, libraries are able to lend an item after purchasing it due to the "first sale" doctrine (Nixon 2003). Consortia agreements are a long-standing way to share resources to meet overlapping needs among institutions. However, because electronic resource contracts limit how and when items are loaned, even after initial agreements, working with vendors can create challenges and barriers to providing access through traditional channels, such as consortiums. One of those challenges is the inability to share use or cost figures with other institutions due to nondisclosure clauses (Nixon, 2003). SHAPES creates a collaborative structure for resource sharing that utilizes software and expertise created by libraries, avoiding some of the challenges of lending traditional documents while creating new copyright considerations.

Open access has also influenced ILL services. While requests have not seen a significant decrease, staff members in these departments often face new considerations for their workflow (Biach, 2012). Requests are becoming less routine and more complex, as the documents or items sought require more investigation to find and share with users. Adding a search for open access times can reduce costs and avoid copyright clearance fees. Users can easily discover resources via search engines, but it is often up to ILL, a library channel they may already use, to deliver them (Biach, 2012). The common thread between ILL services and Scholarly Communication services is sharing. Creative Commons licenses can unify efforts to meet the needs of patrons. Unlike a General Public License (GPL) for software, Creative Commons has several license options and can be applied to all kinds of creative work.

SHAPES personnel who design 3D models work under work-for-hire conditions. Work made for hire is an exception to copyright ownership at the time of creation in a fixed form when a work is prepared by an employee within the scope of his or her employment or a work specially ordered or commissioned for use (17 U.S.C. § 101). SHAPES creators are required by the employer, in this case the Texas Tech Libraries and University of Houston Libraries, to assign Creative Commons licenses to SHAPES files. Creators are to be attributed, but not to retain exclusive rights for distribution, display, or derivatives. Files from outside sources, even if they are under Creative Commons (CC) license are not to be used to avoid liability and the potential to infringe. To create an educational opportunity for the creators, an interface was designed to encourage informed assignment of CC licenses. Presently, the service is limited to faculty looking to use 3D objects in teaching or private study (Chavez, 2016). Design for end-user (downloader) education is included in the method of design, but is not implemented in the

SHAPES project at this early stage, while lending only takes place among the ILL departments of collaborating institutions.

Figure 2. Venn Diagram of intersections of library exceptions, creative commons and fair use.



Instruction Considerations and Discussion

Research Question 3: How does one design copyright education for a project like SHAPES?

a. What can be learned from existing copyright education?

b. What other educational considerations can be made?

Generally, in face-to-face copyright workshops, it is common to start with copyright basics and case examples. Often, instruction can be tailored to scenarios that might best fit the audience, for example, using figures for graduate students publishing a thesis in biology. Sometimes, copyright may be embedded in a program or traditional format course led by a librarian. For example, in 2010, high school students learned to make copyright considerations in a class on media literacy and digital storytelling in which students produced documentaries (Levin, 2010). Instruction concerning copyright might also be gamified to promote engagement and active learning (Bowley, 2017).

Also, quite a few online courses, tutorials, and modules have been implemented. When Rodriguez, Greer, and Shipman implemented their online course in 2014, it was well received for its clear and concise information. However, students and faculty recommended adding more multimedia and interactivity. While many online courses on copyright exist, including massive open online courses (e.g., CopyrightX,[1] Copyright for Librarians and Educators,[2] and Copyright for Multimedia[3]), they are not typically interactive. For example, a copyright course at the University of Montana shifted from using discussion to essays when it was not well received by students (Ravas, 2016). However, students engaged the most when topics were relevant, recent, or complex, such as the *Robin Thicke v. Marvin Gaye estate* case (Lester, 2013; Ravas, 2016). These changes in student engagement show that being able to apply copyright to a relevant context better facilitates learning. Some interactive and multimedia tools have been used to teach copyright. In 2006, Brigham Young University's Copyright Licensing Office created an interactive online tutorial to meet the growing demand for copyright education on campus (Quartey, 2006). It was certainly a milestone, but has not become common practice in libraries. Also, it is meant to provide broad information and does not integrate with any other platforms.

Workshops that focus specifically on copyright considerations for 3D printing were conducted at North Carolina State University ("The Power of Open: 3D Printing & Design"). The workshop focuses on how to lawfully acquire 3D object files and how to apply licenses for creators. It was adapted by the University of California Berkeley as the "Find, Remix and License Designs for 3D Printing" workshop. These types of workshops emphasize physical makerspaces and face-to-face interactions.

With SHAPES, the central function is to share resources. In makerspaces, the central functions are to share resources as well as ideas in a collaborative, experimental environment. The framework design was not merely intended for the use of digital tools, but for digital tools to make instruction more effective (Hogan, 2017). Ideally, if needed, instruction about copyright and its application to 3D objects would be a hybrid model (i.e., face-to-face instruction, online instruction, or both). Certainly, one application or tutorial cannot comprehensively cover *all* the complexities and contexts of copyright, even when specific to one medium, such as 3D objects.

The University of Arizona developed Guide on the Side (GOTS), an open source interactive tutorial application (Sult, Mery, Blakiston, & Kline, 2013). It was designed to give depth to instruction for distance students,

1. http://copyx.org/
2. https://www.coursera.org/learn/copyright-for-education
3. https://www.coursera.org/learn/copyright-for-multimedia

to provide wider campus reach, and to overcome the constraints that limit face-to-face instruction (budget, projects, etc.). GOTS has a split screen interface that allows users to have information, media, or auto-grading quizzes alongside a demonstrative instance of a system, such as a library database. The original study about the tool's design found that screencast tools, such as Camtasia, are often used in conjunction with quizzes or external links, but do not allow users to test the actual process in real time. Pop-up steps or "guide on the side" steps are a common aspect of current web interfaces. The University of California adopted GOTS after its open-source release and conducted a study comparing student preference for GOTS or video screencasts (Mikkelsen & McMunn-Tetangco, 2015). Their results showed student preferences were split between GOTS and video screencasts, which they attributed to different learning styles (auditory, visual, spatial, kinetic, etc.). Therefore, GOTS may fit some instructional contexts and not others. Time was a factor for many students who preferred screencasts, so librarians decided to continue creating tutorials in both formats.

When time is not a constraint, we can teach mindful and practical licensing with Creative Commons. Many libraries and educators use static flowcharts to demonstrate copyright decision making, but very few are interactive or offer an integrated approach. A study of the effect of storytelling and images on law students revealed that the best tools were comic strips for first-year students and flowcharts for upper-division students due to varying skill levels (DeVito, 2013). Schrand found that flowcharts make complex chains of cause and effect more digestible, best represent relationships, and help clearly define tasks (2008). In that study, active learning was linked to multiple intelligences and learning styles, as it was in the University of California study. Interactive content, such as flowcharts, are commonly used in journalism to provide digestible, engaging public information (e.g., "How the Supreme Court Could Rule on the Health Care Law," 2012). No interactive flowcharts exist that are specific to the context of 3D objects or sharing 3D objects as an education resource. Considering multiple learning styles is important because, for example, faculty using 3D objects in teaching seek to help learners visualize the abstract (Keedy et al., 2011; Chavez, 2016). Creating an interactive interface provides complex or abstract information such as general copyright in context, which could help users with an application.

It is important to consider how interactive tools can improve learning. Existing pedagogical models can be drawn from to inform our teaching methods. Understanding by design (UbD) integrates design principles into instruction (Dickson, Dohe, Hinchliffe, Kelly, & Rowell, 2016). Rodriguez, Greer, and Shipman's course was based on the former ACRL standards. Many concepts in UbD can be mapped to the current ACRL framework and Bloom's taxonomy, with the addition of facets for human interaction.

Connecting to the ACRL framework may help librarians integrate design principles into instruction by working from an existing framework. Additionally, ACRL frames explicitly address the importance of copyright and ethical issues of information (Ravas, 2016). UbD's humanistic elements are important to consider when discussing digital literacies, which are conditions of communication with others. Storytelling and media can increase comprehension, memory, and critical thinking concerning law, specifically (DeVito, 2013).

Table 3. Taxonomic mapping of instructional frameworks

ACRL Framework	**Bloom's Taxonomy**	**Fink's Taxonomy**	**UbD Facets of Understanding**
Scholarship is a Conversation	Understand	Human Dimension	Empathy; Explanation
Research as Inquiry	Analyze	Learning How to Learn	Perspective
Authority is Constructed and Contextual	Evaluate	Foundational Knowledge	Interpretation
Information Creation as a Process	Create	Integration	Application
Searching as Exploration	Apply	Application	Application
Information has Value	Evaluate	Caring	Self-Knowledge

From the existing models and information, we can create objectives for 3D copyright education.

Objectives:

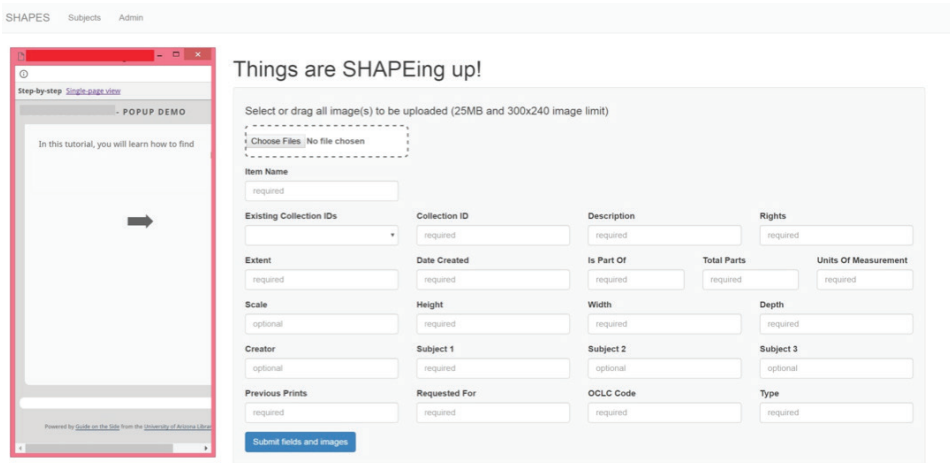
1. Build on existing exemptions and practices.
2. Use interactive tools or exercises to engage multiple learning styles.
3. Integrate copyright education into the process of creation or application.
4. Make tools scalable, effective, and universally designed.

Methods

The design process began by thinking about user personas, as one might when doing usability testing or in digital pedagogy. For SHAPES, the primary use cases would be those creating new works within institutions. Utilizing the networks of a university or other cultural institution addresses user needs to trust and verify the source of the objects. Additionally, a database and metadata schema can provide unique identifiers, as well as help with organization and discovery. The primary SHAPES service limits requests to faculty, which addresses utilizing a modicum of creativity (i.e., small batch production and limited editions). The interactive copyright tutorial was designed for the secondary phase of the service, which would be open to any user with an institutional affiliation.

Active, low-barrier methods to apply copyright concepts were prioritized. Borrowing from the common model of coupling examples with concepts, GOTS was considered the most interactive tool for users to learn threshold concepts before moving on to self-assessment. Twine, an open-source tool using Unified Modeling Language to create storytelling or interactive flowcharts, was also considered . Although a lot of pedagogical issues were considered, it was more important that a user make informed copyright decisions than it was to create a complex tutorial in the interface. The tools allow decision making to become interactive. This mirrors how someone might walk a user through their copyright or reference question. The ideal outcome was "pop-up steps" or "guide on the side" type features.

Figure 3.Prototype of SHAPES copyright tutorial.



Scalability was also a priority, so free or existing tools were used. Multiple skill levels and abilities can be met by straightforward, universal design principles. Partnerships and universal design considerations are strengths of libraries. Simplistic, open tools can allow more libraries to engage with makers, build trust in open culture communities, and reach more potential users. Collaboration among libraries would allow us to leverage our copyright exemptions and expertise.

Ultimately, our servers were not compatible with the GOTS software and Twine made content too long-winded. Time and attention were constraints, considering that a user was only asked to complete a short form. However, both tools served as design prototypes, and a fly-out tutorial was created on the front end by TTU Library developers. The fly-out is prompted from the "Rights" field of the form that users fill out to upload files into SHAPES. This way, it is integrated into the interface. Brief content was used so that users did not have to dig for intellectual property policy or bypass heavy text in Terms of Use to choose Creative Commons licenses. The tutorial contains a user-friendly license generator with only two questions, embedded into the fly-out.

Conclusion and Future Plans

More and more, researchers are discussing how librarians and educators can apply copyright considerations to 3D printing, but very little information has been developed about how to instruct on the topic. Additionally, not enough comprehensive action has been taken toward creating solutions for user needs. The following still needs to be addressed in a broad sense: copyright or patent verification, best practices from makers, and advocacy for user-created designs. This is especially important to demonstrate the strengths of libraries and to avoid the past pitfalls concerning the pervasiveness of new technologies. In other words, libraries should work quickly and consider external factors, such as existing maker communities, to meet the needs of users.

It is imperative in a service profession that we work with our users to build trust and viable solutions. It is crucial that we are not reactionary and risk-averse as practices develop, and instead proactively ensure representatives of libraries, museums, and archives are regarded as stakeholders as development continues. That is not to say that risk should not be assessed or managed when necessary. Cultural institutions are in a unique position to use their exemptions and expertise to empower their communities. For those of us with copyright at the epicenter of our work, we can assist users in exercising and adopting appropriate, flexible licenses. Emphasizing copy-

right during the processes of creation and dissemination is inherently more applicable because copyright is intended to protect creators.

Future plans for SHAPES include assessment, refinement, and the implementation of interface tools. In the second phase, users who are downloading 3D files will be prompted to participate in an interactive tutorial to learn how to best utilize items under Creative Commons. Also, a way to report infringement claims and liability considerations is planned. In the second phase, more user testing of the SHAPES copyright tutorial is planned as well.

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