Using the IAD's Institutional Grammar to Understand Policy Design:

An Application to Colorado Aquaculture

Abstract: This draft offers a preliminary analysis of an on-going project to develop guidelines for applying the IAD's Institutional Grammar to understand the content of policy design. We seek to understand the foundational elements of policy design by examining the individual institutional statements that constitute policies. The Institutional Grammar offered by the Institutional Analysis and Development (IAD) framework is a valuable tool with which to systematically identify the institutions-in-form that govern behavior of people in collective action situations. Understanding how these statements are modified over time may be indicative of broader changes regarding how policy issues are framed, altered contextual factors, and new actors and sources of information entering the policy arena. In this study, we adapt the IAD's Institutional Grammar to code the major laws and regulations of Colorado State aquaculture, through which we identify the institutions-in-form that guide aquaculture activities in the State. We focus our discussion on offering insights regarding the applicability of the IAD's Institutional Grammar as it is currently presented, including theoretical limitations and suggestions for improved applications.

Keywords: policy design, Institutional Grammar, institutional statements, institutions-in-form, rules, norms, Institutional Analysis and Development Framework (IAD)

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I. Introduction

Policy scholars who study policy design do so in an effort to understand, analyze, and evaluate policy processes and their consequences (Sidney, 2007; Boborow and Dryzek; 1987). The study of policy designs has been explored in numerous policy process frameworks and theories such as the Policy Design and Social Construction framework (Schneider and Ingram, 1997), the Institutional Analysis and Development (IAD) framework (Ostrom, 2005), and theories of agent-based modeling (Janssen and Ostrom, 2006). Institutional lenses, such as the IAD framework, are useful in this pursuit as they aid scholars in identifying the contextual elements that produce certain types of policy designs, including the set of participants that operate within a given action arena, the set of allowable actions and how these actions are linked with realized outcomes, and the costs and benefits assigned to actions and outcomes (Ostrom, 2005, 32). The IAD also offers researchers a tool which identifies the individual statements that comprise formal institutions, such as legislative directives and organizational by-laws, to analyze the structure of situations presented in such documents and "model the interaction of actors in those situations (Ostrom, 2005, 137)."

The IAD Institutional Grammar was first proposed by Crawford and Ostrom (1995) as a tool with which individuals conducting analysis can systematically identify and code institutions-in-form presented in various types of documents that relate to collective active situations. The tool is applied by identifying the individual institutional statements that comprise such documents. Recent applications of the Institutional Grammar show both its promise as an analytical tool but also unresolved challenges (Basurto et al. 2009; Andersson, 2007; Speer, 2008). The research question thus posed for this study is: How can the Institutional Grammar be improved to enhance applicability, validity, and inter-coder reliability?

The Institutional Grammar is applied here to the Colorado Aquaculture Act (CAA) and Chapter 0 of the Colorado Division of Wildlife Regulations as a methodological exercise to address areas where the tool may be further developed. The coded statements from the aforementioned documents are analyzed using configuration analyses techniques used in similar previous applications (Speer, 2008; Basurto et al., 2009). Such analyses identify the number of strategies, norms, and rules present within the document, in addition to calculating the frequency counts of various statement components.

This paper contributes to the Institutional Grammar, IAD, and policy design literatures by (i) revising the guidelines for application as originally outlined by Basurto et al., (2009); (ii) offering an additional syntactic component to the grammar, the *oBject*, or B-Code; and (iii) providing empirical analysis of an important case study. The B-Code is useful in minimizing ambiguity in certain cases, may increase inter-coder reliability, and expands the scope of possibilities for researchers when conducting nested and configuration analyses relating to the Institutional Grammar. The use of this additional component minimizes confusion in statements where (i) there is no animate *Attribute* explicitly stated, but there is an explicit inanimate subject to which the *aIm* applies, and (ii) when there are two animate actors within a sentence and ambiguity exists as to which is the appropriate *Attribute*.

Further, in an effort to clarify the use of the proposed B-Code, as well as other components of the tool, the authors also offer coding guidelines and strategies to enhance inter-coder reliability which build off of recent applications of the Institutional Grammar (Speer, 2008; Schluter and Theesfeld, 2009; Basurto et al., 2009). These strategies are based on the findings and past experiences of the authors and address application issues which frequently arise when the tool is being used.

As an empirical, methodological exercise, the IAD's Institutional Grammar is applied to a Colorado aquaculture case study which identifies institutions-in-form through the formal coding of legislation. The coding of the Colorado State aquaculture legislation served as a pilot case to which the B-Code was applied. The team of authors based their discussion of the applicability of the B-Code on their experiences coding these documents to test whether the inclusion of the additional component is practically useful and to suggest coding guidelines that are accurate and understandable.

In presenting this discussion, the authors hope to aid researchers in employing this valuable tool by offering strategies that may potentially decrease ambiguities in its application and proposing the inclusion of an additional coding component to enhance inter-coder reliability and increase the possibilities for various types of configuration analyses. The coding approaches and discussion in this paper draws heavily from the Basurto et al. (2009) piece, in which the authors applied the Institutional Grammar to code U.S. Transportation Policy and abortion legislation in the State of Georgia. This discussion is meant to respond to specific limitations posited by the authors and to expand upon strategies and coding guidelines proposed.

II. IAD Framework and the Institutional Grammar

The IAD framework provides a structured approach for mapping out the institutional attributes that govern actions and outcomes within collective action arrangements, known as action arenas and action situations (Ostrom, 2007, 43-44). Formal rules within the IAD are defined as the "shared prescriptions (must, must not, may) that are mutually understood and predictably enforced in particular situations by agents responsible for monitoring conduct and for imposing sanctions," and

norms, are the "shared prescriptions that tend to be enforced by the participants themselves through internally and externally imposed costs and inducements (Ostrom, 2007, 23)."

The IAD distinguishes between formal and informal institutions by characterizing the former as institutions-in-form and the latter as institutions-in-use. Institutions are understood to be contextual in nature and interactive with the various cultural and biophysical attributes of the arenas in which they are applied (Ostrom, 1994). Further, institutions are generated by actors within an arena to structure their behaviors and participant roles and responsibilities. Ostrom (1994) writes that, "Rules [institutions] are the result of implicit or explicit efforts to achieve order and predictability among humans by creating classes of persons (positions) who are then required, permitted, or forbidden to take classes of actions in relation to required, permitted, or forbidden states of the world (Ostrom et al., 1994, 38)."

The Institutional Grammar offers a structured approach to operationalizing the concept of institutions-in-form by dividing legislative documents into institutional statements that indicate actions that are required, permitted, and forbidden, the actors assigned to particular activities, the temporal and spatial boundaries in which these activities take place, and, in some cases, the punitive measures associated with non-compliance with institutions-in-form. The Institutional Grammar currently includes five components: The *Attribute* (A), *Deontic* (D), a*Im* (I), *Condition* (C), and the *Or else* (O) (Crawford and Ostrom, 1995, 584). Each of these components is discussed in further detail below.

The *Attribute* is the agent (e.g. individual, groups of individuals, organization(s), etc.) that carries out the *aIm*. The portion of an institutional statement that belongs with the *Attribute* includes the agent and the descriptions of the agent. If the agent is individuals then the *Attribute*

might include descriptions, such as age, sex, or position (Crawford and Ostrom 2005, 141). For

organizations, the *Attribute* might include organizational descriptions, such as organizational size

(ibid). The *Attribute* can be implicit or explicit in any given institutional statement. Thus, one

institutional statement might be in reference to an *Attribute* in another institutional statement or an

implicit *Attribute* might be in reference to all subjects in an action arena. One helpful approach for

identifying the *Attribute* is to identify the actor or organization to which the *Deontic* or *aIm* apply

(Crawford and Ostrom 2005, 139). This paper also asserts that the *Attribute* must be animate and

logically capable of performing the specified *aIm*.

The *Deontic* is the prescriptive operator of an institutional statement that describes what

ideally is permitted, obliged, or forbidden (Crawford and Ostrom 2005, 141-149). The *Deontic* need

not always be literally written as the words "permitted", "obliged", or "forbidden" but may also come

in other forms, such as may, must/should, must not/should not (ibid). The *Deontic* is usually

explicitly stated, but may also be implicit or implied by the statement. *Deontic*s are allowed to be

implicit because some statements prescribe a command without using the words may, must, or must

not, especially when an explicit *Deontic* is in a preceding institutional statement. By allowing implicit

institutional statements, this paper differs from Crawford and Ostrom (2005, 144), which state that

*Deontic*s must be explicit. This deviation is undertaken because implicit *Deontic*s are fairly common

in the type of units coded in this analysis. The *Deontic* operators can vary by prescriptive force, for

example "must" represents more force than "should" (Crawford and Ostrom 2005, 142-149). It is

assumed here that various operational forms of the operators take on the same force, for example,

"should" and "must" represent an equal amount of prescriptive force.

The *aIm* describes the goal or action of the statement that the *Deontic* refers to

(Crawford and Ostrom 2005, 140). The *aIm* does not include descriptions of "when" and "where" the

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action is conducted. The *Condition* represents the part of the statement that modifies the *aIm*, often in temporal or spatial terms. The condition can be thought of with the operators "when" and "where" for which the *aIm* is allowed, required, or forbidden (Crawford and Ostrom 2005, 149). For example, the "when" might be temporal or in relation to a process; and the "where" might be geographical or jurisdictional. While Crawford and Ostrom restrict the *Condition* only to "when" and "where" operators, "if" and "unless" operator are also included here; for example, "when" and "where" operators come in the form of "if" and "unless" operators, e.g., when the *aIm* is allowed to occur "if" certain events happen. While the "when", "where", "if", and "unless" are used as operational guidelines, in general, *Conditions* set the prerequisites or restrictions on the *aIm*. It is assumed that the *Conditions* can be explicit or implicit, meaning that the *Conditions* are implied from a different institutional statement. When an institutional statement does not specify an explicit *Condition* nor refer to one implicitly elsewhere, the default value is "at all times" (Crawford and Ostrom 2005, 149).

The *Or else* operator is the punitive action if the rule is not adhered. For the purposes of this paper, as was done by Basurto et al. (2009), the guidelines for coding *Or else* operators have been relaxed. For example, it is not required that the *Or else* operator be backed by another institutional statement for enforcement or the incentives of the monitors (Crawford and Ostrom 2005, 150). Basurto et al. (2009) suggest that the definition may be limited because each statement is coded as an individual unit of observation. The *Or else* must be explicitly stated in order to be coded.

In the Institutional Grammar, there are three necessary conditions for a phrase to constitute a statement. Each institutional statement must contain at minimum an *Attribute*, an *AIm*, and a *Condition*. The *Deontic* and *Or else* component may be present but are not necessary to qualify a phrase as an institutional statement. Those statements which contain each of the aforementioned components are characterized as rules (ADICO), while statements containing the first four

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components (ADIC) are characterized as norms, and statements only containing an *Attribute*, *AIm*, and *Condition* (AIC) are considered to be shared strategies. Where a necessary component, that is, the existence of an *Attribute*, *AIm*, or *Condition*, is missing, it is possible for them to be implied. A more detailed discussion of how the coder should do so is presented later on in this paper.

The ADICO coding strategy has seen more application in recent years (Basurto et al., 2009; Andersson, 2007; Speer, 2008). As it is increasingly applied, potential limitations of the strategy have been highlighted. Basurto et al. (2009), for example, conclude that some of the challenges associated with the technique include: ambiguity regarding how to code statements where the *Deontic* is implicit rather than explicit, uncertainty in identifying the *Attribute* in the institutional statement, and difficulty in distinguishing between the *aIm* and the *Conditions*. New applications of the strategy are being tried as with Speer's (2008) efforts in which she coupled legislative coding with qualitative interviews to study the role of participatory governance in Guatemalan municipalities. Supplementing qualitative interviews with the coding of official documents offers the possibility to juxtapose institutions-in-form with the institutions-in-use to gain a more comprehensive understanding of the particular case being examined. Schluter and Theesfeld (2009) explore the interaction of the Institutional Grammar with delta parameters, positing that the distinction between norms and rules becomes difficult to ascertain when one considers the notion of implicit sanctions, social, psychological, or otherwise.

Building off of the work of the aforementioned scholars, the following sections describe a proposed amendment to the Institutional Grammar as it is currently presented, in addition to detailing coding guidelines and strategies that may be employed to address the specific aforementioned limitations presented by Basurto et al. (2009). To reiterate, these limitations include:

- Uncertainty in identifying the *Attribute* in the institutional statement;

- Ambiguity regarding how to code statements where the *Deontic* is implicit rather than explicit, and;

- Difficulty in distinguishing between the *aIm* and the *Conditions*.

The Introduction of the Object or B – Code

Some of the current limitations with the Institutional Grammar tool may be overcome by additionally including an *oBject*, or 'B' code. The *oBject* would act as an additional component, and is often equivalent with the direct object of the sentence, but not in all cases. The *oBject* can be defined as the inanimate or animate part of a statement that is the receiver of the action described in the *aIm* and executed by the agent in the *Attribute*. For example, "The student wrote the paper." The *oBject* in this statement would be the paper which was written (*aIm*) by the student (*Attribute*).

The *oBject* code would be assigned under two conditions: (1) Where there is no explicit *Attribute* given in an institutional statement, and (2) Where there are potentially more than one *Attribute* given in an institutional statement. Tables 1 and 2 contain examples that illustrate these two cases.

The first example in Table 1 provides a base line case where there is a clear agent (the student) charged with carrying out an *aIm* (write) on a particular an *oBject* (paper). The second example is the more challenging code when the *Attribute* is implicit and the *oBject* takes the position of the *Attribute* of the institutional statement, even though it remains the *oBject*. The coding would be the same for both statements, however, with the addition of the *oBject* code, potential

disagreements among coders on example two would more likely be avoided. The "paper" *oBject* in these examples would be the *oBject* because it is the element on which the agent and aim apply.

Table 1: B-Code Application Case One --No explicit *Attribute*

Case	Statement	Coding	Statement Type
Example One	The student must write the paper by date.	A = student B= Professor D=must I= be contacted C=by date O= N/A	Norm
Example Two	Paper must be written by date.	A = [Implied] student B= paper D=must I=be written C=by date O= N/A	Norm

In the second case, there are two explicitly stated animate actors and there may be some ambiguity as to which of the two is the agent in the *Attribute* or the *oBject*. It is desirable to have both actors coded as individual components when conducting configuration analyses. For example, one may be curious to know how many times a particular actor appears in the document and the context in which he/she is discussed, e.g. his/her role in the action arena, mandated, allowed, and forbidden activities relating to the role, etc. Thus, the B-Code is useful as it allows the coder to list one of the explicitly stated actors as the *Attribute* and creates a new coding category in which to place the second actor.

Table 2: B-Code Application Case Two – Two Animate Actors in the Statement in Two Alternately Worded Institutional Statements

Case	Statement	Coding	Statement Type
Example 3	Student must contact the Professor by date.	A = student B= Professor D=must I= contact C=by date O= N/A	Norm
Example 4	Professor must be contacted by the student by date	A = student B= Professor D=must I= contact C=by date O= N/A	Norm

Stated above are the two instances in which the B-Code is purported to be most useful. Additional coding guidelines and further strategies for identifying each of the Institutional Grammar codes are presented in the following section of the paper.

Summarizing the Utility of the B - Code

Given the previous discussion, it can be argued that the B-Code is useful for the following reasons. First, the introduction of the *oBject* code minimizes coding ambiguity when dealing with statements which lack explicitly stated animate *Attributes* and provides guidance to coders dealing with statements with apparently multiple *Attributes* as to which is the appropriate subject of the statement, and therefore, the appropriate *oBject*. Thus, by minimizing coding ambiguity, the *oBject* code enhances the potential for inter-coder reliability. The Professor-Student example provided above is illustrative of this point.

Secondly, coding the *oBject* as distinct from the *aIm*, in many cases, does not require altering the statement structure to capture the full *aIm* in one phrase. Currently, under the

Institutional Grammar, the object is included within the *aIm*. Doing so often requires the coder to restructure the statement to fit the coding criteria. As will be discussed in the coding strategies portion of the paper, the authors have limited the contents of the *aIm* to only include the primary action, or verb, being addressed in a particular statement. The advantage of taking this approach allows for the *aIm* to serve as an anchor for the statement, around which all other statement components can be identified. For example, once one knows the action that is being discussed, he/she can systematically identify who is responsible for carrying out the *aIm,* under what conditions the *aIm* should be performed, and what are the punitive sanctions associated with not performing the a*Im* as prescribed in the directive.

Thirdly, the inclusion of the B-Code is also useful in the data analysis process, particularly when conducting configuration analyses to organize statements by topic, *Atttribute*, *oBject*, etc. The utility of the B-Code in this sense allows the coder more possibilities in conducting analyses, where statement components are more clearly differentiated. It is quite likely that the coder would choose to organize analyses and conclusions along the *oBject* code, when considering that, in most cases, the *oBject* is synonymous with the direct object of the sentence and thus an integral element of the statement. Tables 7 and 9 (in the Appendixes Section) demonstrate that the *oBject* distinctly identifies elements of the statement that may be both practically and theoretically useful.

Coding Guidelines

General guidelines were presented by Basurto et al. (2009) in which they provided six steps for effectively coding legislative documents in accordance with Institutional Grammar, in addition to notes associated with each:

(1) **Identify all definitions, titles, preambles, and headings and disregard them for coding**

purposes. Titles and headings are first discarded because they are fairly easy to locate and do not constitute an institutional statement.

(2) **Identify sections and subsections of the bill as initial units of observation**. Headers of sections and subsections are called "outline indicators." Outline indicators are titles, subheadings, a capital or lowercase letter, colons, semicolons, or Roman numerals, used to separate sections from sub-sections and sections from sub-subsections, etc.

(3) **Subdivide all initial section or subsection units from step 2 that have multiple sentences into sentence-based units of observation.** If a section or subsection does not have a complete sentence ending in a period, code the entire section or subsection as one unit of observation. If there are multiple sentences in the section or subsection, code each sentence as units of observation.

(4) **Code the units of observation following the ABDICO syntax.** The text in each unit is coded with respect to the *Attribute*, *oBject, AIm*, *Deontic*, *Condition*, and *Or else*.

(5) **Code all units of observation as rules, norms, or strategies.** Following the Institutional Grammar, a rule has all components, a norm has ADIC components, and strategy has AIC components.

(6) **When applicable, imply component when they are not explicitly provided in the statement to qualify it as a norm, rule, or strategy.** In some cases, the *Attribute* is missing because the statement under consideration is actually an extension of the statement prior to it in the document. In this case, the coder should use the *Attribute* from the previous statement. In other cases, an *Attribute* will not be obvious, in which case the implied *Attribute* will be the agent that is expected to carry out the *aIm*, or in the case of a legislative document, the agent who is requiring that the action being discussed in the statement in carried out. With respect to the *Condition* component, unless stated otherwise in preceding statements, the default *Condition* will be "at all times," meaning that the

directive is applicable in all cases unless an exception is explicitly stated.

(7) **Subdivide all sentence-based units of observation that have more than one rule, norm, or strategy into separate units and recode following the ABDICO syntax as rules, norms, or strategies.**

(8) **Multiple coders for inter-coder reliability.** As with all qualitative coding, each document should be coded by multiple coders to meet at least an eighty percent inter-coder reliability criteria. Coding method should be iteratively revised until the eighty percent criterion is met.[1]

Strategies for Applying the B-Code

Additional strategies may be employed to assist the coder in partitioning statements in accordance with the Institutional Grammar, when including the B-Code component. The first set of strategies pertains to the first step of the coding exercise and deals with the identification of institutional statements. As mentioned previously, institutional statements are assumed to constitute individual units of analysis, and are thus treated as independent and discrete. However, in order to understand the contextual elements of the document being coded, which may inform implicit codes, it is suggested that the coder first read through the document being coded entirely in order to gain a general sense of the topical areas and content being discussed. Following this first round of reading, it is then suggested that the coder begin to divide the document into individual institutional statements. It is recommended that *aIms* and *Deontics* be used as indicators for individual statements.

The second set of strategies deals with specific codes. Following is a discussion of the strategies that may be used in relation to each statement component.

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[1] Steps 1-5, and 7, were taken directly from Basurto et al. (2009). The addition of Step 6 here pertains to the use of the B-Code. Step 8 was performed by researchers in the Basurto study, but the researcher finds it important to explicitly state this step as it is a critical element of the coding process.

Attribute

    The *Attribute* is the actor that is expected to carry out the *aIm.* In many cases, the *Attribute* is most clearly identifiable once one has identified the *aIm* of the statement. By first identifying the *aIm*, the coder can assure that there is a logical relationship between the actor and the action being described in the *aIm,* that is to say, that it is possible for the former to perform the latter. In addition, as has been expressed previously, the *Attribute* must be an animate actor or be an entity (ex. organization) that is made up of animate actors. Further, the *Attribute* should include with it all relevant descriptors. For example, "Graduate students must submit paper by date." In this example, the complete *Attribute* would be "graduate students." Additionally, when it comes to implying an *Attribute*, it is critical that the coder understand the context of the statement within the document so as to ensure that an appropriate implication is made. Finally, the coder may encounter instances in which agents are nested within larger organizations/groups, but only the former, the primary agent, is explicitly stated and the secondary agent may be inferred. For example, such an occasion is observed when an actor is a representative or employee of an organization and he/she is carrying out an *aIm* on behalf of his/her organization as a whole. In this case it may be useful for the coder to know both the nested agent in addition to the secondary agent. In such an instance, the explicitly stated agent may be listed as the *Attribute* and the secondary agent may also be included in brackets next to the other.

oBject

    A strategy to note regarding the *Object*, in addition to those provided in preceding sections, is that the *oBject* should include all relevant descriptors, as also expressed in relation to the *Attribute*.

Deontic

The *Deontic* is identified by Crawford and Ostrom (1995) as including the word "must," "may," or "must not," to mean an action is required, is allowed, and is forbidden, respectively. However, application of the Institutional Grammar to legislative documents shows that other words are commonly used in addition to the aforementioned which imply the same meanings. In such cases, certain phrases are assumed to imply "must," "may," or "must not." For example, "required" is a word that frequently appears in the Colorado legislation that implies "must." In such an instance, the authors labeled "required" as the statement *Deontic*, including an implied "must" in brackets next to it. Other words that were dealt with similarly included, "can," "will," and "shall"; the former implying a "may" and the latter two a "must."

aIm

The signature feature of the *aIm* is that it is also usually the verb of the sentence. For example, in the statement, "The student must write the paper," "write" is the *aIm.* The authors suggest that only the verb be included in the *aIm*, and any qualifiers of the verb, including the identification of temporal and spatial boundaries relating to the action being discussed, should be included under the *Condition.*

Treating the *aIm* as an anchor around which to (i) identify individual institutional statements, and (ii) categorize remaining components of the statement, is instrumental as it guides the coder to assess who is the actor that is expected to carry out the *aIm,* and thus aids him/her to recognize the *Attribute* or *oBject.*

Condition

The *Condition* of the statement will include all qualifiers of the *aIm*, including when, where, and how the action identified in the *aIm* is to be performed. Often times, an institutional statement will seemingly contain multiple *Conditions*. Take the following phrase for example, "The Student must submit paper by date, unless he/she obtains an extension." In this case, "by date" and "unless he/she obtains and extension" are both conditions that relate to a student's submittal of a paper. However, to adhere to the coding guidelines previously discussed, the presence of multiple conditions implies that the coder is dealing with more than one institutional statement. Thus, the aforementioned statement would, in fact, become two separate statements, reading: (1) "Student must submit paper by date," and (2) "Student must submit paper, unless he/she obtains an extension."

Or else

Or else statements were not frequently observed in the documents coded for this exercise. Where they were present, they were generally easily identifiable and consisted of monetary sanctions associated with non-compliance with a given directive.

IV. Case Study of Colorado Aquaculture

Many states are actively engaged in aquaculture production and development. In recent years, Colorado ranked fifth in the nation in terms of trout sales, with total trout sales reaching $2.3 million (Colorado Aquaculture Association, 2009). The aquaculture industry also supports the farming of salmon, catfish, tilapia, and various types of bass and carp, among other varieties. While the dry, water scarce geography of the State does not appear to be conducive to aquaculture development, some farmers have innovatively captured warmth from the State's abundant geothermal resources, primarily through hot springs, to support the industry's vitality (Lund, 2003).

New aquaculture opportunities have been presented in the State in recent years in an effort to grow the industry. In response to these new opportunities, the aquaculture industry formally requested to be incorporated into the jurisdiction of the Colorado Department of Agriculture, thus conferring the rights and responsibilities associated with other types of agricultural activities in the State upon the aquaculture industry. Further, a new set of laws and regulations have accompanied this jurisdictional change. This study seeks to understand some of these rules and regulations by systematically coding the institutions presented within the Colorado Aquaculture Act and the Chapter 0 Regulations.

V. Methodology and Research Design

Data Collection

The following discussion describes the process by which legislative documents for this study were chosen and the method by which institutional statements from the Colorado Aquaculture Act and the Chapter 0 Regulations were identified, coded, and analyzed. The following steps were undertaken for this research.

First, informal, in-person interviews were conducted with two prominent members of the Colorado aquaculture community to obtain guidance as to which legislative documents are most formative and influential in shaping aquaculture activities in the State. Based on these discussions, a legislative sample was chosen to include the Colorado Aquaculture Act and the Chapter 0 Regulations from a population of all Colorado State legislation that affects aquaculture activities. As such, the researchers conducted a nested analysis of codable legislation in the State of Colorado (Basurto et al., 2009) for this study.

For the legislative analysis, the CAA and Chapter 0 were first divided into individual institutional statements so that each statement became an individual unit of analysis. In the initial rounds of the coding process, all titles and headings were removed from the legislation. These sections were irrelevant since each statement was treated as an individual unit of analysis that could be analyzed independently of the section in which it was included, and/or its relation to statements surrounding it. Some legislative clauses included multiple sentences which were broken out into individual statements.

Once the institutional statements were appropriately designated, each statement was coded in accordance with Syntax rules and with individual statement components being labeled with an *A* for *Attribute*, *B* for *oBject, D* for *Deontic*, *I* for *AIm*, *C* for *Condition*, and *O* for *Or else*. Following the labeling of the statements, the statements were entered into Microsoft Excel for organizational and coding purposes. Partial analyses of the codes were conducted to summarize findings.

Data Analysis

Two sets of configuration analyses were conducted; one for the Colorado Aquaculture Act and one for the Chapter 0 Regulations. For each document, a configuration analyses was conducted to determine the frequency of statement types (strategies, norms, rules), in addition to determining the *Attribute, oBject*, and *Deontic* frequencies.

Additional analyses will also be conducted on the data set including an analysis of the inter-coder reliability rate when including the B-Code, and also a nested analysis which will combine different units of observation around *Attributes* and *oBjects* to illustrate how these can be grouped in relation to other coding components.

VI. Results

The following section summarizes results from the configuration analysis conducted to (i) determine the number of rules, norms, and strategies present in the two documents; (ii) assess the *Attribute* frequencies in each of the documents; (iii) to assess *oBject* frequencies in each of the two documents; and (iv) to assess *Deontic* frequencies is each of the two documents.

Table 5 displays the number of institutional statements present within each document, per document type. In the Colorado Aquaculture Act, there were 69 total institutional statements, 9 of which were identified as being strategies, 57 as norms, and 3 as rules. In the Chapter 0 Regulations, there were a total of 309 institutional statements, 38 of which were identified as being strategies, 271 as norms, and 0 as rules.

Tables 6 and 8 display the *Attribute* frequencies for the Colorado Aquaculture Act and the Chapter 0 Regulations; due to the volume of statements in the latter, only the top 3 *Attributes* are displayed. In the Colorado Aquaculture Act, the three most frequently referenced attributes were: the Commissioner of Agriculture (21 references), the State Aquaculture Board (18 references), and the Colorado General Assembly (6 references). In the Chapter 0 Regulations, the three *Attributes* most frequently referred to were: the Colorado Division of Wildlife (25 references), aquatic wildlife being transported within Colorado (15 references), and the Director from the Colorado Division of Wildlife (13 references).

Tables 7 and 9 display the *oBject* frequencies for the Colorado Aquaculture Act and the Chapter 0 Regulations; due to the volume of statements in the latter, only the top 3 *oBjects* are displayed. In the Colorado Aquaculture Act, the three most oft cited *oBjects* included: aquaculture (3 references), aquaculture facility permits (3 references), and "nothing in this section" (2 references).

This third *object*, "nothing in this section," appears odd at first sight, however, the Aquaculture Act uses this phrase to refer to all statements discussed in a section that relate to the responsibilities of a particular *Attribtue*. For example, the following statement uses the phrase: "Nothing in this section shall be construed to diminish or supersede the authority of the Division or the Wildlife Commission to regulate or manage wild populations of aquatic organisms in the waters of the State or in facilities controlled or managed by the Division or by the United States Fish and Wildlife Service (Colorado Aquaculture Act, Section 35-24.5-107)." In the Chapter 0 Regulations, the three *oBjects* most frequently referred to were: application for exemptions (29 references), gap size measurement (11 references), and Best Management Practices for Fish Production Facilities (9 references).

Tables 10 and 11 display the *Deontic* frequency counts for both pieces of legislation. In the Colorado Act, "must" was used 43 times, "may" was used 16 times, and "must not" was used 1 time. In the Chapter 0 Regulations, "must" was used 204 times, "may" was used 65 times, and "must not" was used 2 times. The total number of *Deontics* used corresponds with the number of norms and rules present within each document, as all norms and rules have an explicit or implicit *Deontic* present in the institutional statement.

The results of the other proposed analyses will be conducted in preparation for the presentation of findings at the WOW4 conference to be held at Indiana University, June 2 – 6. At that time, a more complete discussion of results will also be offered.

VII. Conclusions

This paper is a preliminary analysis of an on-going project to develop guidelines for applying the IAD's Institutional Grammar to understand the content of policy design. As the Institutional Grammar is increasingly utilized by IAD scholars, limitations with the tool need to be

addressed. This paper begins to deal with the challenges in applying the Institutional Grammar identified by Basurto et al. (2009) by amending the types and conceptual definitions of codes included. Namely, by further systematizing the coding framework and adding a syntactic component to the grammar, the B-Code, which is useful in minimizing ambiguity when coding the *Attributes* and *aIms* in institutional statements. The use of the B-Code may also increase clarity and possibilities when conducting configuration analyses.

While introducing the B-code, this paper applies the Institutional Grammar to a new case study with Colorado aquaculture - an emerging and increasingly controversial industry. This illustration of the Institutional Grammar to Colorado aquaculture enabled the authors to underscore the major agents charged with implementing major policies and the objects of their activities. Given the challenges in understanding policy designs, the Institutional Grammar offers one approach for simplification and analysis.

The Institutional Grammar offers researchers an effective method for conducting a micro-level analysis of institutions. This valuable tool allows policy process scholars to ascertain the genetic code of the policies that guide activities within various political arenas. Its utility may be harnessed by policy design scholars more broadly. For example, scholars applying Schneider and Ingram's (1997) Policy Design and Social Construction Framework, may map out the relevant target populations that are discussed within a policy arena by identifying which *Attributes* are presented in legislation. By examining the activities and sanctions associated with particular activities relating to *Attributes*, they can seek to understand how policies construct certain individuals. Additionally, by examining where and how institutional statements change over time to encompass new actors, activities, and sources of information, scholars using this framework may analyze changes in social constructions and target populations over time. Further, they can try to understand the consequences,

or feed forward effects, of policy design. From a different theoretical approach, scholars using agent-based modeling may also find utility in this tool as they model the behavior and interactions of actors within structured biophysical policy arenas.

Further research that is to be conducted in this area may advance the applicability of the tool methodologically by employing techniques such as was done by Speer (2008) in which she coupled legislative coding with qualitative interviews to understand the informal institutions that interact with formal institutions to guide the behavior of individuals in communities.

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IX. Appendices and Tables

Table 3: Identifying Institutional Statements in the Colorado Aquaculture Act

Section Level	Sample Text Chapter 0, Article VI, Aquatic Wildlife	Units of Obs.
Section	#014 – Aquatic Wildlife Health Management	
Section	**(i)** Inspection and Certification for Prohibited and Regulated Fish Diseases	
Sub-Section	**(2)** All such facilities shall be annually inspected by a qualified fish health pathologist for prohibited diseases.	1
	[All such facilities shall be annually inspected by a qualified fish health pathologist for] regulated diseases, as applicable.	2
Sub-Sub Section	**(i)** Prohibited Diseases	
Sub-Sub-Sub Section	**(1)** All salmonid facilities must be certified to be free of Infectious Hematopoietic Necrosis Virus (IHNV)	3
	[All salmonid facilities must be certified to be free of] Viral Hemorrhagic Septicimia Virus (VHSV)	4
	[All salmonid facilities must be certified to be free of] Oncorhynchus masou Virus (OMV)	5
Sub-Sub-Sub Section	**(2)** All facilities with non-salmonid fishes must be certified free of Viral Hemorrhagic Septicimia (VHSV)	6

Table 4: Syntax Coding of the Institutional Statements in the Chapter 0 Aquatic Wildlife Document

Institutional Statement	All such facilities shall be annually inspected by a qualified fish health pathologist for both prohibited and regulated diseases as applicable
A	A qualified fish health pathologist
B	All such facilities
D	shall
I	be inspected
C	annually
C	for prohibited diseases
	And regulated diseases, as applicable
O	NA
Institutional Statement	All salmonid facilities must be certified to be free of the following diseases: Infectious Hematopoietic Necrosis Virus (IHNV) Viral Hemorrhagic Septicemia Virus (VHSV) Oncorhynchus masou Virus (OMV)
A	[CWD or a qualified fish health pathologist]
B	All salmonid facilities
D	must
I	be certified
C	to be free of infectious Hematopoietic Necrosis Virus (IHNV)
C	to be free of infectious Viral Hemorrhagic Septicemia Virus (VHSV)
C	to be free of infectious Oncorhynchus masou Virus (OMV)
O	NA
Institutional Statement	All facilities with non-salmonid fishes must be certified free of Viral Hemorrhagic Septicemia Virus (VHSV).
A	[CWD or a qualified fish health pathologist]
B	All facilities with non-salmonid fishes
D	must
I	be certified
C	free of Viral Hemorrhagic Septicemia Virus (VHSV)
O	NA

Table 5: Summarizing Institutional Statements

	Colorado Aquaculture Act	Chapter 0 Regulations
Number of Strategies	9	38
Number of Norms	57	271
Number of Rules	3	0
Total Number of Institutional Statements	69	309

Table 6: *Attribute* **Frequency in Colorado Aquaculture Act**

Attribute Type	Frequency
Commissioner of Agriculture	21
Aquaculture Board	18
Colorado General Assembly	6
Division of Wildlife Commission	4
Aquaculture Board Member	2
Department of Agriculture	2
Members of the Fish Health Board	2
Person who violated any of the provisions of this article	2
Any federal, state, or county agency, or any person possessing a valis scientific collecting permit	1
Any person who operates or uses an aquaculture facility, whether as owner, operator, lessee, or pursuant to any contract, or who otherwise buys, sells, trades, or acts as a broker of live fish or viable gametes	1
Court	1
Each person seeking to obtain an aquaculture facility permit	1
One or more satellite stations of a fish production facility	1
Quorum of the Aquaculture Board	1
State Treasurer	1
Zoo accredited by the American association of zoological parks and aquariums	1

Table 7: *oBject* Frequency in Colorado Aquaculture Act

oBject Type	Frequency
Aquaculture	3
Aquaculture Facility Permit	3
Nothing in this Section	2
Annual Permit Fee	1
Destruction of Aquatic Organisms or Quarantines	1
Destruction Orders	1
Fees and Penalties Collected	1
Moneys in the Aquaculture Fund	1
Revocation or Suspension of Permit	1
Rules and Regulations	1
This Article	1

Table 8: *Attribute* Frequency in Chapter 0 Regulations

Attribute Type	Frequency
Colorado Division of Wildlife	25
All aquatic wildlife being transported within Colorado	15
Director [from Colorado Division of Wildlife]	13

Table 9: *oBject* Frequency in Chapter 0 Regulations

oBject Type	Frequency
Applications for exemptions	29
At least one measurement of the gap size	11
Best Management Practices (BMP's) for fish production facilities	9

Table 10: *Deontic* Frequency in Colorado Aquaculture Act

Deontic	Colorado Aquaculture Act
Must	43
May	16
Must Not	1
Total Number of *Deontics*	60

Table 11: Deontic Frequency in Chapter 0 Regulations

Deontic	**Chapter 0 Regulations**
Must	204
May	65
Must Not	2
Total Number of *Deontics*	271