

Cornell University Response to COVID-19 Pandemic: Cornell's COVID-19 Response Strategy Using the Agent Based Approach (ABA)

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ABSTRACT: To better understand how Cornell handled the COVID-19 pandemic, I decided to map the university's response and interaction with the virus. I completed an economics course in undergrad at Cornell on the economics of higher education which spurred my interest in mapping Cornell's response to the COVID-19 pandemic. A lot of the mapping comes from prerequisite knowledge I acquired from the course. The backwards economics and administrative deadweight loss that occurs as a result of academic organizational madness is very intriguing so I wanted to map how exactly Cornell was so effective in their response strategy.

Initially, dealing with the ramifications of an unprecedented global health crisis in the Spring 2020 proved to be a difficult and chaotic endeavor for university administration. University leadership had to provide directions to stakeholders throughout the Ithaca community to ensure that students returned home safely without causing an outbreak in the community. Additionally, given that the faculty and staff are populated with many older individuals, there was a genuine need to ensure de-densifying of the Cornell campus. After the chaos, it was discovered that Cornell's handling of the pandemic was uniquely effective among large research universities. The university's handling of the pandemic was featured on various new outlets as a result. In the Fall 2020 semester, in-person and hybrid instructions resumed, bringing the campus back despite the presence of a life-threatening virus. Despite this, the campus managed to remain open throughout the 2020-2021 school year which cannot be said for many other colleges and universities. Therefore, Cornell's handling of the pandemic provides the perfect opportunity for a map to better understand how the university used channels to ensure safety while under semi-normal operations.

Keywords: COVID-19 | Cornell University | ABA | CAS | DSRP | POSIWID

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Introduction

DURING THE SPRING 2020 SEMESTER, universities throughout the world had to reconcile with an unprecedented global pandemic. As a result, universities had to innovate in a quick time frame to ensure that the delivery of instruction, research, and other activities would go on as planned. However, accomplishing these endeavors



while keeping all parties safe proved to be a difficult challenge to overcome. Cornell's response in particular was lauded as one of the best in the nation. In Spring 2020, classes went fully online and students completed the semester virtually. After the summer, students returned to a campus transformed by the COVID-19 pandemic. Weekly surveillance testing, a reduced campus population, and the imposition of quarantine if exposed to a known positive case made the semester bleak. Despite the effort, Cornell failed to adequately address the many shortcomings that resulted from their response. For example, Spring 2020 placed reductions in coursework requirements on professors. However, these efforts were gone during the next two semesters despite the mental turmoil that still existed because of the pandemic.

The mapping and understanding of this system is important because it provides context for future world events that may disrupt the traditional delivery of instruction. Additionally, this system is important because it sheds light on the changes that could be made in higher education overall. For starters, we learned that universities have the capacity to deliver instruction fully virtual. However, their business models thrive when students are in-person. This prerogative to have students on campus puts thousands of students and Ithaca residents at risk of contracting COVID-19. Cornell's risk analysis found that the back-to-campus plan would work. It worked, however, it did present challenges and numerous positives that disrupted the education and lives of students.

Methods

TO UNDERSTAND WHY I chose to use the ABA Approach, the following section will provide a brief explanation of the approach. ABA is "an approach to systems understanding, problem solving, and analysis-synthesis of various kinds (e.g., process, policy, systems, etc.) that utilizes a CAS perspective as a frame; a specific stepwise method for approaching a given system or problem developed by Drs. Derek and Laura Cabrera."¹ The university system exhibits the characteristics that are primed for the ABA Approach.

¹ CRL, Agent based approach (ABA), , 2020, accessed: NA-NA-NA

Why an Agent Based Approach (ABA)?

ABA WORKS AS AN APPROACH to map and understand Cornell's response because the university system is a complex adaptive system. A CAS system is one that "exhibits emergent and adaptive behavior;

CASs are composed of agents following local simple rules leading to collective dynamics that yield emergent properties; Systems Thinking is a CAS and DSRP and VMCL are the simple rules; All human organizations are CASs². Cornell's agents include the faculty, staff, students, and local residents that make the community what it is. The simple rules followed by the community dictate how rules are disseminated and followed which is the emergent complexity (i.e., Everyone wears a mask on-campus because the administration set the rule). Overall, the leadership structure at Cornell mirrors that of other larger research universities.

² 2

Despite the similarities, Cornell's specific conditions and response made it more effective than its peer institutions. The COVID-19 pandemic response is an especially relevant system to map because of how it has changed our mental models and the way that we interact with the world. Prior to COVID-19, mask wearing was not obligatory. Today, masks have become a huge part of our lived experiences over the last two years. When the simple rules are followed at Cornell, results can be positive or negative just as they are outside of the community. When individuals wear masks, we all benefit from reductions in COVID-19 infections.

Despite the best laid plans, things went astray because of things outside of the control of university administration. For instance, university leadership had to reconcile with parties that went on off-campus that led to outbreaks among certain contingencies on campus that failed to follow the simple rules set by agents in charge (i.e., MBA student outbreak in Fall 2020). Individual mental models informed their behaviors which led to outbreaks. Thus, the ABA Approach is an exemplary approach to use when mapping the COVID-19 response. To better understand why this is the case, the following section will break down the steps to an ABA Approach.

Steps to an Agent Based Approach (ABA)

Step 1: DSRP Analysis of the System

THE FIRST STEP IN THE ABA APPROACH is the DSRP Analysis of the System. "DSRP Theory proposed four universal patterns that underlie systems thinking: these are identity-other distinctions (D), part-whole systems (S), action-reaction relationships (R) and point-view perspectives (P)³." It is through this analysis that we begin to see what a system is. By working with all of the systems moving parts, we begin to understand that everything is a system. These distinctions help clarify things and ideas.

³ 3

When we map, we identify ideas of things to be included. For example, when starting my map the first identity-other distinction I made was the relationship between the President and Provost. Despite working closely, they have different roles that come with different responsibilities. These things and ideas can then be organized into part-whole systems. For example, when mapping, I knew I had to create a part-whole system to represent the populations and the facilities they used on campus. It would not be enough to simply list them because each contingency on campus interacts with different buildings on campus. After identifying part-whole systems, you must then identify action-reaction relationships. I identified that faculty and staff work to support the education of students. However, they also work to support the mission of the university which is to educate and produce and disseminate research. This shows us that an idea can relate to more than one thing or idea, hence why we call the system a CAS.

Step 2: POSIWID and CAS Analysis

THE NEXT STEP IN THE ABA APPROACH is to POSIWID the system. POSIWID stands for “The purpose of a system is what it does.” We POSIWID the current as it IS and POSIWID as it SHOULD BE⁴.

⁴ 4

Instead of looking at what the system produces, we instead look to the design of the system itself to gauge whether it is actually functioning as it should be. The first step involves differentiation. For example, you will take a system that you believe is not working well. Then, you identify the specific result of the failure that may need a remedy. Finally, you flip the result on its head with POSIWID. So, take a campaign for a job in engineering for recent college graduates with a degree in mechanical engineering. The failure of the system might be that the recruiters are not getting applications from recent college graduates with degrees in mechanical engineering. Therefore, the statement would be: the campaign for recent college graduates with a degree in mechanical engineering is exceptionally well-designed by recruiters and good at its purpose of not attracting recent college graduates with the degree. After identifying the IS and SHOULD statement, we must develop a root difference analysis. “In a POSIWID Differentiation and Root Difference Analysis you must develop a statement of the systems’ actual POSIWID and another statement for the systems’ ‘should-be-POSIWID⁵.’” So, for example, below is a root difference analysis able illustrating the meaning of the analysis:

⁵ 4

Next, you should make a list of agents in the system which will

Actual Current-IS-POSIWID	Difference	Future Should-be-POSIWID
The job campaign is good at not attracting qualified applicants.	A poorly-designed job campaign vs. a well-designed and targeted job campaign.	The job campaign is good at attracting qualified applicants.

help with the final recommendations. After finishing the POSIWID analysis, the next step is to create a CAS Analysis Table. “The complex adaptive system table is based on the idea that the greatest leverage points in a CAS are the agents and simple rules⁶.” Thus, we then explicate the simple rules for each agent group in the “CAS Table” for all agents. The CAS analysis is the beginning of the recommendations phase. You identify simple rules for each agent and then back check that they align with the next step which is the recommendations rubric.

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The first step in the CAS analysis is the recommendations rubric which includes about 3-10 “Recommendation Principles.” These principles then become the basis through which all future recommendations must abide by. This list acts as a sort of design principle. This is a backcheck for proposed recommendations as well. This step requires that a system thinker look beyond the specific recommendations to identify patterns which will yield relevant current or future recommendations.

Step 3: Rubric and Recommendations

THE LAST STEP in the ABA Approach is the establishment of rubrics and recommendations. Here, the recommendations can be creative. However, they must abide by the constraints and specific design principles outlined in the recommendation rubric step in the approach. It is important that they abide by the outlined structure.

Results

DSRP Analysis of the System

I USED STRUCTURAL PREDICTIONS to inform how the system would map. Through my own interaction with the system and prerequisite knowledge of the university system, I began mapping the response. However, after thinking through my own biases, I had to check my mental model by remaining objective in the formulation of the map. I remained objective by removing my own social construct of the

system and remaining objective while mapping. Instead, I used what exactly had happened throughout the last two years to inform how I was mapping. Rather than imbuing my own personal view of the situation, I mapped the system as it existed then and now.

Currently, I view the university's response through the perspective of the administration. The agents are an important part of system thinking because all of the decisions that influenced campus operations (i.e., action-reaction relationships) came from them. So, I started by mapping Cornell organizations on one card to begin to understand how information is disseminated. The card starts with the President's office and eventually trickles down to students. As I see it, Cornell is a gigantic part-whole system that works to educate as well as conduct and disseminate research. All of the distinct relationships work towards this goal and everyone's perspectives work together to create the space to accomplish prerogatives. Each person can be thought of as part of the Ithaca community.

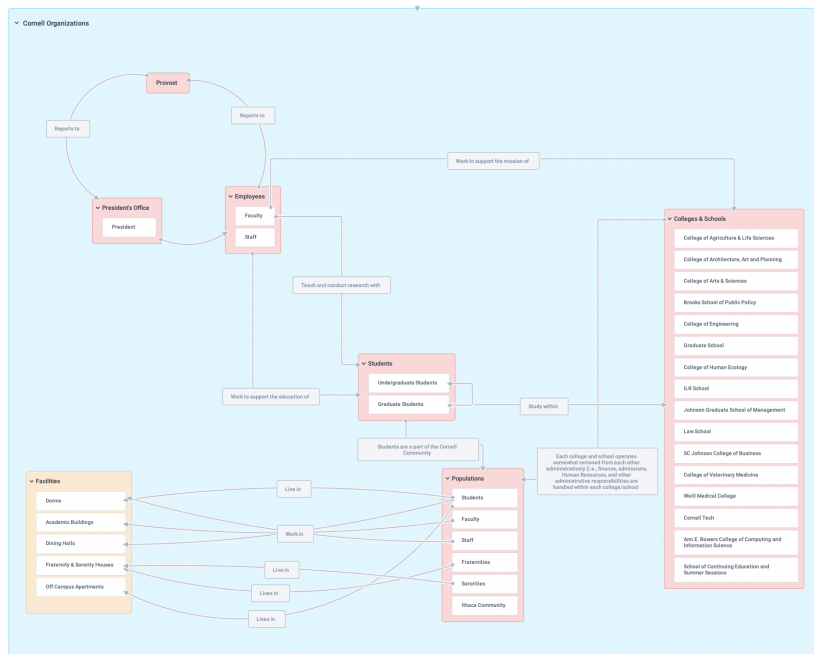


Figure 1: First Part of Systems Map

I started with organizations at Cornell because they create the space for relationships between groups to exist in the larger system that is the Cornell community. I used a P-circle to represent how the President's office interacts with the Provost and Faculty/Staff because the relationship is somewhat circular in the manner in which reporting is conducted. The Provost reports to the President and each Dean reports to the Provost. So, a circular relationship to represent

the interaction is a fair representation. After that, I used a series of part-whole systems to represent the distinctions that exist at Cornell including students (i.e., undergraduate and graduate), colleges and schools, populations (i.e., faculty, staff, fraternities, sororities, etc.).

The gray boxes describe the relationship between each contingency at Cornell. I used an R-channel to represent how each population interacts with facilities on campus because that is fundamental to understanding the response and effort to keep campus spread down. For example, students live on campus and faculty members work in buildings. However, students are found in a variety of settings which is precarious because of the desire to keep transmissions as low as possible. An r-channel is a fair representation for the relationships that exist between populations and campus facilities.

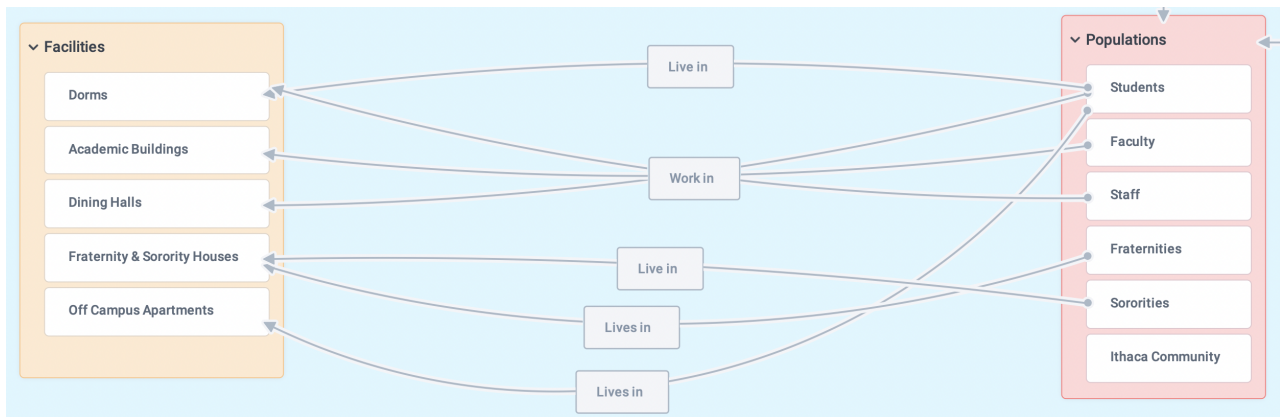


Figure 2: R-Channel

I used a second card to represent the university's response. I used perspectives to represent each semester influenced by the response to COVID-19. Each semester has a perspective and each semester includes different events or changes to normal operations. Certain events happened in separate semesters so perspectives are an appropriate representation of the dynamic that exist between each semester and separate responses. For example, in Spring 2020, learning went fully-virtual whereas Fall 2020 implemented a hybrid model that also integrated in-person learning. The implications of this decision had an influence throughout the Cornell community and it will impact the recommendations rubric.

The decision brought students back to campus, creating the space for increases in infection rates on campus. Handling these dynamics required increased capacity to address events which is represented by aspects of this card. The card also represents the implementation of surveillance testing as a new way to ensure safety on campus by keeping populations healthy to the best of the university's ability. Cornell's capacity to provide fully-virtual learning, surveillance

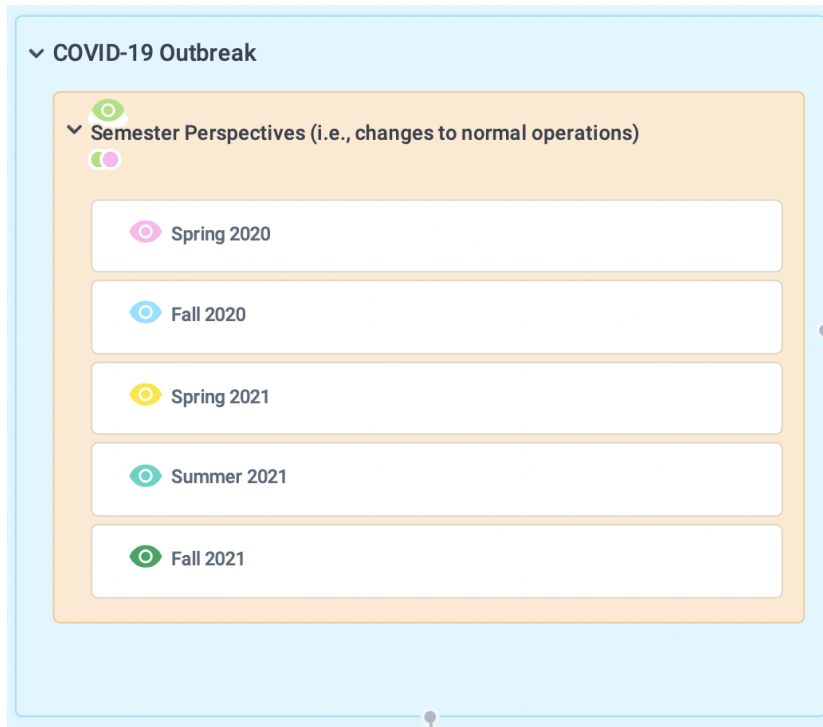


Figure 3: Perspectives in the Map.

testing, and quarantine to students in Statler was a unique aspect of the university's response.

After thinking about the structure of relationships between the COVID-19 pandemic and Cornell, I noticed relationships between certain processes that I had been overlooking. For example, I noticed that the difference in learning methods (i.e., Fully Virtual v. Hybrid v. Fully Online) would make more sense as a p-circle rather than a more simplistic part-whole list. U named this card "public health concerns push for revised functions" because of the changes made. All of the learning methods are related in a circular structure because they are so closely related. Students at Cornell during the pandemic either virtually or in-person interacted with one or more of these modes. Additionally, the modes of instruction also had implications on faculty and staff and their responsibilities. Virtual learning integrates components of in-person learning, so they can be thought of in a circular structure.

This card also illustrates the relationship that existed when the university enforced the denial of travelers on campus and the denial of travel outside of the Cornell community. The university used Wellness Days to address the inability to leave campus. As a result, mental health concerns came up. Mental health concerns also have

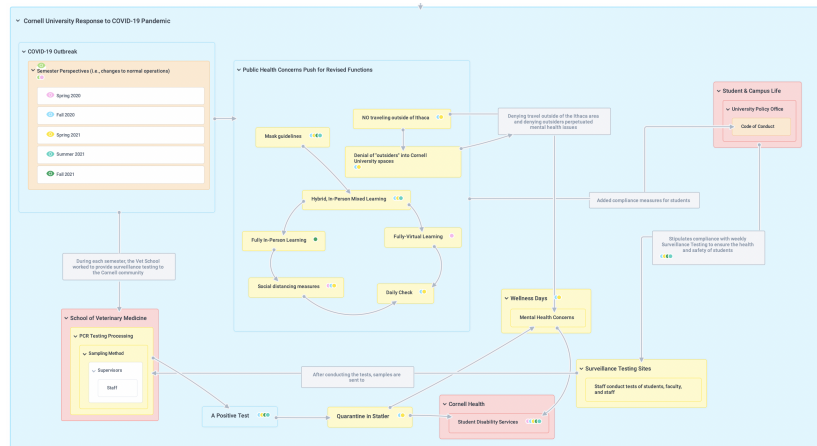


Figure 4: Map of the System

an action-reaction relationship with quarantine as well as Student Disability Services.

After finalizing most of the map, I added a color key to represent each event or activity. After looking at the map, everything looked too similar and the use of gray looked too bland to capture the eye of a person attempting to understand the system. So, adding the colors helped to differentiate sections that can be separated based on their specific activity. I also added descriptions for each arrow to clarify the relationship between different ideas.

After testing my mental model with information and structure, I realized I might be overcomplicating my map. The real world system is impacted by COVID-19. After having this realization, I used a barbell to connect the Cornell organizations and Cornell's response cards. I added the clarification, "COVID-19 pushes for universities to make the decision to shutdown or continue to operate with additional health risks" to the arrow stemming from COVID-19 to the response. I also added the clarification that universities, "Must respond to the pandemic and provide directives to stakeholders in the university community."

POSIWID Analysis

THE POSIWID ANALYSIS addresses some of the shortcomings that occurred as a result of the response from Cornell. The system kept student infection rates low and until recently the university did not have to shut down due to increases in infection rates among Cornell community members. However, facing an unprecedented global pandemic, the university did little to nothing to adjust how

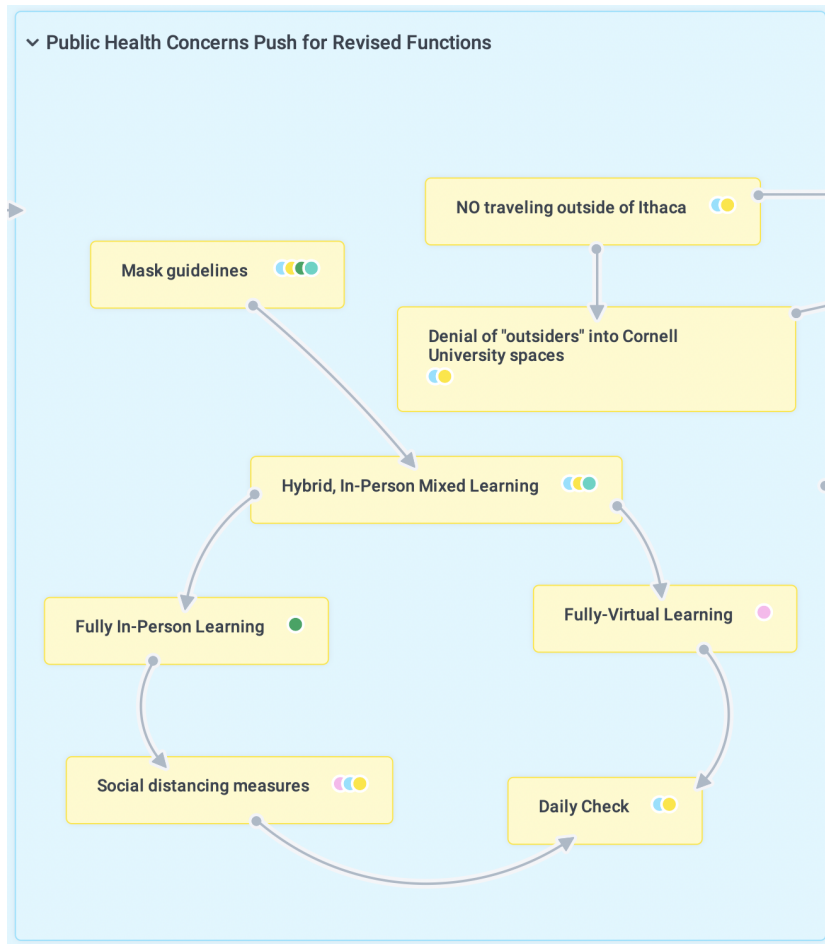


Figure 5: P-Circle

they could alleviate student concerns about their education. Student burnout caused by being fully-virtual or hybrid was not adequately addressed. Instead, the university implemented “Wellness Days” which were days in the middle of the week meant to alleviate student stress. Instead of breaks, administration implemented these periods to deter students from leaving campus and risk contracting COVID-19. In Spring 2020, Cornell created a mandatory Satisfied/Unsatisfied system that was university-wide for undergraduates enrolled in courses. After the spring semester, operations and course requirements went back to normal despite still being in the midst of a pandemic.

Problem Statement	Current POSIWID	Future POSIWID	Root Difference
Decrease in in-person engagement causes burnout in the student population.	The Cornell COVID-19 response is exceptionally well-designed at decreasing in-Person engagements and causing burnout among the student population.	The Cornell COVID-19 response is very good at not causing burnout among the student population.	Poorly designed system that does not address burnout vs. A system that prioritizes student mental well-being.
Decrease in access to campus causes inability to focus for students.	The Cornell COVID-19 response is exceptionally well-designed at denying access to campus and causing an inability to focus on the student body population.	The Cornell COVID-19 response is very good at allowing access to campus and now causing an inability to focus on the student body population.	Denial of access to campus vs. Some access to campus.
The Cornell COVID-19 response is very good at detecting COVID-19 infections.	The Cornell COVID-19 response is very good at detecting COVID-19 among members of the Cornell community.	The Cornell COVID-19 response is very good at detecting COVID-19 among members of the Cornell community.	None.
Cornell prioritizes academic requirements over student well-being.	The Cornell COVID-19 administration prioritizes in-person exams and normal academic requirements during a pandemic.	The Cornell COVID-19 administration does not prioritize in-person exams and normal academic requirements during a pandemic.	Prioritizing normal operations vs. prioritizing reduced academic requirements.

Table 1: POSIWID Analysis

CAS Analysis

Rubric and Recommendations

Recommendation Rubric

No specific recommendation should violate these rules:

1. Any recommendation must not undermine any stakeholder's authority.
2. Any recommendation must come from a individual agent(s) which leads to outcomes.
3. No single recommendation can lead to all of the desired emergent behaviors.
4. Any recommendation will lead to the opportunity for feedback and additional information.

Specific Recommendations

1. Intervention/Recommendation 1: Implement a (suggestion) reduction in class requirements throughout the university. While living in a pandemic, the pressures of being a student are much higher than they were pre-pandemic. University leadership does

List of Salient Agents	Current Simple Rules	Current System Level Behavior
President	1. Disseminate changes to normal operations. 2. Fundraise for the University. 3. Serve as spokesperson for the university.	Student body disdain for lack of empathy; negative view of the President's office and response; too much focus on money and not enough on the student body from administration.
Provost	1. Oversee all academic operations of the university. 2. Organize and manage the academic deans. 3. Act as a spokesperson for the university with the President.	Student body disdain for lack of empathy; negative view of the President's office and response; too much focus on money and not enough on the student body from administration.
Deans	1. Manage their faculty. 2. Manage their respective colleges finances. 3. Serve as spokesperson for their respective colleges.	Do not have much interaction with the concerns of the student body.
Undergraduate Students	1. Get tested each week for COVID-19. 2. Attend classes, study, complete assignments, take tests. 3. Abide by the rules of the Code of Conduct.	1. Students are still testing positive for COVID-19 despite testing parameters. 2. Student burnout from COVID-19 is not being addressed by administration. 3. Students are not abiding by the Code of Conduct. 4. At risk of contracting COVID-19 while trying to get an education. 5. Student disability services fails to truly support student struggling.
Graduate Students	1. Attend classes, study, teach (TA), research (RA), complete assignments, take tests, disseminate research. 2. Abide by the rules of the Code of Conduct.	Graduate students are stretched thin with little to no resources or assistance to scale back responsibilities.
Faculty	1. Attend class, research, teach. 2. Abide by rules set by the Dean/Provost/Faculty Senate.	1. Faculty are failing to prioritize student well-being and instead are prioritizing rote memorization of subject material that will be quickly forgotten. 2. Substantive learning is not happening, especially now during the pandemic. 3. Old systems are not working during the pandemic. 4. Faculty are at risk of contracting COVID-19.
Staff	Work to support campus, faculty, and students.	Staff are being put at risk of contracting COVID-19.

Table 2: CAS Analysis

not realize this because they are not students living through a global pandemic.

2. Intervention/Recommendation 2: Implement opportunities for students to have actual meaningful learning experiences. The pandemic showed us that learning can be completed virtually. However, it also showed us that the old way of doing higher education could be made obsolete. Furthermore, an attempt to remedy the problems rampant in higher education settings calls for the time for change. Providing actual meaningful opportunities for students to make suggestions to senior administrators about academic requirements may remedy this situation.
3. Intervention/Recommendation 3: Provide an increase in mental health resources given the state of the world for the last two years. Instead of prioritizing financial gain on the endowment, university administration should realize the grave importance of investing in the human capital they are responsible for educating.
4. Intervention/Recommendation 4: Provide more opportunities to discourage burnout among the student population. The COVID-19 response was very poor in this area and the future should prioritize this aspect of student life.

Discussion

DSRP Analysis of the System

THE EXERCISE SHOWED me how the system succeeded and failed in the various areas of importance to students specifically. The response is well-designed. This is obvious given the public's reaction to Cornell's It makes sense and it worked at first. However, there are various areas that could be improved by the people with the influence to change things for the benefit of everyone on campus. It is my hope that university administration gives more consideration to student well-being in the upcoming semester.

POSIWID Analysis

THE POSIWID ANALYSIS sheds light on the shortcomings of the system and informs the recommendations. In the areas of COVID-19 spread, Cornell's testing was adequate at identifying positive cases among the campus community. However, mental health and

student burnout was not as highly prioritized and this reality should not be the case. Academic requirements should have been lessened to accommodate students during a time of such huge uncertainty. Despite the need for this, Cornell's attention went to safety as it relates to the spread of COVID-19. It makes sense, but more could have been done.

CAS Analysis

DIFFERENT CONTINGENCIES on campus experienced different struggles as a result of their place within the university system. The system level behaviors show us that there is definitely room for improvement through the recommendations. An effort to alleviate some of the existing stresses should be a priority because of the state of the university currently. Students should feel positive about their educational experience and right now I would argue that is not happening because of issues present among agents.

Rubric and Recommendations

THE RECOMMENDATIONS REFLECT a need to address these concerns throughout the entirety of higher education. These spaces are meant to cultivate learning, growth, and success. However, I would argue that they are a breeding ground for mental turmoil and physical exhaustion. Academia must consider the implications of its prioritization on subjective measures of knowledge. The rubric can be used to inform future recommendations because we learned about the shortcomings of academia during this pandemic. It will require more research and more cooperation to reach a sense of stability and calm that I proposed in my recommendations. The recommendations are agent-based because they involve the multiple stakeholders involved in carrying out the university's mission, especially faculty. The faculty, staff, and graduate students are the lifeline of the university. However, without undergraduate students, the university funds would diminish significantly. These recommendations would change the behavior of the system because I personally believe that mental wellness would create more productivity. It would especially create a space where positive productivity could flourish.

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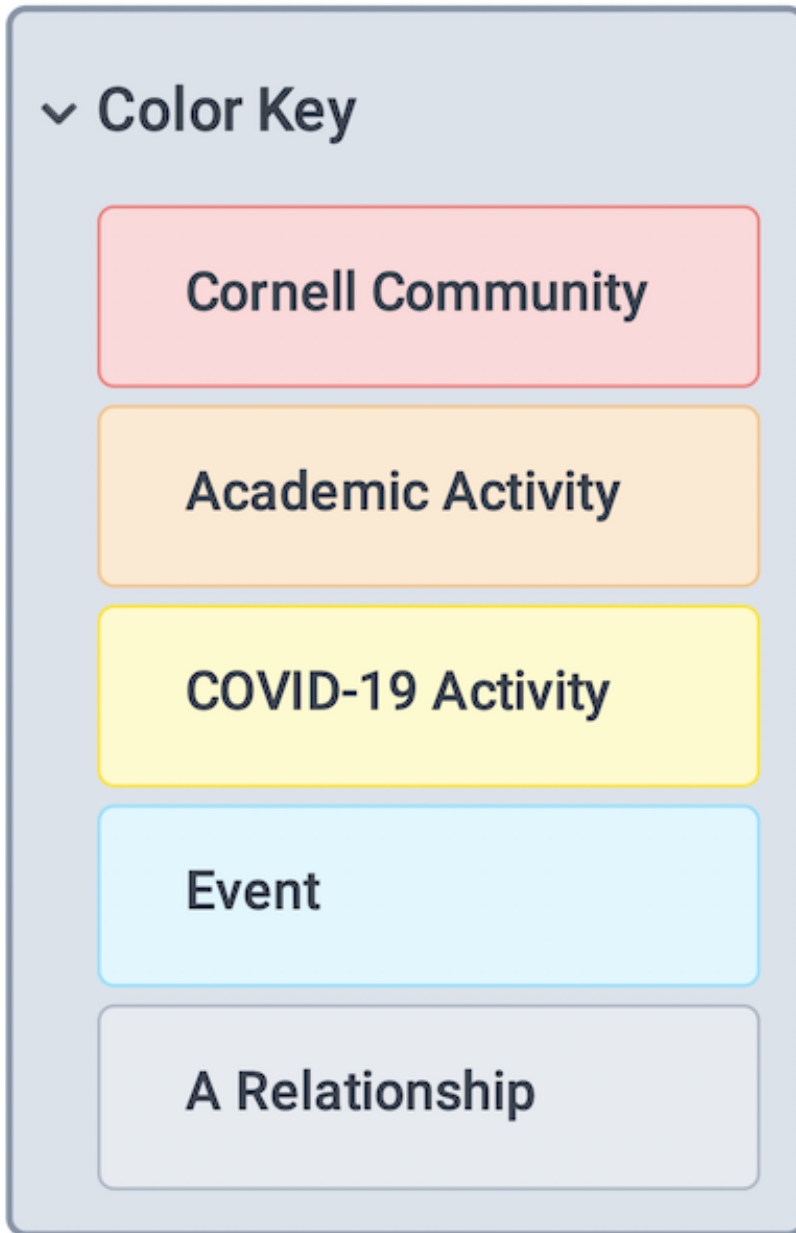


Figure 6: Color Key