Law as Information Processes

by

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Abstract

This thesis describes a new theoretical framework for characterizing legal systems and legal thought. Broadly speaking, legal systems can be characterized as undertaking three functional activities: the intake, processing and distribution of information. The thesis defines and explains what those three activities consist of, their interrelation and describes some of the emergent phenomena which arise as a result of their co-existence. Additionally, examples are provided which show elements of legal systems having behavior neatly predicted by information-first methods of analysis. The aim is to develop information-related tools to understand the function of legal systems and subsystems in society by reference to those three activities, and a robust set of fields and concepts are presented for future development.
# Table of Contents

## Contents

Table of Contents .......................................................................................................................... iii

1 Chapter 1: Introduction ........................................................................................................... 1

2 Chapter 2: Definitions ............................................................................................................ 2
   2.1 Notes on Definition Strategy ............................................................................................ 2
   2.2 Definitions Used ............................................................................................................... 3

3 Chapter 3: Law, an Information Process .............................................................................. 5
   3.1 Intake ............................................................................................................................... 6
   3.2 Processing ........................................................................................................................ 10
      3.2.1 Organizational Design's Under-Utilization in Law ..................................................... 13
      3.2.2 Organizational Design Strategies as Represented in Legal Theory ......................... 16
      3.2.3 Legal Automation .................................................................................................... 20
   3.3 Output .............................................................................................................................. 23
      3.3.1 Communication and Control: Two Legal Theories Examined ................................. 24
      3.3.2 Output Networks ..................................................................................................... 27

4 Chapter 4: The Case for a Technical Theory of Law ............................................................ 30
   4.1 Background of the Problem ............................................................................................ 30
   4.2 Theory and Function ....................................................................................................... 30
   4.3 Interdisciplinary Research ............................................................................................... 35

5 Chapter 5: Tools and Areas of Further Study ...................................................................... 39
   5.1 Network Analysis ............................................................................................................ 39
   5.2 Distributed Processing Systems ..................................................................................... 40
   5.3 Agent Based Modeling .................................................................................................... 41
5.4 Cognitive Studies ........................................................................................................... 44
5.5 Capacity ......................................................................................................................... 45
5.6 Complexity Theory ........................................................................................................ 47
5.7 Complex Adaptive Systems .......................................................................................... 48
  5.7.1 Recursion .................................................................................................................. 49
  5.7.2 Auto-regulation of Law ............................................................................................ 50
6 Conclusion ....................................................................................................................... 50
1 Chapter 1: Introduction

The dominant thoughts within legal theory change infrequently. The frameworks, tools and concepts that we as jurists use to tackle legal questions develop slowly, over time. In the past, many shifts in legal theory have been precipitated as the result of a crisis or as the result of sweeping changes in society\(^1\). Recent research in a number of information-related fields has outpaced legal theory, leaving behind a vast treasure trove of insights untouched by the legal profession. Jurists have not acclimated to the ideas and best practices of these disciplines and industries find themselves uncomfortable in the law, but often without understanding why.

This thesis primarily aims to help resolve this issue by changing how people view the law by introducing a new framework to explain how legal systems and the actors within them function in terms of information. In particular, this thesis advances the idea that Law is an organ of society tasked with managing many types of information. The hope is that this framework will help jurists incorporate a new body of knowledge into the law, thereby guiding future legislators, reformers, academics and practitioners.

The thesis's secondary purpose is to promote the importation of analytical tools from schools of thought traditionally viewed as dissimilar to law. This is done not only in the effort of broadening the mindset of the jurist, but also to invite others of different disciplines to come engage in productive collaboration.

\(^1\) One example is the impact of the Papal Revolutions, where a half century set of insurrections and civil war occurred in the hopes of freeing the church from secular authority. Berman argues that the revolution, which resulted in the birth of modern scholasticism, caused the birth of the western legal tradition, as it was the impetus towards the codification and spread of canon law throughout Europe.

The thesis’s tertiary purpose is to target a wider audience than that which is aimed for in most literature by creating imagery and concepts that are portable between disciplines. In particular, the study aims to introduce its central premise to the public, to legislators, to adjudicators, and to practitioners in addition to scholars.

The framework that this thesis intends on promoting is this: everything Law does can be summarized as a combination of three activities. Law takes in information, processes it, and, finally, distributes it. While deceptively simple, the ramifications of this framework are significant. We will begin by defining terms and distinguishing between ‘law’ and ‘Law’. Then, we will move to examining the three activities that Law performs, and, to conclude, we will examine some of the emergent properties of the theoretical system.

2 Chapter 2: Definitions

2.1 Notes on Definition Strategy

Definitions have been selected to simplify discussion and provide common concepts for future discussion. These definitions are not required to give force to the framework, though, as the four most important defined terms (Data, Information, System and Law) can be tampered with substantially with no meaningful effect on the theory's applicability. The supporting definitions, such as Institution, are framed in a narrower manner so as to provide very specific points of reference to anchor the more nebulous concepts that form the core of the thesis. Hopefully, the result is a piece accessible to the casual reader while still possessing enough rigor to grab the attention of a legal philosopher.

Some of the definitions will be pulled from the fields that inspired their inclusion, and some discussion regarding the effectiveness of these terms as they are applied to Law will be
inevitable. Linking definitions back to their sources promotes interdisciplinarity and acquaints jurists - academic or otherwise - with new concepts.

2.2 Definitions Used

**Data** is the combination of a value and variable type. These variables can be qualitative or quantitative. Some values or variable types are implied by context: for example, if someone referred to another person as 'blue', he would generally be understood to be using the value 'blue' to describe the variable of 'emotional state' rather than that of 'colour'. To understand why the combination of value and variable type is important, consider the value '2'. '2' could refer to the Western Arabic glyph as a visual symbol, to the number of arms on a typical human body, or to the amount of milk in a standard carton in Liters. Without the variable type, the value is meaningless.

**Information** is useful data: timely, concise, and relevant. Knowing that a piano is falling towards one's head is important information, while knowing that a piano was dropped into a trash compactor on the other side of the world is probably not. Tushman and Nadler also require data to be accurate in order to qualify as information\(^2\). I have rejected this criterion because in common usage, information can be incorrect. Keeping the requirement also muddies the distinction between data processing and information processing. In our framework, data becomes information when a system perceives it as useful.

Institutions will be defined as stable, organized, and discrete social structures. This definition is informed by the Stanford Encyclopedia of Philosophy's typical definition of social institutions:

"A typical definition is that proffered by Jonathan Turner (Turner 1997: 6): “a complex of positions, roles, norms and values lodged in particular types of social structures and organising relatively stable patterns of human activity with respect to fundamental problems in producing life sustaining resources, in reproducing individuals, and in sustaining viable societal structures within a given environment.” Again, Anthony Giddens says (Giddens 1984: 24): “Institutions by definition are the more enduring features of social life.”

Law, intentionally capitalized, refers to a broad and inclusive characterization of legal systems, including the institutions and actors who operate as a part of them. This definition is expansive both because our framework explains activities not traditionally associated with legal systems, and because emergent behavior is better examined from an inclusive perspective. Law will be referred to as "Law" when being treated as this overarching system, whereas "law" will refer to laws or a more restrictively defined system.

Systems will be defined in the manner prescribed by Mario Bunge: "The composition of a system is the set of its components; the environment, the set of items with which it is connected; and the structure, the relations among its components as well as among these and the environment." Subsystems represent systems that exist within another system of reference, carrying the same requirements of interrelated of elements and structure. The respiratory system

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Bunge characterizes a number of related concepts, levels., environment, and system type that may be useful as tools or concepts in future examinations of the Law.
is a subsystem of the human body, for instance, much the same way courts are subsystems of Law. Supersystems represent systems that engulf and contain another system of reference. The biosphere is a supersystem containing human bodies in the same way that tort law is a supersystem containing negligence. Institutions are particular social systems, but social systems are not necessarily institutions.

3 Chapter 3: Law, an Information Process.

This chapter will present the theory of Law that is at the heart of this work. Because it consists of three parts, the elements of each will be presented each in turn. This chapter will not exhaustively describe the theory, as such an effort would require a text many times the size of this one, but rather will provide enough illumination to entice an agile mind to explore the theory further.

The theory is that Law performs only three activities: Law takes in information, processes it, and distributes it. Every activity that lies within the legal sphere exists as a combination of one or more of these three categories.

Since the theory is so simple, it might appear to lack substance, but even simple starting points can come together to create marvelous complexity. To illustrate this concept, Conway's Game of Life\textsuperscript{5} is instructive. The game consists of a rectangular grid with live or dead squares, progressing in a turn-wise fashion, although variations exist on different types of grids. The system is governed by three rules: 1) a dead cell becomes alive if it has three adjacent neighbors, 2) a live cell will stay alive if it has 2 or 3 live neighbors and 3) otherwise, it will die. The game has been

shown to be capable of simulating computers, creating self-replicating or growing patterns, and has been the father of thousands of different variations. *Life* demonstrates that simple rules can create complex, interesting and compelling emergent states or behavior, and the same can be said for this theory.

As an example of the emergent properties demonstrable of Law, consider that the cycle of intake, processing and distribution does not take place within a closed system. Distribution puts information into the environment where Law operates after some period of delay, which in turn changes the information that Law takes in. Law is therefore both iterative and dialogic by virtue of its form, and we can come to this conclusion nearly immediately from first principles.

Before demonstrating other emergent properties of the theory, it would be prudent to explain the three activities further. Each activity will be explained in isolation and then with reference to its interaction with the other parts.

### 3.1 Intake

The intake of new information is critical in allowing Law to perform its functions, whatever those may be. Without new information, Law would be a static discipline, focused on old questions framed with old contexts. Thankfully for new generations of jurists, the law regenerates itself constantly and information intake is an important part of that renewal. Information intake is required for even simple legal activities. Adjudication based on facts, for instance, requires Law to know those facts.

Information intake is a relational event. A scientist observing nature, a listener bending his ear to a speaker, or a reader perched over a book all pull in information from a source. As such,
attempting to map the paths through which information is imported into Law is essentially attempting to describe a group of relationships.

Information intake occurs when information is transferred to an element of Law. An element can be an individual, a database, an institution, or any number of repositories of knowledge. Elements obtain information either by active or by passive means. Active communication requires energy and is directed, whereas passive communication occurs without additional cost. Verbal communication directed towards an individual to transmit information, for instance, is a means of active communication between the speaker and his target. In our case, active communication will be communication undertaken for purposes associated with Law. This same act of speaking, however, can passively communicate data to individuals who happen to hear the statement at no cost. In terms of transferring information rather than data there is always a cost associated at the point of receipt in order to interpret and sort data. Intake type refers to whether or not information uptake is active or passive. Take the example of an individual who was, at once, an attorney and an avid snowboarder. His knowledge of snowboarding was not acquired for the purposes of dealing with a specific legal issue, but it may become valuable in assessing negligence related to skiing. Passive information uptake is difficult to model in reductionist systems, as noted previously, and is therefore often discounted as a significant source of knowledge in Law.

Intake of information is not the same as intake of data. Data transfer precedes information transfer, but information transfer represents a goal rather than a mechanism. Determining whether or not a unit of data is information requires using resources to interpret and evaluate the data. Since data has to be screened for utility each time it is transferred throughout a network, the determination of whether or not a piece of data is useful is performed multiple times as different
network elements apply their own criteria for determining utility. As an example, consider the following situation: A situation occurs which prompts a plaintiff to engage a practitioner to represent him. The practitioner pleads the case in front of a judge, who then issues a ruling, which is then placed into an online database. Another practitioner looking to advise a client on a separate matter then accesses the database. Each of these interactions represents a relationship in which data and information have been transferred. Each of these steps involves a relationship of a different type and multiple mediums of communication are involved throughout. This is key, as it demonstrates that information often does not transmit itself across a network of legal elements. Because data transmission involves reprocessing, information intake varies at every step. In other words information is transformed between each step, almost akin to a game of broken telephone. The difficulty in tracking units of information as they flow through a network that changes them at each step might account for the propensity to theorize information networks as being more homogeneous than they are.

Many accounts of Law are reductive, and accordingly oversimplify the process of information uptake. Some adopt a purely institutional view, mapping information flows between the courts, legislatures, the public, academics and practitioners. Others examine the information flows between nations and international institutions. Still others examine how information flows around communities and how that process affects their decision makers. The choice between these and other methods are important as they operate out of simplifying fictions that materially affect the outcomes and conclusions of the research in question. The use of these fictions turns the analysis of Law into the analysis of a subsystem of Law. Conceptually, we can do away with these simplifications in order to develop a more accurate, less encumbered theory.
The intake of information in Law is distributed, rather than centralized, at the macro level. Reductive accounts of Law have difficulty explaining the robust, multivalent channels through which information uptake occurs. In particular, the roles of informal and non-institutional methods of information transfer that aliment Law are underrepresented. This is to be expected, as reductive accounts of Law consolidate system elements for the purposes of simplicity and ease of analysis. Consolidation obscures how varied and distributed system elements are. This weakness extends to processing and output as well, where distribution of elements is key factor in explaining the behavior of Law. That is not to say that every activity will be distributed in every systemic frame - if we examined a Supreme Court reporter, for instance, we would find that it receives its information from a specific source, distributes it from a specific source to the wider public, and then processes information internally. In short, all three elements would be centralized, rather than distributed. The picture looks different when Law as a whole is examined as a system: individual individuals and the subsystems that they are a part of fall away into a soup of network nodes sharing information with each other.

Distributed intake is important because it creates a need for some form of modularity between system elements. To reprise a theme, if different reporters required wildly different methods of access and reported in highly dissimilar ways, the cost of information uptake from reporters would increase. Similarly, if different judges presented their ruling in different formats, consolidating case law would be more difficult, and some level of data processing would be expected to create a more unified body of data.
The statement that Law must import information also implies that Law is not by itself a complete body of knowledge. Law must "scavenge" in the words of Dow\(^6\), which indicates that Law must internalize knowledge. It makes intuitive sense that Law would be structured with recourse to external standards, contextualizing theories and factual information. If these factors are to be taken seriously, then the inability of law to create purely procedural systems of rules should not be viewed as a failing of code-writers and theorists, but rather as a fundamental limitation of Law. While humbling, the admission is also liberating. If Law cannot internally produce all that it needs to know in order to function, it can offload much of that burden elsewhere instead of attempting to recreate knowledge that exists elsewhere. Forensic psychologists, expert witnesses of other sorts, amicus briefs and law commission reports all represent different crystallized avenues Law uses to import information from the external world.

In short, information intake is a complex matter. Not only is it distributed across the legal system, but it also takes different forms, occurs at different speeds, and requires an element processing to sort information from data. Because of their coexistence, understanding the process of intake is dependent on understanding the nature of processing.

### 3.2 Processing

Processing is the heart of legal activity. The judicial process, alternative dispute tribunals, legislatures, and practitioners are all easily recognizable as information processing elements within the Law. Some of these elements operate primarily as processors: courts operate as a

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decision-making center, with rules for information intake and distribution. Others are not primarily locations for decision-making, but constitute avenues for information intake and distribution, where processing is tasked towards distribution. In fact, in certain cases, the role of information processing is primarily to determine how and why particular types of information should be imported into, shared within and then distributed to the exterior of Law.

One of the first questions that rises immediately from the concept of processing as a function is to determine why processing is taking place. The function of a particular processing element might be multivalent; that is to say, it may have multiple functions, the primary function being determined depending on the level of abstraction which is used in the determination. To demonstrate this, imagine a person cooking dinner on a hot stove. His decision not to touch the hot stove directly while cooking might be motivated by his desire not to burn his hand. At the same time, on the level of community, the decision not to touch the stove might be just one of a larger group of health related caution processes affecting public health objectives. Time also plays a factor in determining function: a child processing the same information regarding how hot the stove is more likely to refrain from experimentation on the basis of keeping his parents happy rather than providing for his children, even when both processes are viewed as internal to the family subsystem. Even the exact same pertinent information can be processed for vastly different functional ends.

Because it lies at the center of legal activity, many current topics falling under the umbrella of legal reform can be viewed as attempts to optimize or increase processing capability. Processing

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7 Examples for intake include procedural rules for the submission of evidence, production of witnesses, and submission of memoranda, while rules regarding notice to parties, reporting and publication all regiment distribution of information.
here is not merely the mechanical mathematical crunching of equations, but rather a mix between left- and right-brained questions, problems, and solutions. Some commentators have put forward that mechanical and intuitive decision-making must both be present in certain areas of the legal system, lest they fall prone to biases inherent to their respective methodologies. Certainly, the domination of one method of calculation over the other comes with risks and potential downfalls, but in selected subsystems of law, it might be that the domination of one methodology over the other is desirable. What's more, attempts to improve decision-making, which accounts for one type of information processing, would do well to target specific bottlenecks on processing.

Determining what constitutes a bottleneck, however, requires a determination of what a specific processor should be doing in order to establish benchmarks. This determination requires an analysis of the function of the process, which, as noted above, may involve identification of multiple - and potentially competing - functions acting concurrently. Further, a description of function will not necessarily flow from an analysis of the types of information being processed: case law could be analyzed to determine differences in judicial writing styles just as easily as it could be read to provide fresh ideas for a writer's novel. A process's function is also a factor of the level of abstraction that is being examined, meaning a particular process's function might be optimized differently depending on the systemic frame of reference. In many cases, the determination of function, and the triage between various functions that follows, will be divisive and non-trivial.

Analyzing processing as a process is admittedly complex, but hope exists in the form of tools imported from abroad. Entire fields of sophisticated knowledge have been created for critiquing

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and designing human social systems with respect to their ability to process information. Here we turn to an established but unfamiliar field to jurists in the hope of finding tools to make headway.

3.2.1 Organizational Design's Under-Utilization in Law

Organizational design as a field of study has examined information processing while examining how best to create systems to achieve a goal. One prediction from early organizational design literature was that organizational structures would be limited by the information processing capacity of individual humans. Empirical research on the matter seems to have vindicated the view, and further examination has led to the notion that uncertainties, specifically, represent one of the largest processing burdens to an organization.

Law is no stranger to the idea that certainty must be balanced with flexibility, but this dichotomy is artificial and creates the notion that flexibility and certainty are balanced in a zero-sum game. This leads jurists to view the balance of certainty and flexibility as a matter of opinion or a matter of picking proportions of each that will maximize a measure of interest. When viewed from a systemic design perspective, however, these efforts seem misplaced. As stated by LL Fuller:

"A pervasive problem of social design is therefore that of maintaining a balance between supporting structure and adaptive fluidity. This problem is shared by morals, law, economics, aesthetics, and - as Michael Polanyi has shown - also by science. The nature of this problem is not adequately perceived when we think of it in trite terms as an opposition between security and...

10 Supra 2 at p. 613.
freedom, ... but with attaining a harmony and balance among the processes - often anonymous - of society as a whole.”

The idea of understanding and unmasking social processes is at the core of this theory, and the common coin we have adopted is information, largely due to the paucity of comprehension of information systems in Law. The generation of a robust understanding of the different elements of Law is a precursor to taking strides towards creating the harmony and balance that Fuller describes. This holistic view of society is not a strict methodological requirement but rather a backdrop and reminder that subsystems exist within a higher system, and that optimization of a subsystem at the cost of the function of the supersystem may prove detrimental. A cardiologist who lacerates a patient's lungs to get to his heart may have optimally remedied the patient's circulation issues, but he has likely killed his patient in the process.

A number of different design strategies attempting to deal with organizational information processing have been developed. Galbraith classifies these strategies into two main groups: reducing the need for information processing, and increasing the capacity for information processing. Both of these strategies could equally be applied to redesigning legal systems.

Organizational design forces law to ask not simply what Law 'is' but rather: what are Law's functions and objectives? This question can be subdivided as subsystems of Laws are examined, or it can be constructed in the opposite direction – from the individual's goals upwards. From a systemic perspective, this is the equivalent of choosing meaning at the highest supersystem level then orienting subsystems towards those goals, or allowing the smallest relevant subsystems to

amalgamate their respective goals and to design the overarching supersystems to aid in achieving those. Hobbes' construction of the Leviathan, often viewed as one of the beginnings of modern political science as well as one of the first creations of social contract theory, can be viewed as the generation of government from the procedural amalgamation of an individual's goal to avert death by remaining in society and out of the dangerous pre-social state of nature. Equally plausible is the notion that Hobbes' mid-war work was a top-down attempt to assert that the goal of Law was the maintenance of a centralized government that would bring peace. Goal-based analysis allows researchers multiple avenues of study, while also granting them the flexibility to repurpose areas of Law to better fit the needs of the larger systems they are a part of. These dual methods can be used to complement each other and derive systems wherein incentives and motivations are harmonized. Ultimately, this analysis pushes up against questions regarding what society and humankind's goals are, and by extension what Law should be doing to help achieve those goals.

Importing Organizational Design, as well as a holistic method of systemic thinking runs afoul of the philosophies espoused by influential philosophers. The main critique of fielding a goal-based theory of Law has come from skeptics like Hayek who have claimed that cobbling together a social 'machine' of Law was an impossible task given how unknowable the sum of interests in a society was. If goals are generated at the individual level, and it’s impossible to aggregate those pieces of information, it becomes similarly impossible to derive a social goal from the ground up, thereby forcing it to be imposed from the top down. That simple lack of capability turns the idea of a unifying social goal into a directive issued from on high, which would put significant

\[ \text{13 Captured in his work: Thomas Hobbes.} \ Leveathan: \text{ Or the matter, forme and power of a commonwealth ecclesiasticall and civil.} \text{ Yale University Press, (1960).} \]
limits on social freedom. Accordingly, Hayek preferred to rely on the wisdom of the market in order to provide a system for adjudicating between these interests, instead of relying on a fictional 'social' aspect. Since the market can aggregate social intentions and goals, he reasoned that market forces would be preferable to elitist control. These arguments are no strangers to jurists, as many of them have been launched between the civilian and common law traditions for centuries. Hayek's strategy of relying on purely distributed processing represents a fusion of the two Galbraith strategies. Distributed processing reduces the information-processing requirement per unit involved, while also increases the overall processing capacity of the system. Despite that, it runs afoul of other issues raised by organizational design. In particular, distributed processing increases the net uncertainty and cost of the system, especially in a system where the quality of individual processes is not monitored and the cost of transactions is non-negligible.

This uncertainty causes a need to validate the quality of processor elements within the legal community. This abstract notion is demonstrated concretely in law school grading, bar admission requirements, and experience requirements to be called to the bench, to name a few examples. These mechanisms represent methods of lowering uncertainty with respect to distributed processing. In an interesting twist, legal theories themselves represent harmonizing tools for creating uniform knowledge to reduce uncertainty in characterization between processor elements.

### 3.2.2 Organizational Design Strategies as Represented in Legal Theory

As another interesting aside, note that this age-old feud between centralized design and distributed autonomy is actually very well explored in Law, just not under the technical terms we

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have imported. The debate between common and civil lawyers about the superiority of one
tradition over the other, for instance, is a near-perfect analogue to the debate between different
systems of processing.

On one side, common law's judge-made law provides a sort of distributed processing for judicial
decisions, while civil law's code is an intricately-designed central set of decisions aimed at
reduce processing requirements on the judicial system. In short: it is not a mistake that French
and German decisions are so short compared to British, Canadian, and American ones.

Calabresi's critique of the proliferation of statutes in the American common law tradition comes
to life in simple terms in this framework. The critique states that American law is ossifying under
the intense weight of new legislation being pushed forward, and the growing tail of active
statutes in the past is choking out judicial freedom with antiquated directives. It essentially
argues that a system designed to accommodate distributed processing is now playing against its
strengths by centralizing decision making in a legislative body that does not have the capacity to
produce, amend and update laws in the same manner that the distributed system did15.

The turbulent 1880-1920 period in France was another example of legal theory undergoing
transformation according to Organizational Design principles. In the face of mounting pressure
to reform and modernize laws, the legislature of France was finding that its centralized system
was not adequate in responding to increasingly rapid social change. Because of the antiquity of
unreformed law, many issues were resolved in an unsatisfactory manner by the strict application
of codal provisions designed to deal with completely unrelated problems. The eventual solution
was to adopt the doctrine of abuse of rights, which allowed judges to make a determination of

whether or not the rights were being exercised in a malicious or antisocial manner. In short, a central legislative decision-making processor offloaded processing duties to a distributed judiciary in reaction to a lack of processing capacity.

Because focusing on processing allows us to view Law as functional in nature, one of the central focuses of study will be whether or not Law is satisfying its processing requirements. Accordingly, it implies that where Law is deficient in its tools, we should import terminology relating to processing and information flow. In so doing we open up both novel research questions and new perspectives on Law. What is Law’s bandwidth currently, and is it possible to determine a theoretical minimum, optimum and maximum level? Are our choices of processors for specific tasks optimal, or could we redesign the methods and structures of Law that owe their existence to a lucky historical accident rather than an evidence based design? Is a judge, for instance, the best suited to deal with a highly complex IP case, or would a panel made up of judges, experts and laypeople conferring together produce better results?

Current adjudication models rely heavily on the idea that judges will approximate some version of Dworkin’s Judge Hercules, and to the extent that they will not, additional appellate levels will catch errors. Even in a jury trial, a judge occupies a central position in administering proceedings and still makes many substantive decisions. Accordingly, information processing in trials is largely centralized, and justified on the notion that the centralization will allow a highly-

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skilled adjudicator to exert greater influence over proceedings which would then reduce uncertainty society regarding the quality of the information processing taking place. This design choice makes sense if we assume that judges are superior decision-makers, that is to say, if they approximate Hercules, the paragon of decision-making. Hercules is a judge with unlimited access to information and infinite time to process his result and an incredibly capacity for processing. These impressive qualities do not ensure Dworkin’s claims that Hercules would discover a 'correct' answer, even if one should exist. As discussed earlier, there is an upper limit to the cognitive, intake and processing capacities of an individual, preventing Hercules from procedurally producing perfect results in every instance. Furthermore there is a limit to the storage and processing capacities of such a judge. Dworkin affords Hercules a full and robust knowledge of legal sources, but not omniscience. Even if Hercules was omniscient, not every problem has a solution. The lack of completion in contextual knowledge gives even a procedurally perfect Hercules a source of error to contend with. Since Hercules suffers from defects in his information processing and intake functions, it would do well to for scholars and jurists to disabuse themselves of the notion of judicial perfection and explore another aspect of information processing: error handling. Justice and the search for a judicially 'right' answer are framed in terms of how well a given judge comes to a decision, and human frailty and limitation create uncertainty regarding the quality of that decision.

That mindset is not neutral; framing Justice and coming to the 'right' answer could equally be conceived of as a measure of how well the judicial system handles its error cases. How does Law deal with poorly drafted statutes or laws that are contrary to the public interest? How does Law deal with incorrect decisions, and how can it lessen the impact of incorrectness? What is the cost of those cautions? One example illustrating the historical responses to these questions is the
western tradition of multiple levels of adjudication. Appellate systems provide multiple levels of error handling for incorrect judgments; the Law proofreads its products\textsuperscript{18}. Judicial reticence represents the self-inflicted censorship as an attempt to mitigate the impact of errors.

Uncertainty, again, is one of the main culprits in the creation of a need for information processing, which itself creates costs. In this instance, a multi-level appellate court system is one of the burdens we shoulder in order to reduce uncertainty.

To conclude, understanding the benefits and costs of different design strategies not only explains why certain legal institutions and qualities exist, but also provides suggestions on how to improve these systems moving forward. Comparing the costs of uncertainty with the costs needed to counteract that uncertainty in various designed institutions could be one way to produce model systems. Addressing capacity and processing bottlenecks is another.

3.2.3 Legal Automation

One topic that received a lot of attention in the area of legal information processing in decades past was the attempt to automate or computerize legal decision-making. These attempts have failed, in large part because much of legal decision making is performed in a highly distributed manner\textsuperscript{19}. Attempts to create a software simulacrum of the judge do not capture the reality that he is just one of many points of information analysis along the life cycle of a case, nor do they capture the role of passive information uptake at each step of the processing chain. An

\textsuperscript{18} The analogy between genetic and legal proofreading systems and strategies for maintenance for fidelity might prove to be an interesting study. Most simple organisms rely on a certain level of unhandled copying errors in order for population-level groups to maintain have genetic plasticity in the face of threats, and legal systems might operate in similar ways. The American

\textsuperscript{19} Recent discussion regarding the difficulties in the field have identified issues with respect to sorting data and the yet unmet requirement for natural language tools for conceptual analysis. See:

information process analysis does not advocate for the resumption of automated systems of adjudication, but merely represents a call to refresh, renew, and rejuvenate the information systems contained within Law. Automation efforts have not been entirely unsuccessful, though: effort involving automating the retrieval of case records, summaries and holdings have been successful, as have pieces of software to handle invoices, client billing, and other routine tasks. In certain instances, completely novel capabilities have sprung from new technology, including near-instant access to audio or video recordings of pleadings in certain courts. These represent automation of legal information processing, but not a replacement of judicial decision-making.

Even if a software program has perfected its mechanisms to search case law for relevant tests and quotes, and cases, it would have trouble gathering the contextual information required to understand the impact of a particular ruling, or perhaps even critical elements of the factual circumstances of the case themselves. In short, automation faces a twofold problem in that both information processing and information intake are difficult activities to model. Where these activities do simplify easily, and where contextual information intake was is not required, we would expect and encourage automation. Software used to calculate payments in family and tax law are good examples of automation being used to reduce processing burdens on decision-makers in Law.

While advances in technology have prompted this paper's push towards rethinking Law's relationship with information, it is not always the case that new technology will provide a panacea to communication and processing ills, nor will steps towards optimization of these

20 The move from simple retrieval to relevance based search has been proceeding in many areas of Law. One such example:

systems always come naturally. Huber writes "One... mistaken impression is that advanced information technologies are universally inferior to superior to traditional technologies. ... Particular uses of advanced technologies may have undesirable side effects". The existence of potential undesirable effects creates a burden of uncertainty for firms and actors in Law contemplating the adoption of these new technologies. Additionally, organizational character may influence rates of adoption. Huber notes that "highly politicized or power-driven organizations" may be slower to uptake economically rational technologies for internal reasons, but that in fields that are reasonably competitive, outside pressure will force adoption in order to maintain equivalent organizational fitness over the long haul. One alternative explanation for slow uptake of technology and processing-aids in Law is that many firms, institutions and individuals find themselves in Nash equilibrium with each other, and therefore gain nothing by being the first mover. Similarly, elements within Law that are shielded from competition, similarly, do not face outside pressure, and can accordingly delay implementation of information processing aids. Finally, in legal entities that are aggressively competitive, such as sole practitioners, small boutiques, and recently appointed academic staff we would expect to see the rapid implementation of processing aids in order. Indeed, virtualization of legal practice - a process whereby overhead costs are decreased through the use of information technology - has been growing amongst small and midsize firms. Regardless, it seems clear that adoption of technological aids to information processing will continue at variable rates for different actors in Law.

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21 George P Huber. A theory of the effects of advanced information technologies on organizational design, intelligence, and decision making. Academy of management review 15.1 (1990), 47-71. at p. 50.

22 Supra 21 at p. 51.
3.3 Output.

The last of Law's three activities is information output. Information output refers to Law's ability to transmit, distribute and channel information. These information channels might feedback into legal elements or can transmit information outside to the environment depending on their purpose. Output is the way Law's processing is put into the world. From the release of decisions to the interment of criminals to the publishing of works of research, Law's output changes its environment and informs the public as well as its own community. Isolating output allows us to bring the tools of the communications fields into law. Classifying one of Law's core elements as communicatory in nature reinforces the need for relational methodologies. If Law is fundamentally a field generated by interactions, it explains why Law so often chooses to import sociological information and underscores the need for rigorous interactional theories to play a role in analyzing Law.

Output refers to more than just the production of traditional reporters and broadcasters. Instead, output refers to any individual or institution that shares information of a legal variety. Television shows, elementary school teachers and parents all share in distributing information about Law. This encompassing view of information distribution allows Law as Information Processing to harmonize and derive interesting conclusions from previously unrelated legal theory. One reason why distribution of legal information is considered to be within Law is that it puts within the purview of Law the responsibility or desire to being contemplating how to develop a legal information distribution strategy. If you doubt the impact of distribution of information on the impact of law, consider this: the fabled Twelve Tables of Roman Law are remarkable because of how successfully they distributed legal standards, not because of any specific brilliance associated with the laws themselves.
3.3.1 Communication and Control: Two Legal Theories Examined.

In order to demonstrate how interpreting Law as an Information Process interacts with methods of distributing information, two legal theories will be examined. These theories are not alone in their susceptibility to Information based analysis, but they will suffice to demonstrate some of the more shocking aspects of the framework.

First, take Korsgaard and O'Neill's theory of normativity, where normative standards are normative insofar as "they make[...] claims on us; they command oblige, recommend or guide. Or at least, when we invoke them, we make claims on one another"23. This statement is somewhat analogous to Kant's *Critique of Judgment*. At the risk of oversimplifying the matter, Korsgaard, O'Neill and Kant's normativity is exigent in nature: it makes demands, but how? What exactly is causes that demanding force to be propagated and given strength?

Our framework suggests the spreading of normative concepts occurs through the action of information networks, each element of which exercises some combination of intake, processing and output. Distribution, however, is the most readily controllable aspect. Korsgaard and O'Neill's 'claims on one another' are relational, but do not represent actual claims. Instead, they refer to the effect of shared understandings. Shared understandings do not require equivalent information to be taken up, but they require that individuals come to similar conclusions after information is processed. In cases where two individuals process information in similar ways, similar information is likely to produce similar results. Where disagreement occurs, the lack of synchronicity between the understandings is dependent on different information processing outcomes. In short, the claims we lay upon each other through the process of normativity are not

actually laid upon one another, but rather constitute restrictions on self that grow from within. The broken windows theory\textsuperscript{24} is evidence of this. The broken windows theory works as follows: the state of a particular neighborhood provides information about itself regarding enforcement of laws and the general rules of propriety. In an area which has allowed windows to remain broken, data regarding whether or not the windows are monitored or important is readily available. In this way, an individual's relationship with the environment provides instructions regarding how acceptable breaking additional windows is, but the result of the individual's processing efforts ultimately determine whether or not he will cause the next window to shatter.

Since normative force is self-generated, it stands to reason that information processing must be standardized across society to a certain degree in order to create normative force. If we add the reasonable assumption that normative force can give rise to physical force, we can state that information networks can exert temporal power. Furthermore, we can see that controlling information leads to a control of normative temporal force. Since much of Law's force upon society depends on the normative effects of laws, rulings and regulation, understanding relevant information networks and processes should be a central goal of legal policy and reform research.

Next we turn to Max Weber's famous definition: "An order will be called ... law if it is externally guaranteed by the probability that physical or psychological coercion will be applied by a staff of people in order to bring about compliance or avenge violation"\textsuperscript{25}, which places coercion as the central requirement for law. Weber and Korsgaard both speak of an external force reaching into the sphere of an individual to exert control, but as noted above our framework argues that it is

\textsuperscript{24}James Q. Wilson, and George L. Kelling. \textit{Broken windows.} Atlantic monthly249.3 (1982), 29-38.

information related activities that generate control. In Weber's case, the coercion of law either psychological or physical, is primarily transmitted through information as well. Physical coercion against the person in western countries is primarily motivated by the information it transmits to the person and to society as a whole regarding conduct. Even where mental incapacity removes the ability of the coerced to process - and accordingly react to - coercion related information, the punitive measures provide information to society regarding safety. If it is true that the legal system acts attempts to deter through the distribution of information, then it follows that society's most closely held norms would have priority access to information distribution networks. Evidence towards this hypothesis is offered in the well documented overrepresentation of crime on major broadcast media during prime time.26

Control over information itself, specifically the novelty of information accessible by an individual is possibly the single main punitive tool in Western prisons. Prison inherently removes freedom to experience many novelties which itself causes the drilling boredom of incarceration. Access to the library, televisions and activities, used as carrots to incentivize good behavior merely represent control over information itself. Solitary confinement is yet another step towards information deprivation. In the most extreme cases, targeted sensory deprivation can produce hallucinations within 15 minutes and can significantly damage a prisoner's mental wellbeing27. These novelty-suppression mechanisms aim to deliver information to the incarcerated and to society: physical sequestration a method, not the goal. If Law had tools available which could

Law's traditional distribution channels for information may prove to be overwhelmingly overshadowed in importance by the role of distributed social information channels.

3.3.2 Output Networks

To be clear: If an individual is transmitting, processing or taking up information regarding Law, then they are an element of Law. In this way, the vast majority of lay people will be - albeit often unreliable - elements of legal systems. While at first there might be a kneejerk reaction to exclude such tangential members from the network diagram for a particular legal system, consider that the volume of lay persons associated with the law dwarfs the traditional legal community, and much of a lay person's received information about Law comes from other lay individuals. Understanding that the lay public redistributes incorrect and mythical accounts of law is important to identifying areas of improvement in distribution systems. What's more, these dysfunctional elements of our legal information distribution system can have life or death consequences. Laws against driving while intoxicated, for instance, have been paired in many jurisdictions with public information campaigns running the gamut from police talks at schools, to notices on alcohol bottles and packaging, to television commercials and roadside signs\(^{28}\). Research on the effectiveness of attempts to acquire compliance in the area of decreasing DWI rates have shown that providing information which creates a perception of risk is an effective strategy for increasing compliance\(^{29}\). The law on the books is entirely subservient to the law in the mind, especially where the two are not the same.


Examining output networks forces a few salient questions. It begs the question as to the distinction between input and output networks within the Law. If individuals who receive legal information process it, then they are participating in Law. Additionally, if an individual received legal information, there must have been a corresponding distribution of legal information, so the distinction is irrelevant. This line of thinking is fallacious for a few reasons. The first reason is that legal input networks are not the only information input networks at play in Law. A practitioner's culinary knowledge might be relevant to him in a case of murder by food poisoning, but that does not mean that the practitioner's search for recipes was legal in nature. Second, output networks might distribute, but that does not mean anyone is necessarily intaking the information. In the case of digital databases, a large amount of data is primed for distribution, but only a tiny fraction is being accessed at any moment. Third, output networks represent examinable units with characteristics and capacities distinct from input networks. To return to the example of a digital database, the database can likely serve up information far more quickly than a human can read it. The bottleneck for effective information transfer is reading speed, meaning that to increase the amount of information transferred per unit time in that context, either the capacity of the individual to read and intake the information must be increased, or his burden in processing the information he's intaking must be decreased. Attempts to increase the capacity of the output network, or reduce the processing that it has to perform per pageload would not be effective investments in increasing the bandwidth of the database-human connection. The existence of growing summary databases indicates that legal service providers are attempting to increase the effectiveness of their distribution network by reducing the processing burden for the human element.
Another question it asks is what role Law ought to play in distributing information. Should law restrict itself to focusing on transfers of information within Law, or should academics and practitioners reach out to the public? The evidence regarding drunk driving rates indicates that there is a role for public outreach which has not yet been fully explored. Additionally, if, as Berring states, the form of legal research is prescriptive, then the form and forum of research itself represents a message to the public regarding whether or not they should partake in substantive discussions related to Law.

It should be clear at this point that similar questions and phenomena occur in relation to each of the three activities undertaken by Law. Understanding how systems work is a fundamental requirement to producing an encompassing grasp of Law at the appropriate level of abstraction. While studies of Law can produce fruitful data and suggestions when zoomed in upon a subsystem, oftentimes research and reform efforts fail to see the larger systems in which they are located. This is understandable, the network interactions between the information related elements of law are complex, difficult to characterize, and unfamiliar to most jurists. These oversights are often the cause of unintended negative side effects, significantly increasing the uncertainty associated with policy discussions and impactful rulings. The result, in the end, is increased transaction costs for information related exchanges, as processing begins to rely on modal, rather than binary, logic.

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Chapter 4: The Case for a Technical Theory of Law.

4.1 Background of the Problem

Many have attempted to distill “Law” down into its baser elements, exploring the word and its meaning in an almost alchemical fashion. This paper will take up that tradition once more, but why have we elected to do so, and what purpose does such etymological distillation serve? This section endeavors to both argue for the utility of such intellectual exploration, and to situate that very same utility within a broader pantheon of knowledge.

Some of the functions of our framework are impossible to capture within this introductory piece. We have examined the three different activities in Law, and seen some application of the theory to explain as well as critique the current form of law. These functional demonstrations, however, are only a brief teaser, highlighting sporadic areas of potential utility for the theory.

In this section we aim to propose that examining Law from the perspective of information, costs, bottlenecks and function allows for a more consistent method of approaching policy questions and considerations.

The analysis begins with an overview of conceptualization, specifically, the conceptualization of Law itself. From there it moves forward to examine interdisciplinary legal research.

4.2 Theory and Function

The importance of theory lies in its functionality. The creation of a theory provides tools to engage with abstract concepts and situations. Business experts, for instance, deploy theories
primarily as tools to analyze firms, but recognize that the development of theories is an iterative process. The creation of tools to confirm or deny theoretical hypotheses follows from the creation of a theory. In refining and gathering data about the topic, fields mature, and accordingly their predictions become sharper and their capabilities grow.

This process of development assumes that the initial presented theory has impact, otherwise it would struggle to draw in the resources required to develop. Legal theory is particularly contentious, as the stakes are high; social order, the distribution of goods in society, and the moral imperative of the concept of justice are in play when new perspectives on Law emerge. At the very least, the process of theorizing about Law grants a set of common terminology and assumptions to a discussion in progress. Thankfully, too, as analyzing the amorphous is a task for titans. After a system of axioms has been created, building corollaries and deducing conclusions can proceed comfortably.

This image implies heavily that the starting point for exploration, the island defined by the conceptualization, influences the web of knowledge and findings which grows around it. After all, if the stability of terminology and the existence of shared axioms reduce the cost of information processing by allowing shared mental shortcuts. Physicists, for example, do not derive every formula they use from first principles during every calculation. The reality, however, is even more impactful, as the starting islands themselves have different bridge building tools, which affects the pattern of development around them, rather than just the initial state and location of research. Consider the following: If Law is theorized as a tool of social


welfare, discussing how Law impacts social welfare indicia would be appropriate. Similarly if Law was theorized as a vehicle for economic efficiency then efficiency indicia would become valued information. This is not to say that an economically-focused concept of law would be unable to analyze social welfare indicia, but rather that those operating using that theory would be predisposed to analyze social welfare indicia to examine their effect on economic efficiency.

To demonstrate the effect of starting points in exploration take the example of an often cited and particularly popular textbook on the issue of economic analysis of law. It defines social welfare as quantifiable units of utility in order to perform comparative economic analysis. The effect of this quantification is the implication that social welfare can be defined in an absolute quantifiable non-subjective manner, and then optimized according to economic principles. Later academic scrutiny at first threw this concept out nearly entirely, replacing it with the notion that utility functions were entirely the result of individual preference, and as such represented subjective valuations. A third wave of refinement stated that even weak ethical positions rapidly harmonized individual valuations, and significantly lowered the amount of variability between them. The development of this line of reasoning is firmly rooted in the refinement of a specific set of mathematical functions, largely rooted in quantifying social welfare using a wealth equivalent as a unit measure. Tools to import quantifiable measures of environmental, mental, social, political and emotional wellbeing, for instances, must be developed in a modular fashion prior to the inclusion of such data into the constructed models, delaying research or attention into


these areas. Environmental economics, for instance, was born as a field in the 1960s\textsuperscript{35}, but the history of economics can be traced back to Plato and Aristotle, with more recognizable modern economics beginning to coalesce into a school of thought around 1790\textsuperscript{36}.

One of the ideas from the information-centered analysis which we examined earlier, namely that the capacity of humans to process and intake information is limited, creates a form of opportunity cost competition between theories. Since theories occupy resources in order to operate, their continued existence relies on their ability to out-perform other theories at a given desired task. Additionally, there is an element of path dependence: if theories iteratively improve upon themselves, then mature theories gain a bulwark against competition by nascent theories seeking to occupy the same explanatory space. This momentum explains why philosophical shifts do not occur on rapid timelines, and why the history of thought is so drawn out. The statement that a person "was before his time" comes to mind.

Momentum vastly increases the prescriptive impact of legal theory, and the functionalization of philosophy is especially important when dealing with Law. Matters which fall within Law's umbrella of contemplation are adjoined in spirit to those of fairness, justice, wealth, and propriety among others. It stands to reason that the impact of shifting conceptualization is largest in fields allowing large definitional variance in their core concepts; issues regarding conceptualization of terms in the natural sciences, for instance, are at first glance less discussed.

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\textsuperscript{36} Joseph A. Schumpeter. \textit{History of Economic Analysis}. Routledge (2013) broadly at part II and part III.
Concepts in these fields are more prone to systemic or specific technical nomenclature, which restricts the amount of related concepts that are modified by emergent theories.

Another way of examining the adoption of theories is to examine their memetic fitness. Memetic fitness refers to the ability of a theory or piece of information to survive evolutionary pressure. If variables associated with the fitness of an idea are changed, so too will the rate of adoption of the theory itself. More robust, flexible and encompassing legal theories may resist the erosion of time, or find themselves suitable in circumstances where others were not. Much like in life, a perfectly homeostatic being does not exist. All legal theories remain in competition for attention and space on the shelves of the mind. While potentially possible, the lack of stability in legal theory indicates that the drivers of legal theory fitness are situational, which is consistent with the idea that theories are competitive with each other at a functional level, a finding arising from an analysis of the information capacities of humans.

If evolutionary robustness drives theoretical development then challenges to a theory can provide fuel for productive mutation. Townsend uses foundational crises in mathematics as a model for sequential refinement of a field's theories:

Virtually all scholars ignore the fact that the so-called current foundational crisis is merely one in a sequence dealing with the same basic questions, and that these crises are symptomatic of larger periodic internal reevaluations of the Western intellectual tradition. The mathematical crises have not so much resolved as sharpened understanding of the basic mathematical issues involved. As a result of its crises, mathematics has matured
scientifically, artistically, technologically. One can only hope that other disciplines such as law are as successful in using their opportunities.\textsuperscript{37}

If the metaphor holds, theories of Law can be refined by the sequential improvement of concepts, and this process of refinement is egged onwards by the development of challenges to current understandings of Law.

Information technology has proven to be a disruptive force in both the marketplace as well as in the intellectual realm. Computing capacity has changed how we view systems by allowing us to analyze larger systems using larger data-sets culled from non-local areas with quantitative methods. In so doing, the practical effect of defining larger, more complex systems has gained functional value as the ability to test theoretical hypotheses regarding their behavior has grown.

Put simply, developments in the science and theory of information challenge Law's practices and customs. From Townsend's theory of refinement, this could represent an opportunity to jump forward and vastly increase the sophistication of legal research and theory. Unlike Townsend's example, though, Law has very limited access to the proper tools to fully benefit from the challenge caused from the exterior. The solution is to establish channels through which to import information and tools from areas that know better how do deal with the concerns that are coming to the forefront in Law.

\section{4.3 Interdisciplinary Research}

Legal scholarship suffers from a lack of intellectual cross-pollination with a number of technical fields. Advances in information and computer science have been used to import products to

\textsuperscript{37}Townsend, Mike \textit{Implications of Foundational Crises in Mathematics: A Case Study in Interdisciplinary Legal Research} 1 Wash. L. Rev. 51 (1996).
automate elements of performing law as a trade. Less permeable were ideas to characterize what law is and what law should be. This is not to berate legal scholars; the level of complexity associated with legal scholarship is high and the audiences targeted by scholarship are varied and have different needs. Even within law, different areas of law operate semi-autonomously, with analysis of legal systems possible at a number of different systemic levels, leading to a spectrum of sometimes conflicting viewpoints on many topics.

Interdisciplinary methods of advancing knowledge have advantages and pitfalls associated with them, but ultimately must be embraced by Law. In a 2010 article, Larivière and Gingras gathered data regarding citation rates across disciplines in order to determine the quantitative effect of interdisciplinarity on impact factors\(^\text{38}\). They discovered increasing, decreasing and non-correlated trends between interdisciplinarity and article impact factor by field. Highly technical fields saw their relevance drop as they added outside influences, but social, humanities, and professional fields benefitted from interdisciplinarity. That is not to say that all types of interdisciplinary work are equivalent, though. Law specifically has had different types of interdisciplinarity grow and fade over time. Landes and Posner showed this while providing quantitative evidence of the growth of Economics and Law and the decline of the traditional doctrinal model of law throughout the 1980s\(^\text{39}\).

Interdisciplinary approaches may highlight insufficiencies in the dominant theories, suggesting their replacement or modification. A change in theory does not mean an abandonment of its methods, though. Within a community the advantages of using similar approaches is that results


using the approach are more modular, the limits of a particular method are more widely known, and there is a greater ability to critique research. In short, harmonized approaches are easier to access. This fact is consistent with the notion that mature fields and theories have competitive advantages over novel theories by virtue of the iterative refinement. Novel approaches, by contrast, have untested promise. They could potentially reveal a new area of study, provide a breakthrough in an older field, or critically address a stubborn issue that resists solutions derived from previous approaches. It follows that novel approaches are reactionary and will be preferred when they are tailored to deal with a particular problem resistant to the current dominant approaches. These approaches are often interdisciplinary at their outset, as it is more likely that experts within a particular silo of knowledge will first exhaust the options afforded to them by their present capacities.

Law in particular is open to interdisciplinary approaches. To reprise Dow, “Law scavenges. This fact is widely known. Law borrows from philosophy, from economics, from literary theory, from theology- from anything useful”\(^{40}\). This finding is important not only to demonstrate why law is particularly suited to interdisciplinary approaches and theories, but also reinforces the idea that information intake is central to Law.

The advances in the fields of mathematics, management, operations, information science and computer science are poorly adopted into legal theory. Studying the effects of complexity and capacity in law on legal institutions is currently a difficult task. The methodological tools suited for the task are very young and non standardized while relevant data is difficult to come by or not collected at all. This lack of adoption exists despite substantial theoretical work taking place

\(^{40}\) Supra 6.
in adjacent fields. Some commentators of repute have touched upon institutional and structural issues underlying the court systems. Where there have been attempts to deal with court capacity, research has focused on caseload and associated bandwidth variables, such as delay, at the appellate and Supreme Court levels of adjudication. Unsurprisingly these data sets are not well documented, robust and are restricted in scope and granularity.

Understanding institutional capacities for processing information in particular is a theme that is poorly handled in the literature, especially in law. The Capabilities approach and Institutional economics are two methodologies that touch tangentially upon the human and cost of information elements of institutional capacity respectively. Neither, however, operationally dedicates itself to the study and testing of institutional processes. Institutional processes are not secondary in importance to the aims of these methodologies, either. With respect to law, they lay at the heart of many crisis-points in western legal systems; Access to justice, the rising cost of litigation, the explosion in patent application and prosecution, and international attempts at legal harmonization all relate to law’s institutional bandwidth.

These deficiencies are growing and require intervention in the near future. Thankfully, a wide variety of tools exist, and the field of possible research in this area is incredibly broad. In the following chapter we turn to examine some of these tools and areas of study in order to provide interested individuals with suggested research paths.

41 The following texts are provided as an example of the discussion
5  Chapter 5: Tools and Areas of Further Study

The various information processes in Law are difficult to describe in enough detail to create functional, useful models without adopting the terminology of other, more developed, frameworks in other fields. Naturally, if other fields dealing with the nomenclature of information and transfer have had a longer time to note deficiencies in their terminology they would also have a more tailored and precise vocabulary. Just as those fields grew in response to the challenges they were facing, so too will the legal sciences have the need for a more specific set of vocabulary. While this paper cannot possibly lay out every potential hurdle in the future, it will provide a few potential tools and fields which seem ripe for further exploration and invites readers to join in the process of importing tools from lesser legally-integrated fields of study. Each of the following sections describes one such area or tool.

5.1  Network Analysis

Network analysis is a field of study which describes relationships between system elements. System elements are referred to as nodes, while relationships are named according to their qualities. In social network analysis, the field of network analysis devoted to the study of human social interaction, relationships examined between two individuals, a group termed a dyad. Social network analysis can be used for a myriad of purposes, ranging from producing...

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42 These adoptions are not contained in the definitions section because they represent operational tools, not terms associated with the intellectual foundation of the framework. While they help to flesh out and give meat to the bones of the framework, they don't represent essential elements.
explanations as to why different groups fare differently in the search for jobs\textsuperscript{43} to providing a 'zoom' function to systems analysis:

"a central item on the network agenda is to bridge the gap between the micro- and macro-order... The beauty of network analysis is that it allows a researcher to tie together so many interdependent parts that constitute micro- and macro-social orders. One can understand how changes in one level of social organization (for example, the dyadic) affects another level (for example, the network as a whole)"\textsuperscript{44}

Dynamic network analysis is a further development on network analysis which focuses examines change within the network over time\textsuperscript{45}. These tools can help to visualize dynamic processes\textsuperscript{46} such as information transfer, or merely to show existing static relationships.

\section{5.2 Distributed Processing Systems}

The main unit of distributed processing systems in Law is the individual. The scope of information that Law has immediate access to is greater than those matters which are legal, because individuals and institutions are exposed to and immersed in experiences and situations which fall outside of Law. Instead, as the actual conduits of information within the legal system,

\begin{thebibliography}{9}
\bibitem{44} Stanley Wasserman, and Joseph Galaskiewicz, eds. \textit{Advances in social network analysis: Research in the social and behavioral sciences}. Sage, (1994).
\end{thebibliography}
individuals collect and transport information beyond the mandate of their institutional roles. Distributed systems face a number of organizational challenges which are specifically related to the co-ordination of different network elements for a shared purpose. In particular, distributed systems suffer from duplication and harmonization costs, amongst others.

5.3 Agent Based Modeling

Agent based modeling systems have grown in popularity since the late 90s, spurred onwards by a few seminal works47 promoting the technique and growing access to high-power, low-cost computing platforms. Agent based models have the advantage of higher fidelity at the price of far higher computational costs. From the perspective of a theorist, understanding the mechanics of Law at the level of the individuals who comprise it is a powerful tool. As an example, imagine a practitioner in a personal injury practice who happens to be an avid snowboarder. Because of his first-hand knowledge of snowboarding standards, he is able to determine during a consultation that the half-pipe used by a potential client, who would otherwise have been turned away, was constructed in a shoddy manner. At a systemic level, the presence of extra-legal knowledge significantly expands the capacity of the legal system for accessing information. This type of information, while not traditionally considered to be legal in nature has the power to

47 From the mid 1990s onwards the amount of ABM related papers grows from a trickle to a flood. A quick search on online research databases shows that the amount of ABM papers between 1990-1995, 1995-2000, and 2000-2005 increases by an order of magnitude each interval, then triples in the 2005-2010 interval. The 2010-2013 interval has already matched the entire output of the 2005-2010 interval. The following are three of the most widely cited early ABM works which helped to bring ABM into the mainstream:


influence legal proceedings and is more accurately captured by an individual-focused model. A potential avenue for research associated with this finding is as follows: A study of practitioners finds that most concentrate on upper-middle class hobbies and activities, and a follow up study shows that this has resulted in lower costs for litigation involving those hobbies and activities. A third study might examine the effect of that bias on persons of low income, or to determine whether or not there's an effect on the prevalence of litigation involving ethnically segregated hobbies or activities.

As individuals have lives outside of the bounds of Law, they are exposed to information from outside of the legal system. Even if their title is judge, jurist or legislator, an individual will equally be a member of his or her community, a son or daughter, a sibling, a parent, a neighbor or one of a thousand other monikers. Institutional and other reductionist models will limit the scope of overlap by focusing on the titular legal positions of individuals within a framework.

Individuals also have issues judging their respective knowledge levels, making it difficult for them to self-assess their overall capacity. In particular, people with little knowledge in a field tend to overestimate their capabilities, while people with a substantial amount of knowledge tend to underestimate their competence. Practitioners are well suited to determine whether or not they're competent enough to grapple with the legal issues in a case related to their strengths. Yet practitioners are also prone to overestimating how much they know about issues where they lack expertise, leading them to believe they know more than they do about certain matters. The overlap between lay and legal lives can somewhat remedy this defect; where information is

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48 Sarah Lichtenstein, and Baruch Fischhoff. *Do those who know more also know more about how much they know?* Organizational Behavior and Human Performance 20.2 (1977): 159-183.

broadly held, practitioners will better be able to assess their level of understanding. In areas where information is scant or technical, practitioners are less likely to be able to evaluate their need for help. Accordingly it makes sense that certain subfields of law require additional qualifications from their practitioners in order to mitigate the effect of poor self-judgement of capacity; Tax and patent law spring to mind immediately as fields which have attempted different strategies for tackling these issues. Private sector hiring of tax attorneys heavily favors the acquisition of an LLM in tax, whereas patent offices create stringent public regulations regarding acquiring registered patent agent status.\(^{50}\)

Another advantage of the individual based model is that it allows for a more granular examination of how information spreads. Individuals interact with other individuals as well as their environment to accumulate knowledge. Some types of information - e.g. how to tie a shoelace into a bow - are nearly uniformly available and not particularly interesting to study from a legal perspective. Other types of information - public knowledge of a particular new regulation - by contrast, are not, and accordingly may present an interesting optimization challenge for an Information Process theorist. Individual-level examination provides for the ability to study the propagation of knowledge between different individuals, databases, reporters and institutions in a process of asynchronous information uptake. Network analysis and its sociological cousin social network analysis provide tools to monitor these flows of information, and are robustly developed from a methodological sense\(^ {51}\).

\(^{50}\)These qualifications represent systemic methods of reducing uncertainty regarding processing capabilities, a factor which we will examine in the section on organizational design.

\(^{51}\)Social Network Analysis is a highly cited field of ongoing research. The following are a number of well reputed resources in the area, spanning from methodological commentary and best practices to a historical account accounting for developments since the turn of the century:
5.4 Cognitive Studies

Cognitive studies, that is to say neuroscience, psychology, linguistics and artificial intelligence to name a few, have produced bodies of work characterizing individual human processing capabilities. These efforts are relevant because automated systems for sorting and valuing data are ineffective for most legal applications. This means individuals are responsible for the bulk of information filtering in Law. Psychological and neurological studies have been quantifying factors which affect mental capacity, and have been producing models of the mind that are nuanced enough to recognize multiple mental storage capacities acting in tandem and their effect on information processing. Research has progressed to the point that different senses and different localities in the brain are being examined for their intake and storage capacities. One of the consequences of admitting that humans do the heavy intellectual lifting in the world of Law is our growing understanding of the capacity of the human mind gives us a more quantifiable understanding of the limits of human information processing. Beyond just having a limited processing capability, humans also have limited intake and distribution abilities. What's more, these limited capacities draw resources from each other: the process of intake necessarily involves being exposed to data which is then processed to determine relevance. The limited

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ability for individual nodes within the legal system to take in and store information lies behind many of the procedural and systemic aspects of modern legal systems. Indeed, many of the costs associated with complex legal procedures are tied up in document review, or in the transfer of information between textual, oral, and visual formats. Refreshing and retrieving information which had once been internalized by a human agent is costly. Examples include the cost of due diligence, reviews of case records while submitting motions and duplicated case research.

5.5 Capacity

The external and self-examinations of law and the information that they produce are both dependent on capacities for internalizing information. Prior to the advent of computing, the crunching of massive datasets was impossible, and accordingly many forms of quantitative research could not be performed. Computing power and databases can be viewed in different ways, either as a supplement to human processing and intake capabilities, or as separate network entities within Law itself which themselves operate as information intake, processing and output centers. The nature of the technology in question and more specifically its method of interacting with humans should influence how it fits into one of the two categories. A personal word processor, for instance, might be better modeled as an adjunct to a human's capabilities, whereas a massive automated database with its own relevance screening functions might be better modeled as a separate entity, rather than as a supplement to the capacities of many.

To put it simply the advent of information technology has drastically changed the capacity of human systems to internalize, process and distribute information. Despite that, the fundamental assumptions underlying how best to organize our social decision-making systems remain unchanged, untouched and poorly understood. In the static hold of the status quo, Law languishes.
Capacity type is another term worth of examination. Capacity type is a precision which allows disambiguation between different albeit similar capacities. An online case-law database, for instance, might contain incredible tools to import and store information regarding written decisions, but it will likely have next to no ability to provide contextual information outside of that which was written. An eyewitness at a criminal case might have had a perfect opportunity to intake information regarding what had happened, but his capacity to remember or have his memory influenced by leading questions may call his stored information into question. Even within individual activities that Law undertakes, the discrimination is apt: a particular practitioner might be incredibly proficient at writing for a wide audience, but poorly equipped to articulate himself verbally. The above examples show just a sliver of the different capacities which can exist with respect to information. With respect to institutional and systemic studies of Law, many enterprising pieces of theory fail to account for the central place that these capacities have. Berman's complaint bears all the hallmarks of a rebellion against the limits of capacity:

"It has sometimes been noted that too narrow a view of law makes it impossible for scholars of other disciplines - historians, political scientists, sociologists, philosophers - to study it effectively. It should also be noted that those who lose by this are not only the lawyers but also the social scientists and humanists, who are thus deprived of one of the richest sources of insight into their own disciplines. If our social sciences and humanities have become excessively behavioristic and fragmented, and if our historiography, in particular, has become excessively nationalistic and excessively bound to relatively short time periods, part of the reason is that our
legal thought has also become so, and has consequently passed out of the general purview of the professional scholar and hence of the educated public.\(^{55}\)

Berman decries the lack of scope and vision behind legal historiography but fails to recognize that the act of engaging with the scope of data he wishes to might overtax the capacities of those involved. Likewise, his qualm that lay intellectuals have been pushed out of discussions on law is another capacity issue.\(^{56}\) But the broad vision of Law that Berman creates in unknowing response to academic capacity issues much mirrors our own. Berman describes law as "a living process of allocating rights and duties and thereby resolving conflicts and creating channels of cooperation",\(^{57}\) a definition which hinges upon the concepts of process and relationship.

### 5.6 Complexity Theory

Complexity theory is a field highly related to systems theory. While complexity theory's focus is split between different types of complexity, each in particular has counsels for law. Manson describes the fields of complexity study as follows:

>'Algorithmic complexity' in the form of mathematical complexity theory and information theory, contends that the complexity of the system lies in the difficulty faced in describing system characteristics. 'Deterministic complexity' deals with chaos theory and catastrophe theory, which posit that the interaction of two or three key variables can create largely stable systems prone to


\(^{56}\)As we shall see shortly in the subsection on organizational design, the issue here can be examined as requiring additional capacity from the intellectuals, or a reduced requirement for capacity by making the problem simpler. In the current instance, both solutions work in tandem, as the intellectual digestion provided by professional scholars allows the educated public shortcut to understanding. In many ways, this paper aims to perform the same digestion.

\(^{57}\)Supra 55 at p. 5.
sudden discontinuities. 'Aggregate complexity' concerns how individual elements work in concern to create systems with complex behavior.\textsuperscript{58}

With respect to Law, these different fields each address unique, important issues. Algorithmic complexity asks whether or not a legal problem is solvable at the theoretical level, or whether or not a system that Law regulates can be described effectively. Deterministic complexity examines the appearance of stability in legal subsystems and the sudden destabilizing events punctuate legal history. Aggregate complexity examines complexity with respect to legal information networks, and how relationships between different individuals and institutions in Law give rise to emergent properties.

Complexity theory allows us to conceptualize inability. If legal capacity cannot deal with all problems which are brought before the court, a purely capacity based approach might advocate expanding capacities until the problem can be dealt with. Complexity theory, however, can attenuate that drive by giving us information about the requirements to solving that problem. If the investment into solving a certain problem is exponentially more costly than the benefit of solving that problem, we can discard the need to expand capacities and admit to our inability to deal with the issue in an effective manner in the present time.

5.7 Complex Adaptive Systems

One of the most important elements of complexity theory is the notion of a complex adaptive system. Complex adaptive systems (CASs) have three main characteristics. They intake information, then process them through a system with a large amount of subsystem components

of varying complexity, then deliver some sort of output. This output effects the environment of
the CAS, which then results in differing inputs.

CASs typically operate by means of multiple feedback loops and a number of internal systemic
drives towards homeostatic states. While the degree of homeostatic drive within a system may
vary, homeostatic qualities self-perpetuate themselves and tend to accumulate over time.

Law can be characterized as a CAS which is comprised of individuals and institutions which are
CASs themselves and who may be involved with other human-generated social CASs as well.
This concentric and overlapping layering of complexity is difficult to model accurately, but
provides substantial insight into many legal structures.

5.7.1 Recursion

CAS activity is recursive, in that the outputs of their function affect the inputs that they use in
their operation. This fact has several important consequences. First, legal systems tend to be self-
perpetuating and actors within legal systems tend to act in ways that promote the survival of the
system. The entire notion of bringing justice into disrepute in Canadian law, for instance, is a
homeostatic loop that attempts to prevent the exercise of law from undermining itself.

Since homeostatic loops end up becoming favored in iterative dynamic systems, as is
demonstrated with living and many physical systems, the ability to change institutions and
systems is internally limited. Polyani’s Great Transformation can be viewed from a systemic
perspective as differing responses to system-critical defects in legal systems. Many of the first
social justice initiatives, for instance, can be seen in terms of their ability to diffuse pressure of
otherwise disruptive build ups of system-threatening forces.
5.7.2 Auto-regulation of Law

Homeostatic tendencies are common in legal self-regulation, and not always to the benefit of law's functionality. Because the development of self-preserving loops within the process of law is a function of organic system development, these occurrences can be viewed as a natural occurrence. Do not, however, commit the naturalistic fallacy in believing that legal auto-regulation is good. The determination of whether or not a particular subsystem is good should be performed by determining its value, not by assessing its method of creation.

6 Conclusion

The proposed future research initiatives are only a sliver of the potential afforded by the framework presented in this thesis. Hopefully, this text has its goal of changing how people interact with the Law by affording them an accessible, simple, and lightweight framework. Law functions through information intake, processing and output, and these three activities provide a solid basis for understanding many legal phenomena. They provide insight into legal theory, provide quantitative tools for measuring efficiency and effectiveness in our legal institutions and they are aimed at remedying a number of structural crises which are growing in Law.

Expanding the horizons of Law to include the incredibly detailed and sophisticated bodies of knowledge which address many of the issues that jurists face is robust solution. The development of this framework aims to facilitate that adoption while also remaining intellectually consistent, powerful and lightweight.

At this point it is prudent to recall that this is a theory in its infancy. Where it lacks tools, many can be imported directly to aid its efforts, but others still will need a history and a body of
researchers interested in pushing the boundaries of the ideas contained herein. Despite this, hope remains eternal in the most youthful of ideas, and the invitation to experiment with viewing Law will remain open to all those with curiosity and adventure in their hearts.