

Prospectus

Dr. E's Laser Chair

(Technical Report)

Abusing Influence: Shaping a City Through Zoning

(STS Research Paper)

Presented to the Faculty of the School of Engineering and Applied Science

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Introduction:

Who has power in a community? How do we use societal power? We understand these questions in a variety of frameworks. We can look at power through the lens of economy, social life, social action, thought, beliefs. One power dynamic that can often go ignored due to the long-term nature of it is control over zoning. There are libraries of thought on the topic of what one can do with control over the money in a society, what one can do as a political leader, as a religious leader, even as the figurehead of a social group. Few people think about the long-term sociological ramifications of consolidations of power over zoning rights.

This prospectus is a preliminary analysis how people and entities wield influence over zoning. While zoning is not traditionally considered to be a powerful force in societies, zoning controls the direction that an area will move during its growth and can dramatically affect the city. Well-developed interests in the way that zones are allocated for building projects enables cities to control the ways in which they grow and which communities grow and shrink with the city. Without a diverse set of interests in the long-term plans of a city, single entities can set themselves up to gain an economic or social stranglehold on the city.

This capacity exists multinationally, but it is limited to sociologically stable localities in which zoning regulations are enforced. Without enforcement of zoning, development projects become unpredictable and the will of the community tends to take control. In cities that are sociologically unstable, long-term plans lack the resilience to be enacted. Assuming those two qualifications are met, control over zoning holds the key to the shape that a city takes as it grows, what problems the communities face/care about, even which communities have spaces in the city. Having an awareness of when and where to be vigilant about zoning influence is vital to controlling misuse.

Technical Topic:

How can an authorized user's attention at the Mill's laser cutter be insured during a running operation? The capstone project is advised by Dr. Gavin Garner, Director of Undergraduate Studies, for the mechanical engineering department and done in conjunction with Erich Demaree.

The laser cutting process must always be monitored by attentive and trained personnel. Under certain conditions, fire and toxic volatile compounds are possible. If a self-sustaining fire occurs, the user can swiftly intervene before excessive damage or injury occurs. There is a fume fan installed on the Mill's laser cutter, though leaving it on for long periods do cause unpleasant odors to be pulled from the Mill's drainage system. The laser cutter in the Mill is relatively mundane, and the dangers of inattentiveness can become obfuscated.

The goal of our project is to design a system that prompts the user to remain attentive during cutting and insures the fume fan is turned off while the laser cutter is not in use. We are required to design the system with mechatronics, to limit construction to use only the tools at UVA, to include an authorized user override, and to remain under a \$1500 budget. A current system to prevent laser cutting operation exist if the fume fan is not turned on, but only posted reminders are in place for the user to turn it off. The current system does prevent the running of the laser cutter without the fume extractor fan running, but will not automatically turn off the fan. Without a new system in place, the laser cutter will run unattended and the fume fan could be left on unintentionally. The current workflow does not efficiently handle the reusable scraps from previous cuts, and an improvement in the environment may prompt users to replace their acrylic sheets more deliberately.

We plan to design a chair on a guided system to move the user from the control computer to a proper vantage point in front of the laser cutter. A weight sensor in the chair will deactivate the fume fan after a set interval. We will design the guided chair system in Solid Works to determine proper dimensioning and placement of the components. A prototype will not be built do to the size of the construction. Success will be a reduced risk of fire and automatic shut-off of the fume fan. The chair

design will also encompass the ability to control aspects of the laser cutter and fan system without being required to get up from the seat, further helping the user to stay at their post during the cutting process.

In addition to helping to prevent fires and unfortunate odors being released into the Mechanical Engineering building, we aim to make the laser cutting apparatus a more appealing and interesting part of the Mill as a whole. Drawing attention to such a powerful piece of equipment helps it stay well-maintained and operational, also improving the overall safety. As newer technologies find spaces in the Mill, our project aims to revamp the use of the laser cutter and make it more desirable as a design and production option.

STS Thesis:

Why do we have zoning in cities? Zoning helps a city control which type of buildings can be built in a region in an abstracted way. This enables top-down designs to function in the shaping of a city without going to the level of specific building documentation or planning. Additionally, this zoning helps cities maintain the usage of existing buildings, an example of the usefulness of this is that it prevents private from becoming commercialized and taken over by encroaching businesses. My research question is aimed at identifying what happens when certain parties gain undue influence on the zoning decisions of their cities. My research will attempt to answer “How does a major imbalance in influence over zoning affect local communities?” I will assess these influences by examining Charlottesville, Virginia, as a case study and evaluating the ways in which the shifts in zoning power over the years have affected significant city health markers such as unemployment, poverty, homelessness, accessibility, social mobility, diversity, and traffic. For context, these markers will be evaluated in comparison to national averages over time as well as against similar cities such as Reston and Harrisonburg.

A valuable lens through which to interpret influence in communities is Thomas Hughes’ Large Technological System framework. LTS gives us insight into the ways that technologies, and the producers of technologies can play a role in these systems alongside actors. We can begin to process problems of this nature by first defining the control structures of the systems at play. Many small systems exist below the decomposition boundary, but in issues of public forum, most of the significant actors are either individual homeowners or systems with self-organization. The system builders from these are predominantly the University, City Council, and local rental agencies. Identifying the ways in which these system builders designed the system and built momentum can help give us insights into how and why smaller system components such as homeowners have been marginalized. Emerging from the hierarchy is a self-perpetuated system that carries significant momentum with sometimes obfuscated goals. One such system with more clear goals in mind was that created by Reston’s Robert E Simon.

To evaluate these systems, my research will adopt the following research methodologies for data collection: archival study, the research will parse zoning policy reports and research from the Charlottesville zoning administration and enforcement archives; interviews, the research will gain perspective from the University and the community by interviewing University housing officers, city council members, and local residents; historical analysis, the research will evaluate the ways in which zoning maps have developed over the years using mapping data housed in the Charlottesville open data repository. The research will also be driven forward by the work of Robert E Simon in the form of his book, *Modern Zoning for Reston*. While the book is related to a DC suburb instead of a college town like Charlottesville, the functionality of the city of Reston since its publication in 1967 suggests that it provided a strong framework that we can learn from in city zoning developments.

After reviewing *Modern Zoning for Reston*, it makes sense to use the city of Reston as a secondary data set, allowing us to identify where in the system building process the momentum was shifted away from community values. Reston was founded with seven goals explicitly in mind, most notably in these is Robert Simon’s second goal: ‘that it be possible for anyone to remain in a single neighborhood throughout their life, uprooting being neither inevitable nor always desirable.’ (Reston

Master Plan) As a planned community, Reston's master plan includes not only zoning information at a given time, but how zoning in Reston is and was intended to change as the city grew. In *Modern Zoning for Reston*, Robert E Simon laid out an explicit long term plan for the use of zoning in the city to ensure that communities were stable through the decades (*Modern Zoning*, Simon). Thanks to his plan, and the work of community members, Reston continues to have a socioeconomically diverse and integrated community. Reston uses recurrent indicators as part of its effort to maintain affordable housing throughout the city. (Kitchin) As recent as March of this year, the Reston community fought back against a zoning update in an effort to preserve the community's values during a time in which the city is feeling an increased push to develop following the extension of the silver line (Reston, Merchant). Reston lies in stark contrast with a city such as Charlottesville, whose community lacks the influence to fight against zoning changes.

Charlottesville's zoning is primarily influenced by a select few entities, primarily the University of Virginia. University influence in zoning is felt by the local community in a variety of ways; one of the more dramatic amongst these is that the community on the fringe of University grounds are at risk of losing their homes and communities in the name of expanding the university. On Brandon Avenue, the University of Virginia, after purchasing the majority of the land on the street, petitioned the city of Charlottesville to "vacate all of the City's public interests... in preparation for UVA's redevelopment project." (City Council Agenda Feb 20, 2018) The Charlottesville community responds to these pressures by reserving themselves from the University and separating from the public discourse. Unfortunately, not appearing at the table for discussions of city planning leads to UVA consolidating more zoning power in the region. As UVA continues to expand, it becomes easier to continue the expansion, further marginalizing the local community. Were other actors to have power in zoning discussions, the values of the community might better be upheld during the growth of the University into Charlottesville, thus preserving the relationship between the school and the surrounding communities.

The strife of the community in Charlottesville is felt by locals and students alike. Students find themselves unable to interact with aspects of the community that might be valuable, and locals lose the stability of their communities and their ability to remain in a single neighborhood. The University of Virginia is motivated to maximize the usability of the area for its students, and is not intrinsically motivated to preserve other facets of the region. Charlottesville has a major traffic and parking problem that the University profits from. Based on the Brandon Avenue Master Plan, we know that this new development, which displaced a Charlottesville community, will provide UVA with 500 new beds for students and 220 new parking spaces. Not a single new public use parking space in an area that used to contain 100+ spaces (many of which were public street parking), but 220 permit parking spaces that the University can control the use of and charge for. The University draws so much traffic for events like football games that whole streets like JPA become unusable for hours at a time. The problems facing the City are not being addressed in the continued zoning changes that the City of Charlottesville is making because the primary influencer in zoning decisions has no incentive to improve the issues. We can draw from this that for a city to be developed to handle problems that arise during the growth period, there needs to be a diversity of goals within the city planning committees, a feat which is impossible with a single entity holding primary influence over zoning.

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