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**FACULTY WORKING
PAPER NO. 1279**

Probing Two Chief Executives' Schematic Knowledge
of the US Steel Industry Using Cognitive Maps

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the US Steel Industry Using Cognitive Maps

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ABSTRACT

PROBING TWO CHIEF EXECUTIVES SCHEMATIC KNOWLEDGE OF THE US STEEL INDUSTRY USING COGNITIVE MAPS.

Our ultimate theoretical curiosity concerns organizational transformations. One objective is learning about transformations from the vantage point of industry insiders, viewing industry transformations as cognitive phenomena (as opposed to studies which consider only technical/material phenomena). This paper describes some preliminary analysis from an empirical research project concerning the steel industry. Our principal methodological innovation involves using cognitive mapping. Specific empirical research presented in this paper includes analysis of cognitive maps derived from statements attributable to Mr. David Roderick (chairman of U.S. Steel) and Mr. F.K. Iverson (CEO of Nucor Steel) which we analyzed using a computer program.

Lastly, the paper describes how this study fits into a long range research program for studies of industry transformations.

WHAT WE KNOW (AND DON'T KNOW) ABOUT STRATEGY

For about 20 years scholars have studied several empirical themes in the policy/strategic management field, with varying success. These principal foci include: strategy and structure (Chandler, 1962), environment and strategy (Lawrence & Lorsch, 1967; Lawrence & Dyer, 1983), generic strategies (Miles & Snow, 1978; Porter, 1980), and strategy and performance (Rumelt, 1974). Although these theories/studies contribute important findings about strategy, they share some limitations. Many studies are cross-sectional, take an abstract macro-level view, rely on meagre direct contact with organizations under the microscope, and use multivariate statistics to reach conclusions (e.g. Hambrick, 1984). Even though theorists claim that "environments" affect "strategy", we don't know why or how. We need to know more about how managers maneuver between environmental facts and circumstances, organizational structures, and strategic actions.

Therefore, sooner or later we must study strategists' thinking. Strategists thinking patterns provide the bridge between environmental and company circumstances and strategic actions. Some researchers now recognize the need to study the cognitive dimensions of strategy (Schwenk, 1984; Barnes, 1984; Isenberg, 1985; Walsh, 1985; Stubbart & Ramaprasad, 1985).

SCHEMA THEORY AND INTERPRETTIVE APPROACHES TO STRATEGY

● Active Processing. Situations involving effortful, complex information processing have been characterized as "active-synthetic":

"A large part of the interpretation of sensory data is provided by the knowledge of what the signal must be, rather than from the information contained in the signal itself. This extra information comes from the context of the sensory event" (Lindsay and Normann, 1972, p. 133).

Active-synthetic processes rule out the potential for an "objective" environment because "the environment" cannot be separated from the "strategist-observer." "Information" requires an interaction between an observer and stimuli (Kiesler & Sproull, 1982; Neisser, 1967).

● Enactment. Weick (1979) introduced "enactment" into the organization and management literature. Enactment is a process of actively bracketing experience into concepts and defining relationships between concepts. "Enacted realities" arrive, prosper, persist, or vanish as a function of complex, active processes which strategists impose on the stream of experience—rather than as an imposition of immanent, objective environmental structures upon the mind of a strategist (Smircich and Stubbart,

1985). Therefore, enactment is the organization-theory parallel to the cognitive psychologist's "active-synthetic."

Enactment is not envisioned as a process of incrementally reducing the gap between perceptions versus "reality". Instead, enactment is an active psychological and behavioral process of constructing, modifying, and applying interpretations which can serve as a basis for meaningful action (Smircich & Stubbart, 1985; Chaffee, 1985).

● Strategy. Strategists float in a rich, kaleidoscopic array of potential stimuli — facts, beliefs, gossip, rumors, trends, ideas, etc. For a probing mind, immense sets of cognitive enticements from this crazy-quilt universe afford a manifold array of potential inductions, deductions, inferences, interpretations, speculations, presumptions and conclusions. Since strategies are not dictated by customs, practices or beliefs, strategy making represents an enactment process sine qua non.

● Schemas. Schema theory offers a partial explanation of how strategists enact sense out of non-sense and chaos. Schemas are the cognitive dimension of enacted environments. A schema resembles a format for a computer program (Neisser, 1976). Accumulated experience — in the form of templates or frameworks — guides information processing, inferences, and decision making (Nisbett & Ross, 1980; Taylor & Crocker, 1981). Walsh (1985) has shown, for example, how manager's "success schemas" affect their information processing about strategic problems.

Consequently, the substance of "the environment", organizational strengths and weaknesses, strategic alternatives, objectives, and so forth depend upon schematic knowledge that a strategist brings to the situation (Kiesler & Sproull, 1982). Enactment produces schemas. Schemas guide enactment. Schemas can reduce the environmental maze to manageable cognitive dimensions (Bougon et al., 1977). To understand a strategist's thoughts (and actions) it would be helpful to understand her schemas.

● Summary. Findings in cognitive psychology support the idea of enactment. Schema theory suggests a conjecture that "enacted environments" are located in a strategist's schemas.

STUDYING INDUSTRY TRANSFORMATIONS

The steel industry has been studied as an economic process (Crandall, 1981), a historical process (Hogan, 1971), a technological change process (Off.Tech. Asses., 1980), a political process (Borras, 1983) and a class-conflict (Stone, 1974). Such perspectives reflect an abiding commitment to explanations

which rely on enduring structural forces "causing" the steel industry to change.

We proceed with different questions about industry change. We want to know how shifting mental schemas and evocative images — "enactments" — relate to industry transformations. How, when, and why do enacted environments change? These questions motivate our research program.

THE STEEL INDUSTRY

Because our society purportedly hovers on the threshold of an age of information-processing and high-technology: "smokestack" industries have rapidly lost their glamour. Our colleagues expressed surprise when we elected to study the dull steel industry rather than fashionable, exciting industries such as computers, micro-electronics, or bio-technology. The U.S. steel industry conveys an image of big, dirty, archaic, manufacturing—and failure. People call steel a "sunset" industry. Steel-producing regions are branded "the rust bowl". Management of steel companies are held in contempt. Beleaguered. Forlorn. Desolate. Cataclysmic images grip steel. Titles from recent publications express relentless pessimism: "TIME RUNS OUT FOR STEEL" (Businessweek, 1983), "STEEL BELTED" (Chapman, 1979), "EMBATTLED STEEL" (Challenge, May-June 1978), "STEEL —UPHEAVAL IN A BASIC INDUSTRY" (Barnett & Schorsch, 1983).

But, merely thirty years ago steel reigned in manufacturing:

"In 1950 America's steel industry was the most powerful in the world. Accounting for nearly one-half of global steel output, it produced more steel than all of Europe combined, nearly three times as much as the Communist bloc, and almost twenty times as much as Japan. Moreover, the large American steel firms enjoyed an undisputed position of world leadership in technology and plant scale —the probability that any of them would ever rise to challenge American mastery in steel seemed extremely remote. (Adams and Mueller, 1982, p.73)

Steelmakers confidently proclaimed their accomplishments and invincibility:

"Americans, of course, don't like to take second place in any league, so they expect their steel industry to be bigger and more productive than the steel industry of any other nation or earth. It is; but what many Americans do not know is that their own steel industry is bigger than those of all the other nations on earth put together. No other nation in the world could have matched that record. It is a record that stands in glorious tribute to the men who make steel and the men who built steel in America" (Ben Fairless, president of US Steel, Jan. 1951).

Thirty years is not such a long time from a strategic management perspective. Massive, abrupt changes provoke curiosity.

The rest of this paper describes our efforts to elicit strategists' enacted environments, in the form of their schemas about steel industry conditions, using cognitive mapping.

● METHOD. First, our research group found out everything we could about the steel industry and its history. We collected a formidable array of articles, books, studies, interviews; attended conventions, and even watched films. We zeroed in on the time period 1979-1984, reasoning that '79-'84 represented a period of excitement, and potentially startling transformation within steel. We selected three steel industry participants who represent important groups — David Roderick (chairman of U.S. Steel), Lloyd MacBride (head of the steelworker's union), and Kenneth Iverson (president of Nucor—a steel mini-mill). The data from the Roderick study mainly include analysis of his public statements about the industry between 1978 and 1984.

- What is "Cognitive Mapping?" Cognitive mapping includes several different techniques for identifying, representing, manipulating, and evaluating texts. Most cognitive maps have been a form content-analysis, relying on published documents. Cognitive mapping was first used by Tolman (an experimental psychologist) in 1948. City planners used cognitive maps to explore the theme of man in his physical environment; investigating how individuals "map" and interpret their architectural surroundings (Lynch, 1960). Later, political scientists began using cognitive mapping (Axelrod, 1976).

The emergence of the personal computer has heightened the practical potentials of mapping (Ramaprasad & Poon, 1985). Cognitive mapping can help decision makers cope with the enormous cognitive complexity of policy problems by providing an interactive manipulable, external representation of complex relationships (Ramaprasad & Poon, 1985; Eden et al., 1979; Diffenbach, 1982; Maruyama, 1963).

- The Maps. An examination of several maps follows. The maps span two strategists' statements regarding steel industry conditions. The source-texts were not chosen randomly. After examining many documents, we selected texts which expressed the strategists' recurring themes. For Roderick's maps (RODtxt1, RODtxt2) we enlisted the cooperation U.S. Steel Company. Mr. Iverson's maps were derived from one speech he made (IVsp) plus personal interviews (IVpi) and a questionnaire (IVq) which Mr. Iverson completed (See References, "Research Texts").

- Mapping Process. Cognitive mapping is qualitative, but not arbitrary. Coding proceeded according to elaborate rules developed by Wrightson (1976). Three judges independently examined documentary data to identify the concepts mentioned within a text and to code the cause-effect relationships between concepts, according to the text.

To facilitate analysis, cognitive maps are best represented as a matrix of relationships (Ramaprasad & Poon, 1985; Eden et al., 1979). These matrices contain cause-effect relationships stipulated by the text [see Exhibit One (RODtxt2) and Exhibit Two (Ivq)]. Algebraic (not statistical) manipulation of such matrices generates useful information. The description, comparison, and evaluation of these matrices support the theoretical level of the research.

- Aggregating Concepts into Categories. Analysis of Mr. Roderick's statements produced a total of 208 linked concepts. Judges sorted the 208 concepts into natural categories — drawn from the data. Judges discerned three appropriate levels of aggregation: all 208 concepts, 30 intermediate categories and 5 major categories. Exhibit One shows RODtxt2 in matrix form at the level of 30 intermediate categories. Aggregating facilitates understanding the overall text. Examining matrices helped us to obtain insights. Manipulations expose subtle patterns, hidden among diverse categories. Mapping crystallizes these interrelationships. Analysis also included qualitative interpretation of the texts.

A FIRST STEP: ANALYSIS OF RODERICK'S STATEMENTS

① CONTEXT. Between 1978 and 1984 the entire domestic steel industry suffered a cumulative net loss. For a long time, USS (United States Steel Co.) has watched its market share declining, its plants closing, and its debt rising. Mr. Roderick was elected chairman of USS in 1979. During the period under examination he also served as the head of the American Iron and Steel Institute (attentive to the interests of integrated steel companies). In 1983 he orchestrated the Marathon Oil merger, a significant strategic departure for USS.

② PURPOSE. Our first study was designed to test the feasibility of integrating industry transformation, schemas, and enactment. We were searching for methods to unearth, systematize, and explore a strategist's schematic knowledge of steel industry conditions.

③ WHAT WE FOUND OUT FROM THE RODERICK STUDY.

NOTE: The detailed analysis of that study is available in Stubbart & Ramaprasad (1985).

- Complex Policy Problems? According to Mason & Mitroff (1981), "wicked" problems elude definitive problem formulation, harbor ambiguous explanations, hide important feedback loops, offer a kaleidoscopic array of plausible solutions, and demand tradeoffs (pp. 10-13). Initially, we expected that the steel

industry "problem" was a wicked problem.

The cognitive maps generated from Mr. Roderick's statements are complex. But, in most respects, Roderick's statements — in substance as well as tone — fail to confirm that steel industry problems are ill-structured policy problems. Instead, he says they are simple (but tough) problems. Steel industry problems are essentially problems of control and power — not complex, uncertain problems. In these respects, our cognitive map of Roderick's statements shares similarities with maps derived by Axelrod (1976).

- Cognitive Simplifications. Schwenk (1984), Barnes (1984) and Walsh (1985) have studied the process of cognitive simplification in strategic management. Whether strategists can consistently think effectively about complex problems remains an unsettled issue. Our evidence shows that Roderick's policy recommendations systematically over-simplify the ramifications of his statements. Many of his policy recommendations have (according to his own stipulations) important indirect consequences which apparently defeat his purposes (Exhibit Three).

- Where are the Uncertainties? Dealing with uncertainties always poses a key strategic challenge. Psychological research shows that decision makers often prefer to ignore or forget about uncertainties (Carter, 1971). Mr. Roderick's statements don't disclose many questions or quandaries.

- Ideological Commitments. The texts unreservedly extoll the virtues of "free enterprise" and "free trade," condemning government "intervention" in business. They castigate foreign governments which engage in all sorts of "unfair", "predatory", "protectionist" activities. Indeed, the texts view these issues in a moral light. Nevertheless, Mr. Roderick calls for United States government activism and intervention on behalf of his beleaguered industry. But, intervention must promote free trade, not hinder it. The texts advocate protection in the name of free trade. What's interesting is how they combine the "economic struggle for existence" with ideas of fairness, equity, and sharing.

- Control: The Politics of Helplessness. Mr. Roderick's statements express deep equivocation regarding the role of the U.S. government in the steel industry. The statements blame the U.S. government for neglecting the domestic steel industry. Distrust in the U.S. government goes hand in hand with life-or-death dependence upon that powerful government. The statements describe machinations of malevolent forces, making the domestic companies helpless. Is this the dark side of "illusions of control" (Larwood & Whittaker, 1977). Shall we name this "disillusions of control?"

- Solutions. When Mr. Roderick talks about solutions he mentions going back to the status quo

ante. Mr. Roderick expresses no vision of the shape of the future steel industry except for grim allusions to "1984". Competition is the solution. But the kind of competition needed is a gentlemanly, polite kind, not a Darwinian kind. Cooperative competition. The statements argue for a safety net. Solutions involve governments and companies: ". . . all get together and define some rules we could all accept in common" (RODtxt2).

- Imagery. These statements lack vivid evocative imagery. They argue for retaliating against an invader. The metaphor of "invasions" reminds one of heroic archetypes. Domestic steel interests play the role of the helpless community under attack. Someone must protect this community from greedy, violent intruders (Importers). A hero is needed. Heroes fight against heavy odds (the importers and US govt). Heroes fight for good versus evil. Heroes understand justice and fairness. The local sheriff (US govt) has abdicated his duties, won't help. In this well-known Wild West image, a vigilante hero rides into town, taking matters into his own hands and saves the day. Who will save Steel?

A SECOND STEP: F.K. IVERSON, STATEMENTS, INTERVIEWS, AND QUESTIONNAIRE.

① Context. While integrated steel firms have been trying to catch up to modern technology, losing market share, closing plants, and losing money; Nucor has been pioneering innovations, gaining market share, opening plants, and making money. This probably accounts for the attention Mr. Iverson has been getting from news media, Congress, and analysts. Nucor is also notable for its flat organization structure and its unusual compensation system.

① RESEARCH QUESTIONS

- Perspectives. For our second step we wanted a second strategist whose statements we could compare to Roderick's. We also wanted a more direct form of access than simply public statements. We needed "thicker" descriptions and ways for evaluating public statements against other forms of expression. Documents versus questionnaires. In particular, we wanted a chance to compare a strategist's public statements to what he might say in a personal interview or write on a structured research questionnaire.

① METHOD

- Case Study. Our contacts with Iverson include a case study of Nucor, consulting, and research using cognitive maps. We studied Nucor, wrote a business strategy case on Nucor, read Iverson's statements, and interviewed Mr. Iverson at length.

- Selecting a Document. After studying many of Iverson's speeches and statements, we coded a speech he made in 1984 at the North Carolina World Trade Association about steel industry problems and conditions (IVsp).

From a total of 75 concepts in that speech we selected twenty key concepts. We designed a 21 X 21 matrix. Iverson filled out the matrix by writing a score in each cell (421 scores!). The scores in each cell of the matrix represent Mr. Iverson's judgements about cause-effect interrelationships: from +3 (a strong direct effect) to 0 (no effect) to -3 (a strong inverse effect). This map (IVq) is shown in Exhibit Two.

- Speech versus Questionnaire. We wanted to find out whether the questionnaire approach would yield results different from the map-from-documents approach. The speech contained 24 specific concept-affects-other concept pairs which could be checked on the questionnaire. Only one pair differed. Therefore, we made a preliminary determination that Mr. Iverson's beliefs remained reasonably consistent across the time period, and that the questionnaire method generates data similar to statements (at least for this specific case). Additional analyses comparing discussion, speeches, interviews, written documents, and questionnaires will help us find out how maps generated by these forms differ.

COMPARING TWO STRATEGISTS COGNITIVE MAPS

The maps are enormously complex. Finding ways to categorize and manipulate these maps poses a key challenge in developing and refining mapping. The comparisons which follow represent tentative attempts to explore this challenge.

DO THE MAPS SHARE CONCEPTS? The more concepts which two participants share, and the more they agree about interrelationships among concepts, the stronger their "culture" (Sathy, 1985). In this definition, "culture" is nearly equivalent to shared schemas. We wondered whether Roderick's and Iverson's statements share a "steel industry culture."

To make a comparison, we selected one of Mr. Roderick's texts (RODtxt1, n=77 concepts) which contained about as many concepts as Mr. Iverson's speech (IVsp, n=72 concepts). Using a hierarchical coding scheme, judges sorted each concept into a primary category based on agency. "Agency" means, "who owns the concept, whose action, whose condition?" For example, the concept WAGE DEMANDS usually belongs to Steelworker's Union. If no agency can be established the concept-label default is, "structural".

Words in CAPITALS indicate concepts used in subject's texts.

For instance, the concept PRICES does not belong to a specific group, so PRICES is structural. Next, each concept was sorted into a secondary category: "Statics," or "Dynamics," or "Affects." Statics include circumstances, conditions, or characteristics of an agent. Dynamics include processes, actions, or behaviors of an agent. Affects include norms, motivations, and needs of an agent.

- Differences. Exhibit Four illustrates the results. We noted differences in the patterns of the two maps. First, the identity of agents differs. Iverson mentions CUSTOMERS and Roderick does not. Roderick statements name INTERNATIONAL LENDING AGENCIES, WORLD STEEL, and US STEEL COMPANY, but Iverson's statements do not.

More intriguing, however, agents have different relative salience. For example, Roderick's text stipulated 7 DOMESTIC STEEL COMPANIES concepts. In contrast, Iverson's text mentions no fewer than 29 DOMESTIC STEEL COMPANY concepts. Conversely, RODtxt1 includes 22 FOREIGN EXPORTERS concepts but IVsp notes only 7 FOREIGN EXPORTERS concepts. Another large difference manifests itself in terms of STRUCTURAL agents. Of RODtxt1's 77 concepts, 29 (38%) fit into the STRUCTURAL category. IVsp uses only 12 STRUCTURAL concepts out of 72 (16%). Next, let us partially compare the statements at a more disaggregated level.

- DOMESTIC STEEL COMPANIES' statics, affects, and dynamics. We compared a set of 208 Roderick concepts (RODtxt2) to Iverson's speech (IVsp). Exhibit Five shows a partial comparison of concepts about DOMESTIC STEEL COMPANIES. How many topics and specific concepts (under the agency of DOMESTIC STEEL COMPANIES) do the two maps share? If we group "Topics" together, out of 17 topics, 7 (41%) are unique (2 for IVsp only, 5 for RODtxt2 only). Out of a total of 88 concepts compared, 24 or (27%) are unique to one of the two maps (10 for IVsp, 14 for RODtxt2).

- Similarities. The two maps share certain similarities. Both maps disclose a similar proportion of Statics versus Dynamics versus Affects. Both maps include STEELWORKERS as a very marginal agent.

● WHAT CAUSES STEEL INDUSTRY PROBLEMS?

All texts argue that domestic steel companies face difficult problems. Where do these problems originate? Exhibit Six makes this comparison. This exhibit compares IVq to RODtxt2 in terms of direct relationships between concepts and STEEL INDUSTRY WELFARE.

Using Iverson (IVq) we can ask, "How (if at all) does a particular concept affect DOMESTIC STEEL

COMPANIES' WELFARE?" Causal concepts are listed in the left-hand column. Column "A" lists effects on STEEL INDUSTRY WELFARE stipulated by Iverson. Column "B" lists effects stipulated by Roderick (RODtxt2). For example, according to both Iverson and Roderick statements AMERICAN STEEL INDUSTRY EFFICIENCY (1) boosts AMERICAN STEEL INDUSTRY WELFARE.

Summarizing Exhibit Six, we find that the two strategists statements agree about most (but not all) comparable relationships between causal concepts and AMERICAN STEEL INDUSTRY WELFARE. Notable exceptions include:

— AMERICAN STEEL INDUSTRY WAGES (9): (Iverson "positive" effect on WELFARE, Roderick "negative."). Iverson texts associate high WAGES with high productivity (Nucor's experience), but Roderick texts associate high WAGES with high costs (US Steel experience).

— FOREIGN STEEL EXPORTERS WELFARE (14) : (Iverson statements argue that FSE WELFARE is opposed to DOMESTIC STEEL WELFARE, but Roderick specifies no relationship. This difference reflects a Roderick text theme. The texts claims that various parties interests (WELFARE) are not necessarily in conflict, a position which Iverson rejects.

— IMPORT RESTRICTIONS (11): Iverson argues that IMPORT RESTRICTIONS have a negative effect on DOMESTIC STEEL WELFARE. And, he says that this effect is negligible. On the other hand, Roderick claims that IMPORT RESTRICTIONS are not only "positive", but literally a "life-or-death" issue for the DOMESTIC STEEL WELFARE.

From other analyses (not shown) we find Iverson stating that IMPORTS help USA WELFARE. Roderick protests. Iversons says IMPORTS don't harm NATIONAL DEFENSE, Roderick says they do. Iverson claims that FOREIGN GOVERNMENT SUBSIDIES don't constitute a significant advantage to FOREIGN STEEL EXPORTERS. Roderick disagrees. Iverson declares that SELLING UNDER COST is a perfectly acceptable business tactic. Roderick disputes it.

- Indirect Consequences. One interesting question is whether a map "behaves well". In a well-behaved map, higher-order consequences mirror lower-order consequences. Even if strategists understand "true relationships," they could make serious mistakes if the indirect effects of actions had net consequences opposite to the direct, obvious consequences. Mapping allows us to examine indirect consequences as well as direct relationships.

Exhibit Seven shows the relationship (according to IVq) between 21 concepts and STEEL INDUSTRY

WELFARE. It includes direct consequences (concept x — concept y), indirect consequences (concept x — concept y — concept z), and third-level consequences (concept x — concept y — concept z — concept a). The "variables" which could do the most to increase STEEL INDUSTRY WELFARE include: INCREASING BASIC US STRENGTHS (19, +2794), increasing CAPITAL INVESTMENT (8, +2522), and increasing PRODUCTIVITY OF US WORKFORCE (10, +2489). This map is quite well-behaved. Only 2 concepts have reverse consequences at the higher orders, FOREIGN STEEL EFFICIENCY (5) and WAGES OF STEEL WORKERS (9).

IVq's consistency across orders contrasts sharply with analyses of Roderick's maps. Exhibit Three shows that Roderick's RODtxt2 policy proposals have numerous, significant indirect consequences contrary to the stated intention of increasing DOMESTIC STEEL WELFARE. This comparison must merely suggestive because RODtxt2 only includes signs, not magnitudes.

● WHAT AFFECTS THE LEVEL OF STEEL IMPORTS?

A pressing policy question for the steel industry — indeed for the nation itself . . . "What can/could/should/might affect steel imports?" Exhibit Eight reports IVq first through fourth-order effects on IMPORTS (18) of changes in other variables. According to IVq, policies of: adding to ASI LONG TERM ADVANTAGES (19, -48512), increasing CAPITAL INVESTMENT (8, -44163), produce the biggest reduction in IMPORTS. Declines in FOREIGN STEEL EFFICIENCY (5, -4307), and increasing AMERICAN COMPETITIVE ADVANTAGE (2, -17205), surprisingly produce the smallest effects on IMPORTS. PROTECTIONISM BY US GOVT (11, 23179) produces an increase in IMPORTS!!

● QUALITATIVE

We plan to "deconstruct" these texts (and others) which form an important part of the discourse about steel industry conditions (Calas & Smircich, 1985). Our present comments below, merely convey our impressions drawn from a significant amount of contact with these texts.

- Uncertainty. In order to make a rough estimate of how much uncertainty these maps expressed, we analysed the two primary documents (RODI & IVsp). We checked each cause-effect linkage for any words which convey a sense of "less-than-certain." For example, CONCEPT A "could" harm CONCEPT B, or CONCEPT A "might" reduce CONCEPT B, or CONCEPT A "probably" will affect CONCEPT B, indicates probabilistic relationships.

Neither strategist's statements express much uncertainty. RODtxt1 established 67 causal connections, only one of which was "less-than-certain." Oddly, the beginning of RODtxt1 announces:

"I don't know about clocks, but I do know there's little certainty about the immediate future of steel . . . In short, what you see is not what you get . . ."

But next, it reverses itself:

"The issues are not buried or obscure. Beginning students in business and economics can identify them. Perhaps this is why they escape the full understanding of their instructors."

IVsp contains 59 causal assertions. Of these, 5 convey a bit of uncertainty. But, five of 59 (8%) is hardly rampant with uncertainty.

- Ideology. Both strategists' texts express steadfast loyalty toward principles of free enterprise. The virtues of FREE TRADE, FREE MARKETS and the salutary effects of FREE COMPETITION are taken for granted. Iverson texts appeal to these ideals to justify government restraint. We must endure pain because the market guarantees that everything will turn out OK in the end. On the other hand, Roderick statements bend the same dogma as a weapon: to vilify foreign exporters and their governments, to castigate international lending agencies, and to spur additional US government involvement — to restore FREE ENTERPRISE. Additionally, Roderick's statements promote strong moral overtones. One complains, "Conversely, should we let them (Brazil) bring steel up here? Where's the equity? Where's our sense of justice?" FREE ENTERPRISE entails moral obligations as well as utilitarian calculations.

● CONTROL. In quantitative as well as qualitative terms, Iverson's texts attributes much more control to Domestic Steel Companies. Roderick argues that DOMESTIC STEEL COMPANIES are nearly helpless. Their fate is controlled by distant, malevolent forces.

● THE FUTURE. Of the texts, Iverson's offer a more optimistic vision of the future. Roderick talks about avoiding the bleak future and returning to the status quo ante. Roderick mentions the "Orwellian" connotations of 1984!

● SUMMARY. Analysis of these cognitive maps reveals interesting and significant differences in statements attributable to very-experienced steel strategists. They identify different sets of participants in steel, and implicitly assign them different relative importances. They differ markedly in their analysis of the effects of IMPORTS, and what role the U.S. GOVERNMENT should play. Iverson's map (IVq) "behaves" more consistently across levels. Iverson's statements imply more Domestic Steel Company control. The strategist's views of the future differ sharply.

Neither strategist expresses much uncertainty about causal relationships. All texts steadfastly subscribe to FREE ENTERPRISE principles.

OBSERVATIONS AND DIRECTIONS

Based upon these preliminary studies, we offer observations. These observations are preliminary, speculative and intentionally provocative.

OBSERVATIONS ABOUT STRATEGY SCHEMAS AND STRATEGIC THINKING.

- Do Maps Capture Schematic Knowledge? At this stage, much of our information (not all) has been derived from public statements. Communication is not equivalent to schematic knowledge. We all know that what people think and what they say are not always the same.

- Schema dimensions. Both strategists' texts carry a large inventory of concepts involving steel industry conditions. Roderick's larger map (RODtxt2) contains over 200 concepts. At what level does mapping exhaust the strategist's reservoir of relevant concepts, or reach diminishing returns? Or, can a strategist keep producing concepts ad infinitum?

- Complex Strategy Problems and Cognitive Simplification. Preliminary analysis shows that these two strategists can describe interrelationships among numerous concepts. But, a few important arguments (or rhetorical clusters) dominate their policy perspectives. Moreover, Roderick's "misbehaving" concepts, and both strategists' minimization of uncertainties in steel, raise doubts about whether these strategists approach ill-structured, complex policy problems as tentatively as theorists recommend (Mason & Mitroff, 1981). Or to put it another way, "Can/Do strategists really think about organized complexity?"

Can they use what they know? If strategists approach "wicked" problems with assumptions consistent with well-structured problems, important implications for strategy follow.

- Linear Relationships. In written texts, in interviews, and in structured questionnaires; both executives' texts relied entirely on linear-monotonic relationships between causal variables and effect variables. Iverson remarked to us that, for all intents and purposes, and over a wide range of values, linear-monotonic relationships work fine. Do strategists often discern other types of relationships?

- Feedback Loops. Coding speeches and written documents generated few feedback loops (as Axelrod, 1976). But the questionnaire (IVq) generated many feedback loops. The questionnaire forced Iverson to specifically think about 21 X 21 relationships. Mr. Iverson commented that doing the matrix was interesting because "... it made me think about things I had not thought about before."

- Limitations. These executives are important figures in the steel industry. Given their personal

interests, their stewardship positions, and their advocacy of political options, these maps might embody intentional omissions, rationalizations, and justifications which do not accurately reflect their "real" thoughts or schemas about steel industry conditions.

● OBSERVATIONS RELATING TO COGNITIVE MAPPING TECHNIQUES.

- Do the Maps Share a "Culture?" Similar maps (and underlying strategy schemas) imply similar "culture". Using a broad definition of schematic similarity, we found that these statements cause-effect maps contain a large subset of unique rhetorical clusters — even without taking different connotations into account. Of course, Iverson knows the "Roderick" concept "PROFITABILITY", and Roderick knows the "Iverson" concept "INNOVATION". But, the statements of "core positions" did not use these concepts.

As we make more specific comparisons, the differences become more pronounced. Therefore, these two strategists statements talk about different "entities" when each refers to STEEL INDUSTRY.

Having no standards against which to judge these data, it is hard to assess to what degree these two strategists share a "steel culture." Would comparisons of larger and larger maps multiply or reduce the similarities? How can we define "culture" and measure cultural sharing?

- The Computer Software. Computer programs are a powerful tool for organizing, manipulating, and gaining insights about maps. Using the computer constitutes a significant improvement over a strictly "intuitive" approach to analyzing a complicated text. Finding out how to extend the computer's power to analyze complicated texts is a major challenge.

- Limitation 1. Language texts, particularly texts of speeches for example, leave out quite a bit of information. Combinations of voice, gesticulation, and appearance can affect the meaning of speech.

- Limitation 2. Cognitive mapping is useful, but incomplete. Mapping fails to adequately reflect connotations, metaphors, and symbols. We plan to use qualitative techniques to probe deeper into these

- Limitation 3. Cognitive mapping imposes a kind of linear, tight logic on the text. It allows a type of logical, complicated analysis which highlights inconsistencies and "errors." Whether this form allows the faithful representation of schematic knowledge is a big question. On the other hand, it permits a rigorous evaluation of policy arguments for their internal coherence.

Rather than trying to exonerate cognitive mapping from potentially limiting issues, we suggest that mapping merits testing.

● OBSERVATIONS RELATING TO ENACTMENT.

- Schemas and Enactment. Enactment is an evolutionary process, involving thinking, behavior, and interaction. Cause and effect maps only represent a cognitive, static dimension of an enactment process.

- Subjective Worlds. We had access to official talk. Few of their remarks explicitly tell us what they personally feel about the industry, or how they see themselves as part of industry activity. Therefore, our account falls short of a fully subjective, interpretive study (See %Eden, et al., 1983).

● OBSERVATIONS ABOUT THE STEEL INDUSTRY.

- Control. Larwood & Whitaker (1977) claim that successful persons fall prey to "illusions of control". Our more-successful strategist, Iverson, assigned a major role to domestic steel companies, in blaming them for their present predicament and for forging their future. Roderick described trapped, vulnerable, helpless, domestic steel companies. Perhaps we should name this phenomenon "Disillusions of Control."

- What transformation? Much research shows that knowledge structures tenaciously resist change (Nisbett & Ross, 1980). Roderick's texts are ambiguous on this point. In one sense, they argue change. He says that the steel industry has become "international" and conditions in the industry, such as prices, market share, debt, and profits "violate" traditional (healthy) norms. That is why he is calling for important policy changes from the government. But, at a deeper level, the steel industry is largely unchanged. It is unchanged in the sense that the same concepts (prices, etc.) apply. Moreover, the cause-effect connections between concepts has not changed (for example, "high prices" are still "desirable", "regulation" remains undesirable, etc.). In this second sense of transformation, his schematic knowledge has proven resistant to change. Iverson's theories are different, but hardly more flexible.

FUTURE RESEARCH

Additional research tasks beckon:

- Trace changes in maps. We have data which will allow us to examine how various participants' maps about steel industry conditions may have changed during a 5 year period.

- Explore the potential of maps for representing schematic knowledge of industry conditions and strategies.

- Link maps to events and behavior. Do companies initiate strategies consistent with strategists' schemas? What is the relationship between schemas and industry processes and events?

- Interaction. How do strategists' maps interact? We are now studying the long-term strategic interaction between USS and the United Steelworkers' Union to find out.

- Literary Criticism. Cognitive mapping is weak in the area of connotations, imagery, and meaning. We think that literary analysis can complement cognitive mapping.

- Extend computer software techniques for organizing and analyzing maps. Can we develop standard analyses for evaluating complex policy arguments?

Over the long-term, this research should produce an intergrative progression of studies. These studies aim to establish the usefulness of enactment, schemas, and cognitive mapping for research and practice.

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EXHIBIT ONE

SECOND ORDER AGGREGATE USSTEEL DATA ANALYSIS FOR ALL YEARS
(EXCLUDING SIGNS OF EFFECTS)

	F	U F	C C	E	U U F F	U F F	U M F							
	U S	M S C	M P A A	F U U N S G S	S S O	C F A R								
	N T	O T N P	A R P P	F S S I T O T U U T T R	O R R E M									
	I E U	R E T R R O S A C	I G G O E V E S N E E G	W M E K E O	T									
	O E S L	E R I K F T C O	C A O N L T L G I E E O	O P T E N N	O									
0 R	N L A	O L Y C E I A I S	I P P P P P P O O L L U	R A R T T P	T									
8 0	U U U U	U U E T T R T T	E O O O O O O U M C C T	L O A S E R	A									
S 4	T T T T	T T S S S U Y S	N L L L L L L L T S	O O S	D U O D R O L									
1 UNION UTILITY	0 0	3 0	1 0 0	1 0 0 0	1 0	2 0 0	0 0 0	1 0	2 0 0	0 0 0	0 0 0	0 0 0	13	
2 FOREIGN STEEL UTILITY	0 0	0 0	0 0 0	0 0 0 0	0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0	
3 US UTILITY	0 0	0 0	1 0 0	0 0 0 0	0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	2	
4 WORLD UTILITY	0 0	0 0	0 0 0	0 0 0 0	0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0	
5 US STEEL UTILITY	0 0	0 0	0 0 1	0 0 2	1	0 0 0	1 0 0 0	2 0 0	0 0 0	1 0 0	0 0 0	1 0 0	9	
6 FOREIGN COUNTRY UTILITY	0 0	0 0	2 1 1	1 0 0 0	0 0	0 0 0	0 0 0	1 0 0	1 0 0	1 0 0	0 0 0	0 0 0	7	
7 PRICES	0 0	0 0	1 0 0	0 0 2	0 0	0 0 0	2 0 0 0	2 0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	6	
8 ACTUAL MARKET CONDITIONS	0 0	0 0	7 0 2	1 2 0 1	0 0	0 0 0	1 0 0 0	2 0 0	3 0 0	2 5 0 0	0 0 0	0 0 0	25	
9 US STEEL PROFITS	3 0	4 0	1 0 0	2 0 6 2	2 4	4 2 0 0	0 0 0 0	6 0 0	2 0 0	0 0 0	0 0 0	0 0 0	54	
10 CAPITAL STARVATION	0 0	0 0	11 0 4	0 3 4 3	1	1 0 0 0	2 0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	5 0 2	38	
11 CAPACITY	0 0	0 0	4 0 0	0 1 2	2 0 0	0 0 0	2 0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	4 0 1	18	
12 COSTS	0 0	0 1	11 0 1	0 5 3	2 1	1 0 0 0	2 0 1 0	0 0 0	1 0 0	0 0 0	1 0 0	2 0 0	38	
13 EFFICIENCY	0 0	0 0	0 0 0	0 0 0 0	0 0	0 0 0 0	0 0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	9	
14 ACTUAL US GOVT POLICIES	0 1	4 3	45 2 6	1 3 6 8	3 3	6 2 0 1	5 3 3 0	6 0 0	3 1 12	9 0 0	0 0 0	0 0 0	130	
15 DESIRED US GOVT POLICIES	0 0	0 2	1 8 0	2 0 1	1 4	1 1 0 0 0	0 2 0 0	0 0 0	0 0 0	0 0 0	0 0 0	4 0 1	48	
16 UNION POLICIES	0 0	0 0	2 0 0	0 0 0 0	0 0	0 0 0 0	1 0 0 1	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	4	
17 US STEEL POLICIES	0 0	0 0	1 6 0	0 3 5 6	1 0	0 2 1 0	7 1 0 5	3 0 0	0 0 0	4 7 0 0	0 0 0	0 0 0	62	
18 FOREIGN GOVT POLICIES	0 3	0 4	37 0 0	4 3 4 0	2 6	0 0 0 5	9 4 0 0	12 0 0	1 3 12	9 0 0	0 0 0	0 0 0	133	
19 FOREIGN STEEL POLICIES	0 0	0 1	5 0 2	1 2 0 1	0 0	0 0 0 1	0 1 0 0	1 0 0	1 0 0	0 0 0	0 0 0	2 0 0	16	
20 US GOVERNMENT	0 0	0 3	1 9 0	9 3 3 3	2 1	0 6 2 0	2 2 1 3	0 5 0 0	1 0 7	3 0 0	0 0 0	0 0 0	72	
21 UNIONS	0 0	0 0	4 0 0	0 2 2	0 0	0 0 0 0	0 0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	18	
22 US STEEL COS	4 0	2 0	9 0 3	1 4 2 0	1 1	1 0 0 3	0 1 0 0	5 0 0	1 0 0	0 0 0	0 0 0	0 0 0	33	
23 FOREIGN STEEL COS	0 2	0 1	9 4 2	1 0 3 0	4	0 0 0 1	6 1 0 0	5 0 0	0 2 0	5 0 0	0 0 0	0 0 0	55	
24 FOREIGN GOVERNMENTS	0 0	0 0	4 0 0	0 0 2	0 0	0 0 0 0	0 0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	22	
25 WORLD FACTORS	0 0	0 1	3 2 0	4 0 1 6	5 3	0 0 0 0	3 0 1 0	6 0 0	1 0 0	3 1 1 0	0 0 0	0 0 0	76	
26 COMPARATIVE ADVANTAGE	4 0	2 0	0 0 1	0 2 0 0	1 1	1 0 0 0	0 0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	2 0 0	25	
27 VIOLATION OF FREE TRADE	0 0	0 0	6 0 1	0 2 0 1	0 0	0 0 0 0	0 0 0 0	0 0 0	1 0 0	1 0 1	2 0 0	0 0 0	14	
28 DESIRED MARKET CONDITIONS	4 0	2 0	2 2 0	7 2 0 3	2 3 3	1 0 0 2	0 0 0 0	5 0 0	2 0 1	7 0 0	0 0 0	0 0 0	67	
29 FREE ENTERPRISE	0 0	0 0	0 0 1	1 1 0	0 0	0 0 0 0	1 0 0 0	1 0 0	0 0 0	0 0 0	0 0 0	0 0 0	5	
30 MONETARY PROBLEMS	0 0	0 2	1 0 0	3 0 1 2	3 0	0 0 0 2	0 3 0 0	1 0 0	1 0 0	1 4 0 0	0 0 0	0 0 0	36	
31 TOTAL	2 0	6 2 0	1 5 3 0 2	1 4 7 6	1 9 5 0	4 6 4 8	2 2 2 5	1 5 5 0	3 2 1 4	1 8 1 0	0 6 2 0	0 4 1 6	5 8 9 1	0 1 0 1 5

EXHIBIT TWO

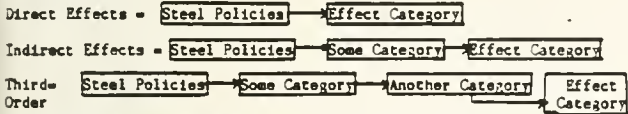
Version Date

Element	Slack	Driver	ASI Eff	ASI Comp	ASI Inv	ASI Tech	FSI Eff	USG	Imp	USG Req	Capital	ASI	Imp	ASI	Prodr	USG	Prodr	ASI	Cost	ASI	FSI	ASI	Ratio	FG	Pol	Open	at	FS	Import	ASI	Stream	ASI	Prob	ASI	Contrib	
ASI Eff	0	1	0	-1	2	5	2	-1	-2	5	1	3	-1	2	3	1	2	3	1	2	3	1	2	1	5	1	5	1	5	-5	5	5				
ASI Comp	0	1	3	0	1	3	-2	2	-2	3	-1	3	-1	1	3	-1	1	3	-1	1	3	-1	1	2	-1	2	1	3	-3	3	3					
ASI Inv	0	1	1	0	0	1	1	-1	-2	3	1	2	-1	2	3	1	2	3	1	1	3	1	1	1	3	2	3	-3	3	3						
ASI Tech	0	1	1	-2	1	0	2	-1	-2	3	1	3	-1	2	3	-1	2	3	-1	2	3	-1	1	1	3	2	3	-3	3	3						
FSI Eff	0	1	0	2	1	0	0	1	0	1	-1	1	-1	2	-1	2	-1	2	-1	2	-1	2	-1	2	-1	2	-1	2	-1	2	-1	2	-1	2		
USG Imp	0	1	-2	2	1	-1	1	0	1	-1	-2	2	-2	1	-2	-2	1	-2	-2	1	-2	-2	1	-1	2	-2	1	-2	2	-2	1	-2	2	-2	1	
USG Req	0	1	-1	-1	-1	-2	-1	1	0	-1	1	-2	2	-2	-2	2	-2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	
Capital	0	1	2	2	2	2	2	1	-2	0	-1	3	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
ASI Imp	0	1	2	2	1	1	-1	1	1	1	0	2	1	-1	1	-1	1	-1	1	-1	1	-1	2	0	2	-2	1	-2	1	-2	1	-2	1	-2	1	
ASI Prodr	0	1	2	-1	5	3	1	-2	3	-1	0	-1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
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FG Pol	0	1	1	1	1	0	1	2	1	-1	-1	1	2	0	1	-1	2	0	1	-1	2	0	-1	0	-1	2	-1	2	-1	2	-1	2	-1	2	-1	2
Open Pol	0	1	3	2	1	2	0	-2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2
FS Import	0	1	-3	-2	-1	-2	2	-1	2	-1	2	-2	-2	-2	-2	2	-2	-2	2	-2	-2	2	-2	2	-1	2	1	0	-2	2	-1	2	-1	2	-1	2
ASI Strength	0	1	3	1	2	3	1	-1	-3	3	-2	3	-1	3	3	-1	3	3	-1	3	-1	3	-1	2	-2	3	-2	3	-2	3	-2	3	-2	3	-2	3
ASI Prob	0	1	3	1	2	-3	1	-2	2	-3	2	-3	3	-2	-3	3	-2	-3	3	-2	-3	3	-2	-3	3	-2	-3	3	-2	-3	3	-2	-3	3	-2	-3
ASI Contrib	0	1	2	1	1	3	-1	-2	-2	3	-2	2	-2	2	3	-2	2	-2	2	3	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2	-2	2
ASI Eff	0	2	nd	37	68	71	17	33	51	76	44	81	-43	68	73	28	44	-38	44	-38	44	-38	44	-38	44	-38	44	-38	44	-38	44	-38	44	-38	44	
ASI Comp	0	2	57	15	44	74	18	-57	-55	79	-29	72	-38	63	78	-16	42	-25	5	-11	80	-76	70	-71	69	-71	69	-71	69	-71	69	-71	69	-71	69	
ASI Inv	0	2	nd	25	43	67	13	-30	-44	64	-62	71	-47	55	62	-29	40	-38	7	-32	75	-71	69	-71	69	-71	69	-71	69	-71	69	-71	69	-71	69	
ASI Tech	0	2	54	37	43	62	16	-32	-46	59	-60	63	-60	55	54	25	37	35	0	-35	70	-66	67	-67	67	-67	67	-67	67	-67	67	-67	67	-67	67	
FSI Eff	0	2	20	14	15	32	-1	13	24	32	-10	29	-21	21	35	13	17	-10	8	3	33	-30	31	-30	31	-30	31	-30	31	-30	31	-30	31	-30	31	
USG Imp	0	2	53	-20	-33	65	2	23	51	-65	37	58	31	32	-62	19	-36	30	3	0	-63	60	-56	60	-56	60	-56	60	-56	60	-56	60	-56	60	-56	60
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Capital	0	2	68	27	45	80	1	-26	66	89	-41	74	-50	76	75	-21	48	-39	0	-6	87	-79	73	-79	73	-79	73	-79	73	-79	73	-79	73	-79	73	
ASI Imp	0	2	29	0	25	45	0	-32	46	-16																										

EXHIBIT THREE

SELECTED NET NEGATIVE EFFECTS OF STEEL INDUSTRY POLICIES

HOW DOES STEEL INDUSTRY POLICY AFFECT:	DIRECT	INDIRECT	THIRD-ORDER
(1) Union Utility	none	none	57%
(3) USA Utility	50%	none	57%
(5) Steel Firms' Util	50%	31%	53%
(7) Prices	none	64%	32%
(9) Profits	none	25%	57%
(13) Efficiency	none	none	60%
(15) Desirable U.S. Govt Policies	100%	100%	100%



For each of the levels that we reviewed: direct, indirect, and third order, simple sums of the signs were calculated. For example, in the first order table of categories (Exhibit 1A) FOREIGN GOVT POLICIES (row 18) concepts exert five separate effects of some unknown "+" or "-" composition upon U.S. STEEL FIRMS' UTILITY (col. 5). If we then turn to a net-sum table (Exhibit 1b) we find that the corresponding intersection (18,5) shows -3. When we add the raw data entries comprising (18,5), minus 3 is the total. Taking both exhibits into account, we reason that 5 entries can add to minus three only when 4 entries are negative and 1 entry is positive. So, Exhibit 4 shows us the net effects of the row category upon the column category. Note, however, that "net effects" refers only to the net of numbers of effects, not to magnitudes of effects.

EXHIBIT FOUR

EXHIBIT FOUR: PARTICIPANTS AND CATEGORIES OF ACTIVITIES IN STEEL SOURCE = IVsp and RODxt1

Agents	N	CONDITIONS	DYNAMICS	AFFECTIVE
RODxt1				
Domestic Steel Cos.	7	3	0	4
United States	2	2	0	0
Internat'l Lending Agts.	3	1	2	0
U.S. Govt	6	0	3	3
Steelworkers	2	0	0	2
World Steel	1	0	0	1
United States Steel Co.	5	0	3	2
Foreign Govts	22	8	9	5
Structural agents	29	21	1	7
TOTAL	77	35	18	24

Agents	N	CONDITIONS	DYNAMICS	AFFECTIVE
IVsp				
Domestic Steel Cos.	29	17	8	4
United States	7	1	1	5
Internat'l Lending Agts.	0	0	0	0
U.S. Govt	13	2	11	0
Steelworkers	1	0	1	0
World Steel	0	0	0	0
United States Steel Co.	0	0	0	0
Foreign Govts	7	3	3	1
Structural Agents	12	8	1	3
Customers	3	0	1	2
TOTAL	72	31	18	15

EXHIBIT FIVE

EXHIBIT FOUR

COMPARING TWO STRATEGISTS "DOMESTIC STEEL COMPANY" CONCEPTS

SHARED TOPICS	Iverson Concepts	Roderick Concepts	Concepts	#
Capital	2	7	UNIQUE to Iverson	
Continuous Casting	2	2	"Innovations"	3
Old Plants	3	10	"Admin. Overhead"	1
Comparative Advantage	2	2	"Long-term strengths."	6
Capacity	1	6		total 10
Wages	1	2	UNIQUE to Roderick	
Competition	1	3	"Profitability"	5
Efficiency	4	5	"Prices"	4
Welfare (of steel)	3	8	"Inflation"	1
	total 19	45	"Marketing"	3
			"Unemployment"	1
				total 14

EXHIBIT SIX

WHAT VARIABLES AFFECT THE WELFARE OF THE DOMESTIC STEEL INDUSTRY?

EFFECT ON DOMESTIC STEEL WELFARE.....

CAUSAL CONCEPTS

	According to Iverson (IVq)	According to Roderick (RODort2)
1. American Steel Efficiency	positive	positive
2. American Comparative Advantage	positive	positive
3. American Steel Innovation	positive	positive
4. Adopting Technology Advances	positive	positive
5. Foreign Steel Efficiency	negative	negative
6. US Govt Import Policies	negative	negative
7. US Govt Regulation	negative	negative
8. Capital	positive	positive
9. Wages	positive	negative
10. Productivity	positive	positive
11. Protection	negative	positive
12. Customer Welfare	positive	zero
14. Foreign Exporter Welfare	negative	zero
15. Steelworker's Welfare	positive	negative
16. Foreign Govt Policies	negative	negative
17. Open Markets	positive	positive
18. Foreign Steel Imports	negative	negative
19. Basic L.T. Strengths	positive	no data
20. American Steel Fut. Problems	negative	no data
21. Contribution of Steel to USA Welfare	positive	positive

Key: "positive" means direct. "negative" means inverse.

n.s. means subject does not mention. "zero" means no relationship.

EXHIBIT SEVEN

EXHIBIT SEVEN : DIRECT AND INDIRECT EFFECTS OF CONCEPTS ON STEEL INDUSTRY WELFARE
SOURCE = IVq

CONCEPTS	1st ORDER	2nd ORDER	3rd ORDER
1. AMER STEEL EFFICIENCY	3	66	1998
2. AMER. COMPETITIVE ADVANTAGE	3	20	930
3. INNOVATIONS IN AMER STEEL	3	48	1409
4. AMER STEEL ADOPT TECH ADV	3	84	2361
5. FOREIGN STEEL EFFICIENCY	-1	12	370
6. US GOVT POLICIES ON IMPORTS	-1	-34	-1017
7. US GOVT REGULATION OF STEEL	-2	-64	-1795
8. CAPITAL INVESTMENT FOR STEEL	2	84	2522
9. WAGES OF US STEELWORKERS	1	-35	-1209
10. PRODUCTIVITY OF US WORKFORCE	2	76	2489
11. PROTECTIONISM BY US GOVT	-2	-42	-1311
12. WELFARE OF AMER STEEL CUSTOMERS	3	65	2170
13. WELFARE OF AMER STEEL INDUSTRY	0	88	2366
14. WELFARE OF FOREIGN STEEL EXPORTS	-2	-18	-718
15. WELFARE OF AMER STEELWORKERS	3	47	1400
16. FOREIGN GOVT STEEL POLICIES	-1	-33	-1097
17. COMPETING IN FREE TRADE, OPN MKT	2	67	2465
18. IMPORTS OF FOREIGN STEEL TO US	-1	0	-661
19. BASIC, LONG-TRM US STEEL STRENGTHS	3	87	2794
20. FUTURE PROBLEMS OF US STEEL	-3	-81	-2579
21. AMER STEEL CONTR. TO US ECON GRWTH	3	72	2452

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EXHIBIT EIGHT

EXHIBIT EIGHT : EFFECTS ON IMPORTS
SOURCE = IVq

CONCEPTS	1st ORDER	2nd ORDER	3rd ORDER	4th ORDER
1. AMER STEEL EFFICIENCY	-3	-29	-1097	-36118
2. AMER. COMPETITIVE ADVANTAGE	-2	4	-555	-17205
3. INNOVATIONS IN AMER STEEL	-1	-25	-782	-24701
4. AMER STEEL ADOPT TECH ADV	-2	-52	-1237	-42018
5. FOREIGN STEEL EFFICIENCY	2	-11	-276	-4307
6. US GOVT POLICIES ON IMPORTS	-1	19	580	17314
7. US GOVT REGULATION OF STEEL	2	36	951	32044
8. CAPITAL INVESTMENT FOR STEEL	-1	-56	-1318	-44163
9. WAGES OF US STEELWORKERS	2	9	676	22344
10. PRODUCTIVITY OF US WORKFORCE	-2	-40	-1385	-42806
11. PROTECTIONISM BY US GOVT	-2	27	691	23179
12. WELFARE OF AMER STEEL CUSTOMERS	-2	-35	-1180	-37778
13. WELFARE OF AMER STEEL INDUSTRY	-1	-53	-1250	-41504
14. WELFARE OF FOREIGN STEEL EXPORTS	2	-1	431	13277
15. WELFARE OF AMER STEELWORKERS	-1	-25	-744	-25006
16. FOREIGN GOVT STEEL POLICIES	2	6	610	20695
17. COMPETING IN FREE TRADE, OPN MKT	1	-45	-1395	-41021
18. IMPORTS OF FOREIGN STEEL TO US	0	-6	429	10287
19. BASIC, LONG-TRM US STEEL STRENGTH	-2	-46	-1539	-48512
20. FUTURE PROBLEMS OF US STEEL	2	42	1436	44645
21. AMER STEEL CONTR. TO US ECON GRWTH	-1	-39	-1359	-42344

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