"RE:Search" - Unpacking the Algorithms That Shape Our UX

The Montana State University Library seeks $50,000 in funding from the Institute of Museum and Library Services through a Laura Bush 21st Century Librarian Program planning grant under the National Digital Platform category to conduct an environmental scan of the field's knowledge of algorithms, develop a proof of concept search application employing common algorithms, and create an Open Education Resource (OER) curriculum and pilot class that will be taught to librarians to improve our digital literacy around the algorithms that define our online experiences and shape our world.

National Need for the Project: Our technological experiences are increasingly mediated by algorithms - the code and computational processes embedded into our software. Recent work by scholars, such as Dr. Safiya Umoja Noble, has shown how algorithms exhibit implicit biases and reify societal prejudices. Moreover, the technical nature of algorithms and the lack of transparency surrounding them can be a challenge for novices. We, and our patrons, routinely engage in systems that predict, recommend, and speculate about our interests based on the digital fingerprint we provide with our link clicks and "likes", but we all struggle understanding how and why those systems work as they do. In seeking to understand common systems, like the Facebook news feed or the Google search engine results page, we view this grant research as an opportunity to discover the scope and reach of algorithms and how they might be taught. We are looking for ways to address a gap in our field: a lack of an understanding around the rules that govern our software and shape our digital experiences. Librarians have a long history of teaching digital literacy; however, while our ACRL Framework for Information Literacy considers how authority is constructed, our instruction programs have not kept up with how algorithms in software construct our experience. We are calling for a new competency that we have termed "Algorithmic Awareness". Librarians can apply this new competency to enrich our instruction programs and extend our relevancy by defining an emerging form of digital literacy for our patrons. At its core, this project is about introducing a new expertise into our profession and providing a new teaching moment for our librarians.

Proposed Work Plan: The planning grant will primarily support releasing a curriculum focused on algorithmic awareness; teaching a pilot course on algorithmic awareness for librarians; developing a proof of concept application showing algorithms in practice;[1] engaging with experts in the field to shape the curriculum via online sessions and an in-person meeting; conducting testing/evaluation of librarian and library patron's awareness of algorithms and their role in our digital experiences; and traveling for project discussion and dissemination. This year-long project has three phases. Each phase will take 4 months to complete. A detailed description of the activities in each phase are as follows:

-*Phase 1: Testing, Evaluation, and Curriculum Development:* Drafting a curriculum on "Algorithmic Awareness" with an emphasis on training instructors to carry forward what they have learned into future instruction. Bringing together an advisory group including scholars, librarians, administrators, and designers to shape the curriculum. Preparing and conducting an environmental scan of algorithm awareness in the profession using interviews and surveys. Usability testing of selected library patrons with an emphasis on how current systems like Twitter, Facebook, and Google use algorithms as part of their user experience. Releasing of a white paper explaining how algorithms work including common algorithms in use by popular systems such as Twitter, Facebook, and Google.

-*Phase 2: Pilot Implementation:* Development of a proof of concept search application that applies common algorithms for relevancy, recommendations, understanding sentiment, linking relationships between users, and grouping documents into categories.[2] Proof of concept code released as an open source project for additional learning opportunities. We will use the search application to demonstrate and unpack the various algorithms present in the proof of concept as part of the teaching sessions. In the process, students will gain a perspective on how code becomes an interaction and we can establish how theory leads into practice.

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[1] We have drafted a working code sketch (https://github.com/jasonclark/search-ux). Grant work will refine and finalize this code and allow us to demonstrate how algorithms are commonly implemented.

[2] Some of the algorithms we will study include: PageRank, merge sort and heap sort, Dijkstra's algorithm, link analysis, and TF-IDF (Term Frequency-Inverse Document Frequency).

-Phase 3: Education: Conduct class using the "Algorithm Awareness" curriculum in a national forum including: the Digital Library Federation (DLF) National Forum or online as part of the Library Information Technology Association (LITA) Continuing Education program. Assess course learning objectives based on response of pilot class. Strategize about curriculum expansion by bringing curriculum to the Montana State University Library Curriculum committee for a potential semester-long course and seeking potential opportunities for the course within Library and Information Science graduate programs. Release an "Algorithmic Awareness" curriculum syllabus as an OER.

Performance Goals and Outcomes: The realization of each project phase will produce three key deliverables that will offer immediate professional development advances for knowledge of algorithms and how to teach this gained competency. These deliverables include: an OER curriculum for teaching algorithm awareness; an open source proof of concept search application demonstrating how algorithms move from theory into practice; and a pilot course for librarians to learn how to recognize, teach, and decode algorithms for information literacy instruction. This project will be measured using the IMLS' agency-level goal of learning and specifically the performance goals to "Train and develop library and museum professionals", "Support communities of practice", and "Develop and provide inclusive and accessible learning opportunities."

Relevance to Project Category: In developing a curriculum, a proof of concept, and a pilot course, the grant work promises to enhance our professional understanding of algorithms, increase our knowledge and capacity with digital library tools, and expand the profession's information literacy competencies. This outcome aligns with the IMLS agency theme of continuous learning in response to advances in technology. The key grant deliverables align with the IMLS agency theme of creating documentation and professional development that enables others to implement or replicate project outcomes.

Key Project Staff
- Project Lead, Developer, Instructor, and Principal Investigator:
    - Jason A. Clark, Head, Library Informatics and Computing—Montana State University.
- Grant-Funded Research Assistant:
    - To be determined.
- Advisory Group:
    - Instructional Designer (To be determined)
    - Lisa Janicke Hinchliffe, Professor/Coordinator for Information Literacy Services—University of Illinois; member of ACRL's Information Literacy Immersion Program.
    - Scott Young, Digital Initiatives Librarian—Montana State University.
    - Jan Zauha, Professor, Reference and Outreach Librarian—Montana State University.
    - Bethany Nowviskie, Director of DLF.
    - Andromeda Yelton, President of LITA.

Preliminary Budget: Our request for $50,000 will primarily support curriculum development and teaching, a research assistant, development of the search proof of concept, testing/evaluation, and travel. Salary requests would be used towards: a buy-out of time for the PI's work in coordinating grant work, teaching the curriculum in a pilot course, and developing the proof of concept, and a research assistant's work in analyzing interview data, preparing project documentation, and assisting with development/design of the curriculum and proof of concept. Direct costs include: $8,270 to cover 10% of the PI's time for 12 months based on annual salary; $14,040 to hire a research assistant at a rate of $13/hr for 1080/hrs; $2,300 for testing and evaluation services including incentives for participants, software, and tools for conducting the study. Additional costs of $16,900 will allow the key project staff and advisory group members to meet and attend library and technology conferences to share project progress, disseminate results, and generate dialogue for curriculum development and algorithmic awareness in libraries. Indirect costs would be at 34.5% of direct costs totaling $8,490.