Overview
TechShop is an urban manufacturing workshop and makerspace located in the SoMA neighborhood of San Francisco that provides access to machining and fabricating tools and training to anyone regardless of experience. Members pay a monthly fee for access to professional machine tools, to learn manufacturing skills and create their own projects. Though many of TechShop members are hobbyists, a number of successful products were prototyped at TechShop, including the Square mobile-payment card reader.

The organization of TechShop’s machine assets follows functional, safety, and operational principles commonly used in professional workspaces. The physical organization of TechShop is interrelated with its membership and training systems to support a broad range of interactions, including the skill acquisition that enables its members to build their own unique ideas.

What
The equipment in TechShop is organized within the space to support safe and efficient interactions with machines for its 1,000 active members. The organization also reflects certain operational requirements of the machines and supports maintenance interactions performed by the shop staff. People and resources are also organized through TechShop’s proprietary membership database, which organizes contact information, payment history, entry and exit logs to the facility, and which machines each member is permitted to use (once they have been trained).

How Much
Machines and tools in the workspace are organized at the top-level by the kind of material they are used with: wood, metal, or plastic. More efficient interactions are supported by further grouping machines and tools that are frequently used together to accomplish certain production tasks. For instance, machine tools, welding tools, and grinding tools are each grouped together. This reflects a principle of resource organization around certain tasks. Ethnologists who studied the arrangement of tools in the similar context of blacksmithing referred to this type of organization as a ‘taskonomy’, where tools are classified together by the functional relationships necessary to carry out a given task and would not be retrieved as a group in a classification scheme based on primary function, shape, or material.

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2 Calvo, Andrew. Director of Sales, Techshop SF. Personal interview. 01 December 2016.
The machines are also organized based on requirements for their maintenance and user safety. For example, the tools for woodworking (table saws, routers, bandsaws etc.) are separated in an enclosed room separate from the rest of the shop because sawdust is damaging to most other equipment. Sawdust is highly flammable, and the separate woodworking area is arranged for safety around a powerful HVAC system that sequesters sawdust in waste containers for removal⁴.

Advanced manufacturing machines (laser cutters, 3D printers, and small CNC mills) are kept on the second floor in an open work area and lounge. These machines have fewer operational and safety requirements, tend to be quieter, and can be operated in a mixed-use space. Additionally, these machines are computer-controlled and positioned close to the computer stations that run Computer Aided Design (CAD) software. CAD software produces a set of instructions used by the machine to cut material or produce an object with high precision.

Why
Any machine shop must be organized to support safe and efficient use of its machines, and the space around them must be kept clean. These organizing principles are common practice but also satisfy the regulatory requirements established by the Occupational Safety and Health Administration (OSHA) and the San Francisco Fire Department. TechShop is further organized to allow members access machines on their schedule, and to share the space with people working on separate projects. TechShop’s online equipment reservation system, which organizes scheduling of machines, takes care of both scheduling and validating that members have been trained in a machine’s safety procedures before being allowed to use it.

As a whole, TechShop’s physical and membership organizing systems support the learning interactions that are core to TechShop’s mission, which co-founder and former CEO Mark Hatch describes project-based skills acquisition⁵. Members learn the skills they need through machine-specific trainings, enabling members without experience to learn the skills needed to complete a project. There are no prerequisite courses beyond a general safety course, and the class schedule is planned each month in response to member demand for certain trainings. Instructors, who are employed by TechShop as independent contractors, are matched and scheduled to teach courses based on their availability⁶. This flexible organization of classes empowers members to start producing objects in a short period of time.

How or by Whom
The layout of TechShop’s equipment was part of the design of the facility. The TechShop facility is a pre-existing building whose dimensions, available floor space, and the location of ventilation and power systems shaped the organization of the machine assets within it. Within the space constraints, machines are also organized following common principles of shop layout and the

⁴ Neider, Martine, SFMade Make to Manufacture Fellow. Personal interview. 30 November 2016.
⁵ Hatch, Mark. Co-founder and former CEO of TechShop. Jacob’s Design Institute, UC Berkeley. 18 November 2016. Berkeley, CA.
⁶ Calvo interview, 2016.
regulations that govern the installation and use of large machine tools. Once installed, the physical organization of the space was mostly set from the time of installation due to the difficulty and cost of re-routing existing systems. This organizing system does require a lot of maintenance, which is performed by TechShop’s ‘Dream Consultants’ who manage the shop and maintain machines. They are responsible for ensuring that tooling - the sets of different sized drill bits and cutting heads - are kept organized and stored in an area designated for each machine. Dream consultants also organize their maintenance activities and information about the conditions of machine-tools in a dedicated ticketing system.

Other Considerations
The organizational systems that TechShop developed are now being used to create a design-pattern for forming and operating membership-based workspaces. TechShop’s founders advise other businesses on how to set up their own shared workspaces with the same core equipment. A separate organization called TechShop Global forms partnerships with large firms in other countries to create networks of makerspaces in those countries, and licenses the TechShop brand and proprietary CRM systems⁷. The ambitious goal of TechShop’s founders is to have 1,000 workspaces spread across the U.S. and abroad, and make shared workspaces and access to manufacturing tools a common feature of cities and communities.

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⁷ Calvo interview, 2016
ARTIFACTS

TechShop Case Study
Peter Rowland
Replaceable bits and hand tools that facilitate certain common machining tasks are kept close to machines in rolling storage containers.
Safety is a primary factor in the organization of any shop space. A dividing wall separates the entry to the shop floor into a hallway containing bins of safety glasses and other Personal Protective Equipment (PPE). Flammable materials are required by law to be kept in a locked cabinet with clear signage.
Techshop members have access to computers with the complete suite of Autodesk software for computer-aided design (CAD).
Areas of the shop are organized by the type of material that can be worked on. Woodworking generates waste that is damaging to other machines and is given its own dedicated area apart from the rest of the shop floor.
Advanced machines like Laser cutters and 3D printers are controlled by computers that convert designs into sets of instructions followed by the machine.
Mills and lathes, sometimes called the 'mother-machines' because they can be used to make any part, are positioned in the corners of the room close to work tables where parts and tools can be organized for a given task.
Members use RFID encoded badges to control the pictured networked control boxes that authenticate that a member is allowed to use a machine and turn on the power feed to enable them to turn it on.