Influence of Policy Actors' Values on the Role of Science in U.S. Ocean Policy: Integrating Methods for Investigating Human Dimensions Issues in Environmental Policy

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Abstract
The role of science in ocean policy is influenced by values reflected in the perceptions policy actors express about scientific and political facts and processes. Discourse and policy analytics framed in scientific methodological terms yield useful information to specific questions that are responsive to quantitative results but limit considerations of complexity regarding values surrounding human interactions. This paper explores a recent study that combines narrative analysis and V diagramming to inform and guide the logic used in the statistical Q Method investigation of discourse participants' values in the U.S. Commission on Ocean Policy (USCOP) review process. The analysis is conducted within the framework of deliberative public policy and conflict theories and the debates surrounding approaches to discourse. Because the study is *about* science and the scientific method, *about* policymaking and methods by which policy is produced, and *about* how the two interact, combining and interlacing the methods considers the complexities and relationships within the specific USCOP process. Weaving data and methods helps to frame, test and interpret the statistical results.

I. Background

I.1 Introduction

The necessary relationship of environmental science to politics and to policymaking has led to widespread directives for building a democratic knowledge-based society (European Commission Directorate-General for Research 2006; National Research Council 2005) by addressing what has been described as a "mutual incomprehension between scientists and decision makers"(Clark 2007). Meaningful inclusion of human dimensions at all stages of the scientific and decision making process on multiple scales and across disciplinary boundaries is increasingly recognized as significant. The current President of American Association for the Advancement of Science (AAAS) recently called for sustainability science that is "interdisciplinary, intersectoral and integrative" on a worldwide scale (Holdren 2007). Understanding and evaluating the scientific evidence contributing to discussions and decision making often requires a level of technical expertise not shared by public or policy audiences (Jasanoff 2004; National Research Council 2005). In work relating to cultural norms ascribed to by the environmental scientific and policymaking communities including uncertainty (Clark and Majone 1985; Majone 1989; Tickner 2003) and (Tickner, Raffensperger, and Meyers 2005) the roles of policy actors' values in ocean environmental discourse and conflict has remained under-investigated.

Traditional discourse and policy analytics framed in scientific methodological terms yield useful information to specific questions that are responsive to quantitative results but limit considerations of complexity regarding values surrounding human interactions. This paper considers the interrelationship of methods used in a recent study investigating the role of discourse participants' values in the U.S. ocean policy review process to address some of that

complexity (Wilson 2006). The study findings, conducted within the framework of deliberative public policy, conflict theories and debates surrounding discourse approaches, reveal that the necessary collaborative work between scientific and non-scientific policy actors could be aided by a more complete understanding of culturally influenced values and intentional actions that are influenced by occupational norms held by the respective policy actors. The ways in which this study integrates methods, theories and questions from the social and natural science to address such issues is applicable beyond ocean policy to the emerging interdisciplinary field of sustainability science.

I.2 Context for the Study

Ocean and coastal issues are increasingly visible instances of the larger science / policy controversy (van Eeten 1999, 2000; Mitchell and Paroske 2000) that requires attention to the human dimensions element as coastal populations increase, fisheries decline, pollution crosses political boundaries, climate change is assessed, security issues receive worldwide focus, and mineral and petroleum energy resources become scarce (NSTC Joint Subcommittee on Ocean Science and Technology 2006). In 2004, The U.S. Commission on Ocean Policy (USCOP) presented the first recommendations for national comprehensive ocean policy change in over three decades. Subsequent analyses and recommendations have shown that many of the most critical and pressing conversations involve controversies over science and how it is used in the policy process. Disparities in technical knowledge and social processes can undermine both the credibility of policy actors and the usefulness of science.

Beyond knowledge gaps, conditions may spawn disputes when values diverge or discourse is obscured by philosophical tradition, community boundaries or rhetoric. Problem-structuring concepts, formal analysis of judgments and decision analytics vary between ocean scientists and decision makers because of their institutional cultures, norms and values. Experts compete for dominance in agenda setting through implementation by legitimizing positions within the social sphere in both the scientific and decision making realms (McComas 2001). A growing emphasis on "Habermasian" participatory processes and legitimacy issues heighten tensions as lay knowledge that reflects a range of societal norms and values is incorporated into decision making. Interrelationships of influential parties influence the conversation within the rest of society. Together these factors constitute perceived fundamental conflicts among opposing viewpoints, often resulting in difficult or intractable disputes or suboptimal use of science in policy decisions.

Collaboration, particularly through information consensus, is often suggested as a positive approach to such differences (Wondolleck and Yaffee 2000; Dryzek 1997; Keil and Desfor 2003). Policy actors are entreated at all levels to use collaborative processes for environmental governance issues. Nowhere is that challenge more pressing than in ocean and related climate issues in which the urgent call for interdisciplinary and transdisciplinary process as defined by Funtowicz's "postnormal science" (Funtowicz and Ravetz 1992) requires blending social scientific and natural scientific principles, methods and findings. Such collaboration requires the continual interfacing of science and policy actors, knowledge and methods.

I.3 Frameworks and Strategies

A psychologically safe communication climate that respects a variety of values and points of

view helps to mitigate the challenges to collaboration, (Gibson and Gibbs 2006), particularly in large scale or global projects and issues such as ocean policy and climate change. Dryzek's political theory, particularly involving issues of information consensus and public discourse, and Berejikian's discourse model (Dryzek 2004, 1990; Dryzek and Berejikian 1993) together with the debates surrounding approaches to discourse (Skollerhorn 1998; Alario 1998) provide a foundation from which to explore values within the science / policy interface.

Value-focused thinking as a decision-analytic tool considers that attention to values can serve as the basis for key steps in designing decision processes, developing more widely supported alternatives and recognizing opportunities to improve the range of available choices (Keeney 1992). Studies in environmental decision making frequently involve concerns about judgments and values. Values influence issue-based topics such as *what* should guide choices about scientific research agendas, from fundamental research to practical applications of research. Further, values questions influence the relationships among strategic objectives, how research problems are chosen, and methods chosen for selecting levels of analysis and scales that are appropriate for linked decisions among disciplines and across political agencies (McDaniels and Gregory 2004). Key judgments about such topics directly influence the study and practice of complex environmental decision making and applied social learning issues (Keeney and McDaniels 2002).

Dryzek's and Flyvbjerg's revival of Aristototelian *phronesis,* sometimes translated as "practical wisdom," offers a theoretical construct for analyzing values within the U.S. ocean policy review process. Using phronesis in this context places social science and its methods in specific relationship to scientific methods (Flyvbjerg 2001). Taking the phronetic approach requires purposefully examining the practical interrelationships of problem construction, agenda setting, inclusion of actors and data at different scales and scopes of time, spatial distribution, power differentials etc. For example, judgments come into play in using experts' advice on matters of uncertainty. Uncertainty is currently handled primarily in a casual manner. Experts are often unquestioned by non-technical audiences. In other situations, position-holders may create a competing expert forum that results in tension among experts and suboptimum decisions that limit the ability to discover new choices, highlight disagreements and undermine confidence in experts. Broadening this application of phronesis to inform a combined theoretical and practical study of ocean policy, it serves as a framework within which to statistically analyze Q-method data about values relating to social and environmental questions.

Cognitive hierarchy theory states that players who are not in equilibrium due to power, position or ability each assumes the primacy of his or her strategy (Camerer 2004). Network theory considers that policy networks share a common body of knowledge and a common allegiance to professional norms (Schneider and Ingram 1997; Mingus 1999). Intercultural collaboration and conflict theories are useful in analyzing information about values that contribute to policy decision making. The contribution of such theories is enhanced when guided by continuous application of the principles of practical wisdom. For example in this study the process reveals that areas of potential agreement, even on issues assumed to be mired in intractable conflict, may be discovered through inquiry into culturally influenced values and intentional actions. Integrating public policy with intergroup cultural analyses based on values, communications, collaboration, and value-rational potential zones of agreement may yield information about more productive future discourses. Purposefully navigating intergroup cultural commonalities and

differences may improve communications – resulting in better and more durable policy decisions.

II. Multiple Methods for Investigating Scientists' and Policy Makers' Values

Interdisciplinary collaborative process requirements expose the pressures on both ocean scientists and policymakers to act. Values held by individuals directly affect their discourse and their actions. Scientists are professionally obligated to ideals that promote rational processes. Scientists require time to consider variables, replicative potentials, and peer review processes. Policymakers are obliged to attend to political realities, human perception, and short timelines for action. In the case of the USCOP process, both scientists and non-scientists hold values that affect their inputs into environmental decisions. Understanding values held by influential ocean science and policy actors is a precondition to finding ways to improve the discourse between them. The study discussed in this paper about the U.S. ocean policy review process includes among its objectives:

> To identify and compare specific core and peripheral values held by the types of policy actors in the ocean policy conversation and
>
> To assess how those values influence the potential agreement zones between policy actors, and assess how types identified in the policy discourse are currently positioned and might better fit into the ocean policy development and governance structure (Wilson 2006).

Because this study is *about* science and the scientific method, *about* policymaking and methods by which policy is produced, and *about* how the two interact, combining and interlacing the methods considers the complexities and relationships within the specific USCOP process. Weaving data and methods helps to frame, test and interpret the statistical results.

II.1 Interrelationships among Methods and Data

Alternating between the conceptual and methodological continually subjects analytical technique to theoretical logic. V diagramming, narrative analysis and Q method were integrated before results were placed within in a policy map of ocean policy events. This paper concentrates on how the first three methods, used concurrently and iteratively rather than sequentially, created results and processes that are integral parts of one another and of the composite results.

Integrating these methods revealed new information about the roles of values in the science / policy interface. For example, early interview, text, and observation data used to construct research questions were combined with later interview, text, and observation data to create themes which revealed discourse characteristics and statements representing the breadth of the ocean policy discourse: the 400-statement Q concourse. Factor analysis through Q method then revealed "ideal types" exhibiting scientific and policy cultural values sets calling for further interviews to yield deeper insights into values and reasoning. From this effort, four discourse types or "factors" carrying significant power and influence differentials emerged. Cross-referencing statistical findings with narrative and V diagramming results helped to validate or challenge the strength of those findings.

Most studies about values do not investigate values and attitudes from the subjects' point of view, but rather from the pre-determined conditions researchers are interested in investigating across

different subjects. Such studies tend to limit the variables according to the parameters of statistical methods used in survey research, often exclude public policymakers from the samples, and make no attempt to deal with those who work across functions (Steel et al. 2004). Instead, Q method, especially when enhanced by interacting with the other methods as in this study of values in ocean policy, encourages emergent objective and subjective data to elaborate on or even reframe a study.

II.1.1 Narrative Analysis

Interest in narrative approaches for natural resources has been shown in studies like Satterfield's work about trade-offs of hydroelectric power and fisheries (Satterfield, Slovic, and Gregory 2000). Natural and social scientific research efforts use subjective decisions about what data to include, what questions to ask, whom to ask and what methods to use. These important subjective judgments are only beginning to be more formally studied and consciously considered in an interdisciplinary context for environmental decision making.

In this study, analyses of the texts, observations, and key informant interviews framing the research questions also contributed to the Q concourse (more fully defined later in this article), and framed an emergent context for the study. Narrative analysis as a compliment to statistical analytic evaluation served as a filter through which to consider conditional judgments and decisions in research design. Central elements in this analysis were the questions developed from the discussions with knowledgeable actors in the ocean policy discourse (see Table 1 below.)

Table 1 Issues guiding key informant interviews, narrative analysis and V diagrams

- How can the ocean environmental science / policy interface be conceptualized?
- What factors hinder or promote learning and useful interchange between science and policy?
- Is there a larger goal to the interchange than either "good science" or "good policy?"
- To what extent and in what contexts does scientific evidence influence ocean policy?
- What counts as "evidence" for environmental policy-making?
- How can the quality of evidence be evaluated?
- How does the framing of evidence influence policy-making?
- Can conflict be managed between scientists and policymakers through a process of negotiation?
- How can the worlds of science and policy be reconciled for better environmental decision making and better science?
- At what levels, through whom, and in what venues does learning occur that will improve the science / policy relationship?
- If a new framework for communication was established and implemented between scientists and policymakers, would better decisions for the oceans result?
- What are the characteristics of a better ocean environmental decision?

Specifically designed narrative coding techniques, together with a clear understanding of the relationships among those techniques, can aid in systematically laying out the elements

surrounding subjective judgments inherent in environmental policy issues. Open thematic coding (identifying broad themes), selective coding (alpha-numeric representations of data connections and links to key research issues) and interpretive data coding (abstract emergent issues from combined statistical, narrative and V diagram data) each had a distinct function in this study; each informed the other coding designs, culminating in the emerging picture of the ocean policy conversation and context. Iterative reflexivity sharpened the understanding about how meaning was being derived by discourse participants through viewing the data from different perspectives and with different criteria and topical markers, verifying theoretical relationships among emergent values and types discovered in the Q process. Capturing thoughts generated from the participants' reflective deliberation during and after the sort, and coding the narrative data by ideal types that emerged from the Q study, placed the statistical results within the practical discourse. Further, the narrative analytical process connected the data to the V diagrams linking methodological and practical aspects of theory in a logical flow of inquiry about the communication issues between scientists and policymakers.

II.1.1.1 Roles of Interview and Observation Strategies

Interview strategies contribute to the research design by encouraging and capturing emergent data through non-formulaic responsive interviewing following Rubin (Rubin and Rubin 2005) in "conversational partnerships" that allow for more detail and for participants to add their own thoughts rather than closely adhering to a list of pre-determined questions. These data are amenable to analytic elements of "thick description" (Geertz 1973) and memoing technique (Strauss and Corbin 1998; Glaser 1998; Glaser 1978) for a result that is flexible but not random (Rubin and Rubin 2005). Interview strategies in this study were guided by the above framework. Further, the "elite" interview process (Dexter 1970) was chosen because it is most effective when the interviewer has detailed subject matter knowledge and can judge the biases of the interviewees (Hershman and Russell 2005), and can act as an analytic tool through reciprocal placement of the interview data in context of what emerges throughout a study. Participants volunteered information about what they felt was most important in the ocean policy review process focusing on specific issues like fisheries, offshore production, and governance matters that affect all issues. This influence was used in weighting statements for later inclusion in the Q-set and for data analysis.

The first set of interview subjects, n=32, fell within 19 self-defined categories category hybrids (see Table 2 below) of ocean scientists and policymakers at local and national scales and other pertinent stakeholders categories. Self-definition is philosophically compatible with Q-methodology. The interview subjects did not serve as Q participants; Q participants contributed an additional 15 post Q-sort interviews which were woven back into the analysis.

Table 2 Self-defined Categories of Initial Interview Subjects

Scientists	Policymakers	Scientist/Policymaker Hybrids and Other Discussants
Coastal Plant Biologist	Federal Agency staff	Oceanographer, U.S. institutions and international advisor
Academic International Institution scientist	Attorney - Ocean Environmental Law	Agency scientist involved in legislation and agency representation
Resource Manager/Scientist – State Agency	Congressional staff	Science journalist covering marine issues
Marine Mammalogist	Marine Protected Areas - oversight organization Staff	Community members – fishing
Marine Geneticist	Consultant – Environmental policy and law	Community members – residents non/fisheries
Native American Fisheries Scientist	ENGO executive	
	Academic communications specialist	
	Regional ocean policy board members	

Observations at meetings related to the ocean policy review process added another type of data to the study. Attendees at 10 observed meetings engaged in informal conversations with the researcher and with one another as part of the meeting processes. A protocol was developed to guide data collection so that data could be compared across observations for inclusion in the Q concourse. At the same time, sufficient flexibility was maintained to capture information that was unique to a particular observation at it related to the research questions, particularly those pertaining to precaution and risk, communications, best practices, democratic processes and policy development.

II.1.2 V Diagramming

V diagramming was used to further investigate the research questions that guided the logic behind the creation of the Q concourse. Using this approach, earlier narrative analysis was purposefully linked with the study's research questions in context of the theoretical and practical aspects of the research process. After major concepts were thematically and selectively coded, detailed interpretive coding was conducted through V diagramming using it as an analytical tool rather than as a design tool[1]. The V diagram was invented in 1977 by Bob Gowin in a seminar on science and education at Cornell University. It has been used as a heuristic device to analyze scientific knowledge claims. The V diagram is a particular type of concept map juxtaposing a

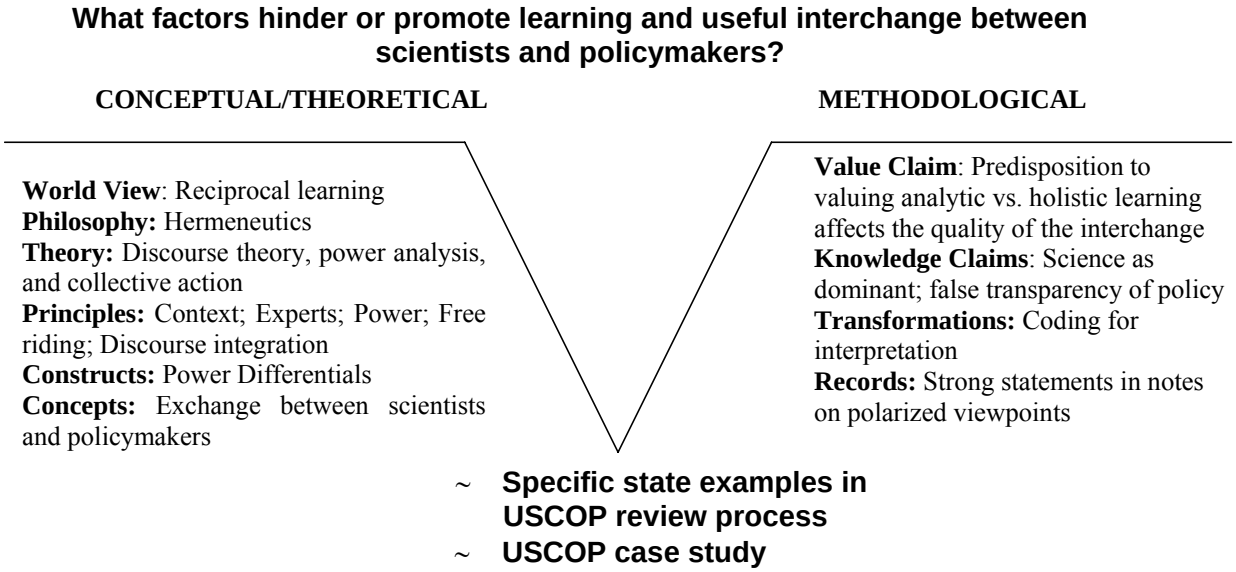
[1] V diagrams have frequently been used to design studies or decision making processes.

conceptual (thinking) side with a methodological (doing) side around a central focus question (Gowin and Novak 1984) (see Figure 1 below).

V diagramming has been used to explore how professionals can gather and interpret the information they need for effective decision making.[2] According to its creator, it is a method for "simplifying complexity without denying it" (Gowin and Alvarez 2005). V diagramming gives prominence to philosophy as a significant part of the structure of knowledge making it an appropriate method for the interpretation of the complex concepts and ideas from interviews, literature, and observation notes. In this study, the research questions provided the framework for the V diagrams by serving as "focus questions" in 12 separate V diagrams – one for each research question.

The V diagram is divided into two regions, the conceptual/theoretical and the methodological. Each element is related to the focus question; the interplay between the two regions filters through that focus question. The left side begins with philosophical and theoretical underpinnings of the question. This allows for testing the question within the literature surrounding the study. By following down the first column, concepts emerge from the theory which then becomes particularized into "events" or phenomena of interest *as they relate to the focus question* at the bottom of the V. Moving to the right side of the V, the lower part of the column indicates the records that need to be created in the research. Moving up the right-hand side of the column shows how those records are transformed by coding and analysis into knowledge and value claims.

Figure 1 Sample V-Diagram from Study: Question #2



[2] V diagramming in a graduate research course for decision making at the Lewis and Clark Graduate School of Education and Counseling illustrates an academic application in social science.

V Diagram Factors Hindering and Promoting Interchange: Incorporation of Literature, Theoretical, Interview, and Observational Analyses Applied to the Research Question

World View: Even among different cultures, learning goes both ways. Each culture teaches and each culture learns.

Philosophy: Recognition of the Aristotelian ontological variations episteme, techne and phronesis within interpretation of knowledge both given and processed.

Theory: Power theories, social learning theories and culture. At issue are perceived differences in culture and the place and importance of power in the discourse. Each exists within the context of the other.

Principles: Related to context, this question addresses the level of dependence on context. Other principles include the definition and appropriate use of experts, the super-additive nature of power, free riding limiting collective action, and tactical productivity and strategic integration of the discourse.

Constructs: The exchange between the two groups sets the parameters around science as expert and legitimizes the unidirectional scientific critique of social science. Science perceives the need funding from policymakers, not ideas or processes. Considerations include the consensus learning model.

Concepts: Agenda setting, question framing in the USCOP process, selection of the Commissioners, view and use of the PEW report.

Records: Notes from participating in the OR team federal response & WA public response processes.

Transformations: The notes are coded for developing the Q concourse and to preserve special comments for interpretation.

Knowledge Claims: The purpose of science is to develop a predictive theory and to explain; it is to inform policy. Other side claims scientists are overly-revered in the process of ocean policy. The policy process is hidden although there is "apparent transparency" through public involvement and due process.

Value Claim: Differences on timeframes, precaution, and risk are considered as examples of analytic vs. holistic dispositions.

Applying one V diagram to each research question shown in Table 1 and coding the narrative data provided a framework for defining the characteristics of the Q concourse and the choices about the subsequent Q set. V diagramming also helped refine the issues framing the pre and post Q-sort interviews. This systematic approach, as shown above for one of the research questions, also forced a return to the core questions for analyzing composite results after completing the Q-sort and legislative mapping.

Each research questions in Table 1 logically follows the one before, because they emerged in that order from the early interview and other narrative analyses. For example the value claim resulting from the V diagram of the question shown above, "predisposition to valuing analytic vs. holistic

learning affects the quality of the interchange," led directly to question #3: "Is there a larger goal to the interchange than either "good science" or "good policy?" In this way, the resulting values claims emerged as twelve well-supported data points, each leading into the next sub-question under investigation to show the logic linking theoretical abstractions to the concrete, practical events in the U.S. ocean policy review. Progressive V diagrammatic results acted as a test to help ensure that the range of larger ideas and statements was captured for use in the Q concourse that formed the basis for examining values held by a particular set of scientific and policymaker actors.

II.1.3 Q Method

Statistical analysis of the study's data about values provided another set of results that strengthened the study. Over 2,000 theoretical and applied Q studies have been published in a variety of disciplines including medicine, psychology, environmental studies and policy (Valenta and Wigger 1997). Recent Q method studies have yielded information about stakeholders' beliefs and values (Swedeen 2004; Shilin, Durning, and Gajdamachko 2003; Proops 2001). Q includes quantitative methods, rules and tenets from the natural sciences. It also augments factor analysis with new ways of knowing from the social sciences. It is in this realm that conventional policy analysts have started to see Q as a useful tool in integrating the natural and social sciences (van Eeten 2001a, 2000). Q method research is not designed to be generalized to a population beyond the subjects in a defined research study. Rather, its aim is to uncover, explore, and categorize valid and authentic viewpoints concentrating on a small number of subjects. The prevalence and distribution of Q study's results may be subsequently tested in a larger population through surveys or similar techniques designed to extrapolate results to a larger population.

A rigorous qualitative analysis such as the one described above for this study lays a stronger basis for employing Q method to analyze statistically the data to reveal "ideal types"[3] exhibiting scientific and policy cultural values sets held by study participants. Q method is a structured approach to studying subjectivity including opinions, beliefs, viewpoints, or attitudes (Brown 1993). As such, the goal is to broaden the range of ideas through having the research subjects generate their own ideas rather than restricting the ideas by a preconceived framework generated solely by the researcher. Q methodology is based on the following premises of subjectivity: first, it is self-referential, and second, it is communicable by the participants (Amin 2000; van Exel NJA 2005). Beginning with the premise that each individual perceives the world differently, this study used Q method to construct typologies of theoretical frames of different perspectives on the role of values in the science / policy interface in U.S. ocean policy review.

Q holds a values orientation for human motivation and stresses that discovering attitudes provides a way of indirectly knowing that which is unobservable. This is aligned with Weber's concept of explanatory understanding, but with a twist: the knowledge is emergent from the subjects themselves rather than existing in pre-determined categories to be tested (Addams and Proops

[3] Weber's four ideal types are traditional behavior, affectual behavior, rational value-oriented action, and rational goal oriented action. These types are not normative, but serve as a comparative tool through which to examine particular instances and discover what is unique in each case by finding commonalities and variations between types

2000).[4] In this study, ocean scientists and policymakers participated in a "Q-sort" and were afterwards interviewed for deeper insights into values and reasoning. The discourse types or "factors" that emerged facilitated an examination of policy actors' perceptions through their values and beliefs, and illuminated ways in which perceptions, actions, and discourses affect communications among policy actors.

Because of its compatibility and iterative reflexivity with qualitative methods, Q method can contribute to policy design, selection, implementation, and evaluation in ways otherwise unavailable through surveys and R methodology. In this study, Q method illuminated specific areas related to consensus and conflict (Steelman and Maguire 1999) in part by revealing patterns from correlations made across participants' values. In this way, Q method provided broader information about underlying issues surrounding potential agreement and causes of dispute than the more common comparisons drawn from the way subjects respond directly to particular questions.

In this study, uncovering the patterns began with constructing the Q concourse of 400 statements from the above-described narrative coding and V-diagramming analyses of a combination of key primary documents. Direct testimony to the U.S. Commission on Ocean Policy, transcripts from the parallel PEW Commission process as well as statements contained in the two reports, transcripts from Congressional hearings, semi-structured interviews with key informants, and group observations were used to construct the concourse.

The concourse was reduced to a 64 statement Q-set that represented the range of viewpoints (Addams and Proops 2000), following Brown in approximating the range of types of statements in the original concourse (Brown 1980). Through placing the statements within a 4x4 matrix according to Dryzek and Berejikian helped to ensure that the Q set was representative of the full range of types of political discourse and of content and argument claims (Dryzek and Berejikian 1993) (see Table 3 below). Categories emerged which were checked for consistency by applying the open and selective coding results from the narrative analysis processes. Each of the 400 statement was further labeled as possessing attributes of *one or more* major quadrants.

Using cell structure as a heuristic device following Fisherian experimental design principles, the statements were reduced to a manageable number while maintaining the conceptual breadth of the original concourse. Like the study by Dryzek and Berejikian, this was a highly political conversation with a number of nuances and highly charged language. Since the intent was to seek the quintessentially political aspects of discourses and to engage in what Seidel and others termed political discourse analysis (Seidel 1985), it was an appropriate approach for the conversation on ocean policy. The table below shows how a modification of Dryzek and Berejikian's approach to combining Q method with political discourse analysis reflects this particular discourse while maintaining that the discipline, rather than the researcher, defines the domain.

[4] This is the reason that one would not, for example, test a Q-sort derived solely from a concourse with individuals who are "expert" in a field of knowledge related to the content of the discourse if that group of experts left out actual discourse participants; the information from those experts would significantly slant the research view of the discourse that actually occurred, and therefore distort the emergent attitudes and values within the Q process. This is also why Q method proscribes against the research predetermining categories of the discourse only from experts that do not represent the full range of discourse participants.

Table 3 Modified Categories within the discourse:[5] Concourse statements to Q-Sort statements

Types of Claims Made in Arguments	**Expert Decision Making** (ontology as it relates to conceptual claims reflecting on expert decision)	**Degrees of Agency** (relative power possessed by specific actors)	**Motives** (material self interest, larger social civic interest, indifference)	**Assumed Political Relationships** (hierarchies based on education, political circumstances, societal norms etc. by the actors themselves)
Definitive (concerning the meaning of terms, e.g. precaution or uncertainty)	20 of 400 concourse statements reduced to 4 statements:	12 of 400 concourse statements reduced to 4 statements	17 of 400 concourse statements reduced to 4 statements	12 of 400 concourse statements reduced to 4 statements
Designative (concerning perceptions of questions of fact e.g. the primacy of scientific thinking or what constitutes power)	33 of 400 concourse statements reduced to 4 statements	36 of 400 concourse statements reduced to 4 statements	29 of 400 concourse statements reduced to 4 statements	34 of 400 concourse statements reduced to 4 statements
Evaluative (concerning the worth of something that does or could exist, e.g. scientific knowledge, strength or limit of science as a way of knowing)	37 of 400 concourse statements reduced to 4 statements	20 of 400 concourse statements reduced to 4 statements	30 of 400 concourse statements reduced to 4 statements	28 of 400 concourse statements reduced to 4 statements
Advocative (concerning something that should or should not exist, e.g. boundaries).	27 of 400 concourse statements reduced to 4 statements	16 of 400 concourse statements reduced to 4 statements	21 of 400 concourse statements reduced to 4 statements	28 of 400 concourse statements reduced to 4 statements

[5] The parameters for structuring the types of arguments people make are based on a hybrid of Toulmin's classification scheme (Toulmin 1958), which is frequently employed in legal and logic models. The matrix was used to break down the categories of discourse into logical units utilizing Toulmin's classification of claims that may be made in arguments (definitive, designative, evaluative and advocative). Together with vanLehn's hypothesis-evidence argument that incorporates expectations about the question under investigation (vanLehn 1985), the Toulmin model concentrates on decomposition of the problem into issues, positions, and opportunities to support contested positions.

As an instance of emerging data influencing research design decisions, the modification was accomplished by making rational judgments based on the narrative and V-diagramming analyses. Berejikian's definition of ontology was narrowed to reflect the categories in the actual discourse. Also, the original category "unnatural political relationships" was redefined as "assumed political relationships" so that statements addressing hierarchies based on education, political circumstances of the time, and social norms as perceived by the actors were more appropriately represented. This subtle distinction denoted a less permanent position of "assumed relationship" within the hierarchy than "natural" divisions would indicate and better reflected the specific conditions within this study in which actors may change or combine their occupational affiliations, and hence their cultures of practice.

Within standard Q methodology, the primary classification is not the type of argument but the categories within the discourse. However, adding Toulmin's structure to the discourse categories, but formulating it over content or functional categories, aided in organizing the discourse to help ensure a Q-sort statement selection that best represented the full discourse on scientific subject matter and questions of employing scientific methods in the final policy discourse analysis. Such modifications have been suggested as ways in which to increase the usability of discourse representation models (Newman and Marshall 2005). Further, since the intent was to test the logic of the statements deemed significant and appropriate to cover the discourse, Algirdis Greimas' semiotic squares guided the narrative analysis at this point by formally considering statements containing oppositional logic.[6] Applying this logic to the selection of Q statements within a quadrant is consistent with Q methodology's goal of capturing all elements of the discourse within a concourse and subsequent Q-set. Semiotic squares techniques have often been used in policy analysis to critically examine ways in which policy positions are related to each other (Roe 1994) and to increase the number of alternatives available for controversial and intractable issues (van Eeten 2001b; Addams and Proops 2000).

After the Q-set was constructed, participants in the study were asked to rank-order the statements along a continuum from -4 to +4 according to the subjects' preferences. Through this ranking, participants attributed subjective meanings to the statements, revealing their values by being challenged to prioritize statements and create relationships among the statements that represented the larger conversation. Each of the fifteen Q-sort participants were purposely selected for their specific occupational affiliations and for their self-labeling as scientists or policy professionals. Post Q-sort interviews focused on the 86% who showed characteristics of an "ideal type." These data were again coded and placed within the overall scheme to be considered in later composite data analysis.

Individual participant rankings were subjected to a factor analysis through which persons rather than tests were correlated following Stephenson (Stephenson 1935). This type of analysis reveals factors, or theoretical types, only if statistically significant clusters of correlations exist. Revealed factors are described through their common values, attitudes, beliefs, or viewpoints. Eight unrotated factors were extracted using PQMethod software (PQMethod 2002). Five factors

[6]An explanation of Greimas theory and semniotic squares, can be found at http://www.cla.purdue.edu/academic/engl/theory/narratology/modules/greimassquaremainframe.html. Further information is available in Dino Felluga's "The Road is Clear : Application" in *Introductory Guide to Critical Theory* available at http://www.purdue.edu/guidetotheory/narratology/.applicatioons

emerged that had an eigenvalue ≥1.[7] They were selected for rotation (McKeown and Thomas 1988) using the Varimax orthogonal method and verified against graphical manual rotations. They were then flagged to select the participants who showed characteristics of particularly "pure" cases of each factor - those that explained more than half of the common variance, and are significant at $p<.05$. Factors with the least commonality to other factors typify more unique types whereas those with high commonality show less variation. Because this study focused on large categorical differences, unique types were of particular interest in this study and were sought by design in the P-set selection and in the choice of a leptokurtic forced sorting pattern. The resulting factor arrays expressed the idealized points of view for the participants in this study.

The three highest-loading factors' were initially examined noting defining sorts as shown in Table 4 below and by other indicators to see if the three factors sufficiently accounted for the discourse characteristics. Q encourages checking interim findings against logic and judgment throughout the process. A somewhat weaker but important fourth variable was shown to be valuable in the analysis due to its attributes of power in decision making that were not apparent in the statistical results but have real-world implications in ocean policy decision processes and outcomes.

The ideal factors that emerged were:

Factor A: Expert Knowledge
Factor B: Instruments of Social and Economic Process
Factor C: Individualism
Factor D: Communitarian

Table 4 Factor loadings and variables

	Factor A: Expertise	**Factor B: Instruments of Social & Economic Process**	**Factor C: Individual-ism**	**Factor D: Commun-itarian**
Factor A Marine Biologist	0.8413*[8]	-0.1600	0.1189	0.2327
Environmental Agency Biologist	0.7061*	-0.0474	.04483	0.2400
Environmental Journalist/Chemist	0.7639*	0.2049	0.0752	-0.0171
MPA Manager/Biologist	0.7139*	0.0101	0.3085	-0.0982
Academic - Oceanographer /Community Education	0.6592*	0.4682	0.0696	-0.1193
Ocean Environmental Advocacy/ Policy Analyst	.07775*	0.2983	0.0536	-0.0613
Factor B Attorney	0.0527	0.7185*	-0.0962	0.3379
Academic - Public Policy	0.1200	0.7320*	0.2917	-0.1551

[7] Eigenvalues are derived from the sum of all of the squared loadings for a particular factor.
[8] Note: * shows a defining sort for P-set individuals that defined that Factor. The numbers show the direction and relative strength of the defining sort for each participant category.

Factor C Research Organization Administration/Oceanographer	0.2673	0.2655	0.5227*	-0.1201
Environmental Agency /Oceanographer	0.0467	0.1854	0.7226*	0.1386
Academic - Microbiologist	0.1835	-0.0694	0.6519*	0.1099
Factor D Scientific Nonprofit Director	0.2392	0.0294	0.4041	-0.5591*
Coastal Community Political Actor	0.0755	0.0529	0.3616	0.6681*
These two did not load significantly on any factor: Coastal CBO Manager[9]	0.4834	0.0911	0.1966	0.5133
Environmental Negotiator/Ecologist	0.5623	0.4799	0.3241	0.0109

II.2 Findings and Methods: Relationships of Interlaced Methods and Study Findings

This study suggests that areas of potential agreement, even on issues assumed to be mired in intractable conflict, may be discovered through inquiry into culturally influenced values and intentional actions informed by democratic and conflict theories and practices. Descriptions of the emergent factors illustrated distinctly different conceptions about what was of value in the science / policy discourse.

The four factors explained 62% of the total variance in the set of Q-sorts. After rotation, thirteen of the fifteen participants met the PQMethod flagging criterion for pure cases: six on Factor A (Expert Knowledge); two on Factor B (Instruments of Social and Economic Process); three on Factor C (Individualism); and two on Factor D (Communitarianism). A few representative findings appear below to illustrate the type of information derived from interweaving methods throughout the analysis.

Factor A accounted for 36% of the total variance, assigned the highest positive score to a normative prescription for science and public perception as key to making things work, and said that the norm should be largely scientific and well informed by scientific expertise. While they indicated that social science has its role and does not overtly harm the scientific method, they were clear that they believed policymakers need more scientific information than is currently available to guide good ocean policy decisions. Factor B strongly favored indicators from both the natural and human environments with a particular sensitivity to economic components. Accounting for 9% of the variance, this factor criticized ocean policy for being piecemeal, political, redundant, and contentious. Factor B valued summary arguments disclaiming the objectivity of the natural sciences and favoring balance over precaution. Factor C also accounted for 9% of the total variance. This factor preferenced the interests and capabilities of the individual over either social or environmental concerns, holding that sustainable development indicators are unsatisfactory guidelines. A distrust of large government defined this factor type; they showed a slight inclination to favor scientific expertise in decisions. Factor D valued actions at the

[9] CBO denotes a community-based organization.

community level, shied away from big government believing in making community decisions based not on political compromise but on scientific facts but with the benefit of summary arguments. Factor D accounted for 8% of the total variance.

An important revelation in the analysis was that the overriding commonalities among the factors were at the level of unimportance related to technical aspects of the USCOP documents or process (non-significant at $p>.05$), which appeared to result from disinterest or feelings of insufficient knowledge to comment. Early Q-sort data interpretation indicated that strong factors in this overall P-set, although involved in ocean policy issues, did not consider themselves well enough versed in the technical aspects of the policy process to usefully comment or to express their values through strong feelings. But that interpretation would have been incomplete. Later interviews showed that reactions to these reports were based more on participants' values relating to using science in policy than on the degree of knowledge about or interest in the specific instance of the application of those values in U.S. ocean policy. Even with this further explanation, additional nuances were discovered among the factor types.

The reluctance to comment on technical aspects by the more expert and process-oriented Factors A and B was due to their perceptions of insufficient information (such as technical briefings or the scientific studies) *to allow them to know whether the statements truly represented their values about using science in ocean policy* and a hesitation to commit "on record" to public positions on specific issues in the complex and multi-faceted discussion. For Factor A, the discomfort was more about commenting on policy without a strong perceived factual basis than to a lack of specific information. Factor B took the more political standpoint of choosing not to comment on isolated statements. Ultimately both factors claimed to need more information before commenting, but for different reasons. Weaker but important similarities surrounded statements about which the factors were not neutral. While most reported in post Q-sort interviews that socio-economic and biophysical systems are interactive (regardless of whether environmental or economic concerns weighed more heavily for the participant who defined the factor), equality between the two was non-significant ($p>0.01$) to the participants. Critical nuances would have remained undiscovered without the qualifying narrative analysis of additional interview data that clarified factor types' values related to the research questions at a depth that the statistical analysis alone could not accomplish.

II.2.1 Correlations as an Interim Step

To encourage fruitful interactions, an assumption was made that it might be important to establish areas of agreement before taking on issues containing more basic value differences between groups. Therefore, this study also investigated whether statistically identified correlations signaled discourse areas where common ground could be established. For example, positive correlations were analyzed by focusing on underlying values similarities between Factor A (Expert Knowledge) and Factor C (Individualism) including the notions that "there are too many actors in the ocean policy process" and that "science actors also often operate at the level of self-interest." The strong correlations between Factors A (Expert Knowledge) and C (Individualism) at 0.4095 indicated a potentially important relationship between those factors which might render greater zones of potential agreement than between other factors, but the statistics alone did not indicate what those commonalities might have been. Conversely, areas in which significant differences existed also warranted further investigation (e.g. 1. how valuable each factor found

models, and what the appropriate use of models could be, and 2. whether or not political designation of recovery regions works). If the identified differences proved to be highly negatively correlated, they might signal topics that would best be avoided in early discussions because they contain the seeds of basic values differences. Strong correlation does not presume statement consensus. To say two factors correlate does not mean they agree on specific statements, but rather that they show a similar variability in regards to particular statements.

Again emphasizing the importance of judgment, literature on Q method suggests that Q statistical correlations should be considered as intermediate steps in the analysis of Q data. While correlations offer information, they should not be considered merely statistically, outside the context of the discourse (Brown 1980). Issues considered when placing correlations in context included the importance participants assigned to statements during Q-sort interviews, and the power differentials among the participants who loaded high on a particular factor type. Factors' correlation statistics were therefore compared with both the listed differences between specific factors and with the distinguishing statements for each factor. As in the example of strong overall correlation between Factors A and C discussed above, statements about which factors had the strongest degree of difference needed exploration by topic to examine their relative importance to the overall discourse. At the other end of the scale, the weakest correlation of 0.0130 between Factors A (Expert Knowledge) and D (Communitarian) indicated a potentially less consequential relationship. A weak correlation could either denote less agreement potential, or fewer things about which factors strongly disagree. Additional contextual analysis was required to ascertain the meanings of weaker correlations to investigate the consensus information potential within the weaker correlations.

II.2.2 Discovering Consensus Potentials: Sample Results from this Type of Study

Correlation is a step towards investigating areas of possible consensus but looking for areas of consensus is more complex than simple correlation. Because Q measures how each factor relates each particular statement to all the other statements in the Q-set, the distinguishing statements for each factor are important information in defining the factors themselves. In this study, areas of consensus were first indicted by statements that did not serve as distinguishing statements for either member of a particular factor pair. However, to consider these as areas of potential consensus, those non-distinguishing statements also had to be examined for their statistical significance and differences. Further, they were considered within the context of the interview statements in order to identify anomalies or to confirm or deny the potential for consensus.

As shown above, values relating to science in policy questions were more powerful motivators than technical information about the USCOP review process. The larger governance issues dealt with in this report also fell into the category of potential consensus. Factors A and B had different reasons for being reticent to express views on the technical issues, but there was consensus about not expressing those views. Factors C and D primarily pled ignorance about the technicalities of the ocean policy review process. They were somewhat intimidated by the national conversation. In some cases they did not see how it applied to them locally, or felt they had neither the scientific or public policy background to comment.

The fact that all four factors shied away from these statements indicated that the technical policy issues may not be the best way to begin a productive conversation. The study shows that

beginning with the technical issues, especially issues at the federal ocean policy issue level, before finding points of agreement might even impede the discovery of other hidden commonalities. Starting with the "wrong" questions or problem statements could have the unintended consequences of promoting deeper or intractable disputes. Further, knowledge about why the various factors did not relate to those technical issues offered information about areas with good potential for agreement – a positive starting point for improving communication and understanding.

III Discussion and Conclusion

Discovery of reliable knowledge about improving practices among policy actors in a complex environment requires applying pluralistic methods to value-rational questions. A combination of narrative content analysis, V diagramming and Q analysis was used in the study examined in this paper to describe and interpret identifiable factors that contribute to problematic communications between ocean scientists and policymakers. Each method and its resulting data sets informed the others. Narrative analysis was used in the framing of the study including the Q concourse and Q-set development. Q method's factor analysis was used for analyzing the discourse by representing statistically-derived factors as policy-related narratives. These factors were then interpreted using concepts and data from the narrative analysis in order to combine all aspects of data collected including pre and post Q-sort interviews, observations, and transcripts which were placed within the context of the literature and theory through V diagramming. Data collected and iteratively analyzed was used to modify research designs and inform research judgments throughout the process.

III.1 The Importance of Varied Scales and Scopes

Statistical information including results from the Q study's factor analysis comes in discrete parcels that yield some value through modeling and reductionist strategies. At the same time the irreducibly rich nature of social systems and interactions such as policy discourses and outcomes lead many social scientists to the conclusion that they can only be assessed within a theoretical perspective. Flexibility in scale and scope as called for by both environmental scholars and practitioners requires interdisciplinary methods and knowledge, inclusion of diverse data, and reliance on democratic discourse. By placing new inquiry and findings within a dynamic scale pulsing from a meta-scalar perspective to the particular and back out again to the larger scale, points of view can be more faithfully rendered, examined, and kept in context.

The role of scale in the discussion of preferred policy making methods is exemplified by the Q statement in this study regarding the dominant "Expert" factor's insistence upon the scientific method as the best model for decision making. By contrast, local stakeholders of both the "Individualistic" and "Communitarian" persuasion were more concerned about situationally dependent local issues that theoretical larger scale issues in what Martha Nussbaum calls the "priority of the particular" (Nussbaum 1990). Remembering that policy is a process rather than a product, it often morphs when applied at different scales. Two examples of this that have occurred since the completion of the formal ocean policy review process are: 1) the plethora of independent federal agency "comprehensive" strategic plans for the ocean;[10] and 2) coastal state

[10] Each agency claims to have the scientific expertise and tools to lead the effort. For example the USGS

processes designed to keep policies and management within political rather than ecological boundaries (Amos 2005),[11] despite the commissions' reports and other urgings such as the consensus statement for marine ecosystem-based management signed by leading science and policy experts (Communication Partnership for Science and the Sea (COMPASS) 2005).

Why are scale and scope so important? Questions posed (and solutions offered) at different scales are quite different. For example, it is easy to assert, as many do, that knowledge lies in the local communities. While that may be considered true at one scale, locals do not ask the same questions as national policy actors. Yet those national actors seek support to achieve legislative victories for and from small communities who are asking the micro-question: what happens to their local economy if they cannot fish for salmon during a year of declines in wild stocks?

Scope is also a factor. Environmental policies are always subject to economic conditions and methods. For example, under the standard view of environmental management review of disputed issues, market failure and preferably quantifiable damage in economic terms are labeled as the environmental causes for action. Under neoclassical economics, the end-of-pipe solutions encourage the science of remediation over the science of prevention. Powerful discussants, for instance those from environmental engineering, embed their assumptions and beliefs in the conversation because there is no challenge to the legitimacy of capital accumulation. In a discourse such as this, monetized cost-benefit analyses dominate environmental policies under structured processes that pre-determine the "appropriate" questions.[12]

III.2 Addressing Complexity in Science and Policy Interactions

Traditional policy and discourse analytics framed in strictly scientific methodological terms control the variables in ways that can yield useful information to specific questions that are responsive to quantitative results. By definition, such studies usually limit the complexity regarding values that surround human interactions. The basic tenets of positivism are usually applied to a general methodology for acquiring scientific knowledge which is considered within those studies to be certain and value free (Azevedo 1997). When applied as the best or only way to approach social scientific questions, this form of scientific inquiry leaves a large number of questions unanswerable. To address such limitations, this study was guided by inductive logic that allowed emergent data to frame and address questions that were not pre-determined by the researcher. Quantitatively derived findings were placed within qualitatively defined contexts.

"A Plan for a Comprehensive National Coastal Program" (U.S. Geological Survey 2004) states, "The overall goal of this Program is to provide the scientific information, knowledge, and tools required to ensure that decisions about land and resource use, management practices, and future development in the coastal zone and adjacent watersheds can be evaluated with a complete understanding of the probably effects on coastal ecosystems and communities…"

[11] For example, in the Pacific NW, the OPAC process in Oregon and the Ocean Policy Workgroup in Washington bear remarkable resemblance to each state's goals and initiatives. The USCOP recommended Regional Oceans Councils that were designed to be more related to ecosystem boundaries than political boundaries. While states recognize in their statements the cooperative requirements of ocean policy and management, many of the outcomes (such as budgetary) reflects state boundary politics, tensions, and competition.

[12] This discussion thread is a synthesis from the personal privileged conversations with research participants.

Moving reflexively among data collection, analysis, framing (Schon 1983), and reconceptualization as defined by Strauss, personal conversations, interviews, texts, and interchanges during observed meetings were continuously analyzed and compared providing narrative descriptive data that created a context in which the intimate connection between the scientific and policymaker actor could emerge. This study illuminates aspects of the working relationship of intergroup and intragroup values and norms in ocean environmental policy. Through focusing on values using interconnected methods, this work exposes dimensions in the discourse that may highlight less obvious commonalities and differences between scientists and policymakers in the ocean policy discourse. This study also shows the inherent potential in allowing and encouraging instances to emerge in which interests may correlate on seemingly unrelated topics. These instances may then reveal opportunities to recast the discussion along consensus trajectories or even reframe the problem.

While an inclination has been shown towards modeling social systems on the study of ecological systems (Field, Hempel, and Summerhayes 2002), care must be exercised when using this approach in how humans learn and communicate. The social world is even more complex than the physical world. Although long held as primary rules of democratic discourse, theories of higher level learning processes that claim primacy of rules-based communicative rationality have been seriously challenged (Flyvbjerg 2001). For example, Dreyfus contends that rational thinking alone is inadequate for comprehending the breadth of human activity. Applying his theory of five levels of learning to expert scientists and government agents charged with the development and promulgation of policy with respect to the environment suggests that there is a more advanced position to strive for that lies beyond the common definition of "expert" - defined as technical proficiency and occurring between learning levels three and four. Dreyfus' fifth level of expert operates at a level of moral and ethical vision intuitively beyond rules, but wisely uses analytics when a problem occurs (Dreyfus and Dreyfus 1988). Looked at in this way, the goal becomes embedding higher level social learning processes in the discourse of environmental policymaking (Keegan and Dyball 2005). In this study, multifaceted cultural proclivities and individual values reached beyond stereotypes to help define actions. Q method, which could have been another tool to further stereotyping, was shown instead as an implement for contributing to handling intractable disputes through reframing the discourse.

This research also addressed the nature of questions which must remain appropriate within and across knowledge systems. When old and instrumentally-based questions are posed to address increasingly complex situations, the results fail to meet our expectations. Framing better questions requires an understanding of underlying reasons behind ecological and human systems' changes and their unintended consequences. More complete questions also require acknowledgement of the need for social and political adaptations at a fundamental level rather than at the reactionary and remedial level. This work involves not only asking different questions, but also using practical wisdom and judgment to frame the discourse by appropriately including information from scientific studies and placing technical "solutions" as transitory tools rather than end results – appealing to the wisdom inherent in human values. Operating in this intentional and holistic way may help elevate the current ocean policy and other environmental and climate change discourses from the current state of deep immersion in the dialectic ideology that seeks compromise to a superior form of dialogue based in social justice and equity.

Ecologist and philosopher David Abram says discourse, as with language itself, is a "complexly

ramified web" and has meaning only in relationship to all other parties to the discourse (Abram 1996). Max Weber defines value-rationality as one of the ideal types of social action. Having been largely ignored in favor of instrumental and technical rationalities, it now takes its place in defining relationships by integrating a "reflexive analysis and discussion of values and interests…. aimed at praxis" (Flyvbjerg 2004). Aristotle and Weber agree that such a balance is a precondition for a sustainable and decent society.

III.3 Putting it Together: Theory, Method, and Practical Application

The statistical Q study examined in this paper had at its core a concourse based on reflexive analysis and further structured through narrative coding and V diagramming. As additional interviews conducted as part of the Q-sort process were woven back into the analysis to help interpret and test the statistical results by combining the theoretical and practical aspects of the research, values in intergroup communications were placed into the realm of cultural factors in policy analysis. In this way, the framework was set for more in depth investigation of the topic within and beyond ocean policy which, according to Geva-May, is also sparsely populated in the literature of public policy (Geva-May 2002). A similar call for applications of cultural theory in policy analysis research is also made by Hoppe (Hoppe 1999) and by Bobrow and Dryzek (Bobrow and Dryzek 1989).

However, independent theories fail to give adequate information to alter the science / policy discourse process when taken by singly (much like the concepts of "wise use" and "ecological modernization").[13] Perhaps the answer lies in connecting flexible pluralistic theories requiring consideration, judgment, and choice through the application of practical wisdom regarding both theory and practice. Attention to boundary zones of methods, knowledge and cultures reveal major characteristics of different variables and pinpoint where scales may overlap. Just as, in studying the coastal zone in which research oscillates from large ecosystem scales to single communities, organism or water sample, it is appropriate in studying ocean policy processes to alternate between wet and dry zones, large theory and particular practice, and flexible and more structured methods.

If the goal of the ocean policy review process is participatory and open deliberative decision making, a dialogue across disciplinary and cultural boundaries that divide scientists, policymakers and the public must incorporate appropriate consideration of how scientists might work with policymakers to tackle the complex multiscalar and integrated issues surrounding ocean policy (Wilson 2004). Looking at values and value-laden types through composite lenses like Q method, V-diagramming, and narrative analyses, and then setting those findings into the practical structure of political events as modeled this study can provide useful information for framing new interrelationship strategies between environmental scientists and policy makers.

[13] The "wise use" movement puts private property matters first and foremost. "Ecological modernization" is a technical accounting of environmental processes within society and is the basis for the concept of sustainable development (Bond 1999).

References

Abram, D. 1996. *The spell of the sensuous*. New York: Vintage Books.

Addams, H., and J. Proops, eds. 2000. *Social discourse and environmental policy: An application of Q methodology*. Cheltenham, UK.: Edward Elgar.

Alario, M. 1998. Global environmental risks: Between political hazards and policy decisions. *Journal of Risk Research* 1 (4):295-306.

Amin, Z. 2000. Q methodology: A journey into the subjectivity of the human mind. *Singapore Medical Journal* 41 (8):410-414.

Amos, A. M. 2005. A snapshot of U.S. activities in ecosystem-based fisheries management: A report to the Lenfest Ocean Program at The Pew Charitable Trusts: Turnstone Consulting.

Azevedo, J. 1997. *Mapping reality: An evolutionary realist methodology for the natural and social sciences*. Albany: State University of New York Press.

Bobrow, D. B., and J. S. Dryzek. 1989. *Policy analysis by design*. Pittsburgh, PA: Pittsburgh University Press.

Bond, P. 1999. Economic growth, ecological modernization or environmental justice? Conflicting discourses in South Africa today. Paper read at Political Economy the Environment and Economic Crisis, August, at Bantam, CT.

Brown, S. R. 1980. *Political subjectivity: applications of Q methodology in political science.* New Haven, CT: Yale University Press.

———. 1993. A primer on Q methodology. *Operant subjectivity* 16:91-138.

Camerer, C. F. 2004. A cognitive hierarchy model of games. *The Quarterly Journal of Economics* 119 (3):861-898.

Clark, W. C. 2007. Linking knowledge with action for sustainability. *Presentation at the 2007 AAAS Annual Meeting: Science and Technology for Sustainable Well-Being*, February 18.

Clark, W. C., and G. Majone. 1985. The critical appraisal of scientific inquiries with policy implications. *Science, Technology and Human Values* 10 (3):6-19.

Communication Partnership for Science and the Sea (COMPASS). 2005. Scientific consensus statement on marine ecosystem-based management.

Dexter, L. W. 1970. *Elite and specialized interviewing*. Evanston Northwestern University Press.

Dreyfus, H., and S. Dreyfus. 1988. *Mind over machine: The power of human intuition and expertise in the era of the computer*. New York: Free Press.

Dryzek, J. S. 1990. *Discursive democracy: Politics, policy and political science*. Cambridge, UK: Cambridge University Press.

———. 1997. *The politics of the earth: Environmental discourses*. New York: Oxford University Press.

———. 2004. Handle with care: The deadly hermeneutics of deliberative instrumentation. Paper read at Empirical Approaches to Deliberative Politics, May 21-22, at Florence, Italy.

Dryzek, J. S., and J. Berejikian. 1993. Reconstructive democratic theory. *American Political Science Review* 87 (1):48-61.

European Commission Directorate-General for Research. 2006. From science and society to science in society: Towards a framework for "co-operative research," Report of a European Commission workshop, Governance and Scientific Advice Unit of GT RTD Directorate C2. Luxembourg: Office for Official Publications of the European Communities.

Field, J. G., G. Hempel, and C. P. Summerhayes. 2002. *Oceans 2020: science, trends and the*

challenge of sustainability. Washington DC: Island Press.
Flyvbjerg, B. 2001. *Making social science matter: Why social inquiry fails and how it can succeed again*. Translated by S. Sampson. Cambridge, UK: Cambridge University Press.
———. 2004. A perestroikan straw man answers back: David Laitin and phronetic political science. *Politics and Society* 32 (3):389-416.
Funtowicz, S. O., and J. R. Ravetz. 1992. Three types of risk assessment and the emergence of post-normal science, edited by S. Krimsky and D. Golding. Westport, CT: Praeger.
Geertz, C. 1973. Thick description: Towards an interpretive theory of culture. In *The interpretation of cultures*, edited by C. Geertz. New York: Basic Books.
Geva-May, I. 2002. Cultural theory: The neglected variable in the craft of policy analysis. *Journal of Comparative Policy Analysis: Research and Practice* 4:243-465.
Gibson, C. B., and J. L. Gibbs. 2006. Unpacking the concept of virtuality: The effect of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly* 51:451-495.
Glaser, B. G. 1978. *Theoretical sensitivity*. Mill Valley, CA: Sociology Press. .
———. 1998. *Doing grounded theory - issues and discussions*. Mill Valley, CA: Sociology Press
Gowin, B. D., and M. C. Alvarez. 2005. *The art of educating with V diagrams*. Cambridge: Cambridge University Press.
Gowin, B. D., and J. D. Novak. 1984. *Learning how to learn*. Cambridge,: UK Cambridge University Press.
Hershman, M. J., and C. Russell. 2005. Report on interviews with regional ocean and coastal leaders in the Pacific Northwest, August 2004-January 2005: Assessing the potential for regional ocean governance in the Pacific Northwest: University of Washington.
Holdren, J. 2007. Session Presentation to Grand Challenges to Sustainable Science: Sustainable Systems. *2007 AAAS Annual Meeting: Science and Technology for Sustainable Well-Being*, February 17.
Hoppe, R. 1999. Policy analysis, science, and politics: From speaking truth to power to making sense together. *Science & Public Policy* 26 (3):201-210.
Jasanoff, S. 2005. *Risk, precaution and environmental values*. Carnegie Council on Ethics and International Affairs 2004 [cited March 18 2005]. Available from http://www.carnegiecouncil.org/media/683_jasanoff.pdf.
Keegan, M., V. Brown, and R. Dyball, eds. 2005. *Social learning in environmental management: Towards a sustainable future*. London: Earthscan.
Keeney, R. L. 1992. *Value-focused thinking: A path to creative decisionmaking*. Cambridge, MA: Harvard University Press.
Keeney, R. L., and T. McDaniels. 2002. A framework t guide thinking and analysis about climate change policies. *Risk Analysis* 21 (6):898-1000.
Keil, R., and G. Desfor. 2003. Ecological modernisation in Los Angeles and Toronto. *Local Environment* 8 (1):27-44.
Majone, G. 1989. *Evidence, argument and persuasion in the policy process*. New Haven: Yale University Press.
McComas, K. A. 2001. Theory and practice of public meetings. *Communication Theory* 11 (1):36-55.
McDaniels, T., and R. Gregory. 2004. Learning as an objective within a structured risk management decision process. *Environmental Science & Technology* 38 (7):1921-1926.
McKeown, B., and D. Thomas. 1988. Q Methodology. Sage University (Paper 66).
Mingus, M. S. 1999. Comparative network theory: An interpretive study of the Canada-United

States pacific salmon treaty. Dissertation, Public Administration, University of Colorado at Denver, Denver.

Mitchell, G. R., and M. Paroske. 2000. Fact, friction, and political conviction in science policy controversies. *Social Epistemology* 14 (2/3):89-107.

National Research Council. 2005. Decision making for the environment: Social and behavioral science research priorities. Panel on Social and Behavioral Science Research Priorities for Environmental Decision Making. Committee on the Human Dimensions of Global Change, Division of Behavioral and Social Sciences and Education. Edited by G.D. Brewer and P.C. Stern. Washington, DC: The National Academies Press.

Newman, S. E., and C. C. Marshall. 2005. *Pushing Toulmin too far: Learning from an argument representation scheme*. Xerox Palo Alto Research Center 2005 [cited November 30 2005]. Available from http://www.csdl.tamu.edu/~marshall/toulmin.pdf.

NSTC Joint Subcommittee on Ocean Science and Technology. 2007. *Charting a course for ocean science in the United States: Research priorities for the next decade*. JSOST, August 30 2006 [cited March 5 2007]. Available from http://ocean.ceq.gov/about/docs/jsost_chartcourse_083006.pdf.

Nussbaum, M. C. 1990. The discernment of perception: An Aristotelian conception of private and public rationality In *Love's knowledge: Essays on philosophy and literature*, edited by M. C. Nussbaum. Oxford, UK: Oxford University Press.

Proops, J. 2001. Attitudes towards the environment: Informing and reforming environmental policy. Paper read at Fifth International Conference of the International Society for Ecological Economics (ISEE): Ecological Economic Management and Planning in Regional and Urban Systems, September 26-29, at Moscow, Russia.

Roe, E. 1994. *Narrative policy analysis: Theory and practice*. Durham, NC: Duke University Press.

Rubin, H. J., and I. Rubin. 2005. *Qualitative interviewing: The art of hearing data*. Thousand Oaks: Sage Publications.

Satterfield, T., P. Slovic, and R. Gregory. 2000. Narrative valuation in a policy judgment context. *Ecological Economics* 34:315-331.

Schneider, A. L., and H. Ingram. 1997. *Policy design for democracy*. Lawrence: University of Kansas Press.

Schon, D. 1983. *The reflective practitioner*. New York: Basic Books.

Seidel, G. 1985 Political discourse analysis. In *Handbook of discourse analysis: Discourse analysis in society*, edited by T. A. v. Dijk. London: Academic Press.

Shilin, M., D. Durning, and N. Gajdamachko. 2003. How American ecologists think about coastal zone environments. In *Values at Sea*, edited by D. Dallmeyer. Athens University of Georgia Press.

Skollerhorn, E. 1998. Habermas and nature: The theory of communication action for studying environmental policy. *Journal of Environmental Planning and Management* 41 (5):555-573.

Steel, B., P. List, D. Lach, and B. Shindler. 2004. The role of scientists in the environmental policy process: A case study from the American west. *Environmental Science and Policy* 7:1-13.

Steelman, T. A., and L. A. Maguire. 1999. Understanding participant perspectives: Q-methodology in national forest management. *Journal of Policy Analysis and Management* 18 (3):361-388.

Stephenson, W. 1935. Correlating persons instead of tests. *Character and Personality* 4:17-24.

Strauss, A. L., and J. Corbin. 1998. *Basics of qualitative research: Techniques and procedures for developing grounded theory* 2nd ed. Thousand Oaks, CA: Sage

Swedeen, P. 2004. The potential for sustainable forestry in Washington state: A discursive and institutional analysis. Dissertation, Ecological Economics, The Union Institute & University, Cincinnati.

Tickner, J. A. 2003. Precautionary assessment: a framework for integrating science, uncertainty and preventive public policy. In *Environmental Science and Preventive Public Policy*, edited by J. A. Tickner. Washington DC: Island Press.

Tickner, J. A., C. Raffensperger, and N. Meyers. 2005. The precautionary principle in action: A handbook. Place Published: Science and Environmental Health Network. Available at www.biotech-info.net/handbook.pdf (accessed October 27, 2005).

Toulmin, S. 1958. *The uses of argument*. Cambridge, UK: Cambridge University Press.

U.S. Geological Survey. 2006. *A plan for a comprehensive national coastal program*. U.S. Department of the Interior 2004 [cited February 23 2006]. Available from http://www.wb-infokiosk.org/bp.php?url=http://marine.usgs.gov/coastal-plan/usgs-ntl-coastal-plan.pdf.

Valenta, A. L., and U. Wigger. 1997. Q methodology: Definition and application in health care informatics. *Journal for the American Medical Informatics Association* 4 (6):501-510.

van Eeten, M. J. G. 1999. 'Dialogues of the deaf' on science and policy controversies. *Science & Public Policy* 26 (3):185-192.

———. 2000. Recasting intractable policy issues: The wider implications of the Netherlands civil aviation controversy *Journal of Policy Analysis and Management* 20 (3):391-414.

———. 2001a. Recasting intractable policy issues: The wider implications of the Netherlands civil aviation controversy. *Journal of Policy Analysis and Management* 20 (3):391-414.

———. 2001b. Recasting intractable policy issues: The wider implications of the Netherlands civil aviation controversy *Journal of Policy Analysis and Management* 20 (3):391-414.

van Exel NJA, G. d. G. 2005. *Q methodology: A sneak preview* 2005 [cited December 17 2005]. Available from www.jobvanexel.nl.

vanLehn, K. 1985. Theory Reform Caused by an Argumentation Tool Palo Alto, CA: Xerox Palo Alto Research Center

Wilson, L. A. 2004. U.S. ocean policy review: Science and policy opportunities and challenges. *Littoral 2004: Delivering Sustainable Coasts: Connecting Science and Policy* Proceedings, 1:25-30.

———. 2006. Communications between ocean scientists and policymakers: An analysis though the U.S. ocean policy review process. Dissertation, Public Policy / Administration, Union Institute & University, Cincinnati.

Wondolleck, J. M., and S. L. Yaffee. 2000. *Making collaboration work: Lessons from innovation in natural resource management*. Washington DC: Island Press.