THE CRUCIBLE

STRUCTURAL FOUNDATIONS OF CONSCIOUSNESS AND FREEDOM

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ABSTRACT

Human limitations prevent us from wholly explaining consciousness and freedom, but analysis of structure allows us to partially penetrate their mysteries. Structure pervades experience and provides a stable framework. Instabilities may arise, however, during formation of images, when selecting among competing alternatives, or while coordinating faculties, such as eye and hand. Such instabilities arouse consciousness. Resolving instabilities commonly involves isolating unstable matters from one another, embedding each such matter in a structurally stable matrix, and imposing structure on each one separately. Resolution of an instability may call for an exercise of freedom, evidenced by suspending judgment and responding to happenstance opportunities presented by the problem. General principles are stated and applied to particular problems in language, logic and law.

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INTRODUCTION

Threading a needle requires a conscious effort. Laying a book on a table does not. What differences account for the need for concentrated consciousness in the first task but not the second?

One difference is that our powers of muscular control are sufficient to lay the book to rest once the act has been set in motion but are not sufficient to start the hands toward threading the needle and then automatically to carry the task through to completion. We need consciously to adjust our hands while threading the needle and to control the inherent shakiness of muscular activity on such a fine scale.

More generally, consciousness is needed to correct error and to control our faculties at their extremes.

Other functions of consciousness are shown on marvelous television programs that bring scenes of wildlife predation into our homes, close up and in vivid detail. For example, several coyotes chase a jackrabbit.[1] The rabbit runs this way and that and uses a marshy area and stand of trees to elude its pursuers; then, flushed by a goshawk, it falls prey to the coyotes. We cannot avoid a conviction that all the animals are acting consciously and that consciousness enables them to take quick advantage of happenstance opportunities.

Expert wildlife observers also read consciousness into acts of predation. One scientist writes that hawks "do some appraising of their chances for success on the basis of preliminary responsiveness of the prey before launching forth in an actual attack. Or, they may feint and then follow through if the prey betrays some uncertainty or physical weakness."[2] According to this scientist's view, hawks interpret the reactions of their prospective prey. Their interpretation is apparently conscious.

A theory of consciousness should account for its involvement in these functions of error correction, the employment of faculties at the margins of competence, the ability to take quick advantage of happenstance opportunities and the interpretation of the acts of others.

Freedom presents an even more difficult problem. I know that I am free and that other persons are also free.* Freedom, at the very least, includes taking quick advantage of happenstance opportunities. Indeed, I intend to show that all of the functions of conscious acts listed above call freedom into play.

For example, consciousness and freedom are present in heightened form during sports and games, war, business and other forms of competition. (The exercise of freedom is perhaps the chief reason for competing in amateur sports and games.) These activities are similar in many ways to animal predation, discussed above. Our experience in these activities supports

*This paper serves as an argument directed at skeptics.

conclusions about the advantages of consciousness and freedom in such predation.

Despite my certainty that I am free, the concept of freedom present serious difficulties, It clashes with concepts of science that describe phenomena in terms of mechanisms and random processes. Mechanism excludes freedom. Freedom is purposeful, and random processes do not properly describe it. Science, at least as presently conceived, is incompatible with freedom.

Here, I approach consciousness and freedom indirectly through the concept of structure. Structure pervades experience. Generally, structure is stable. When, however, structure is unstable, such as during the processes of image formation or while selecting between alternatives, consciousness is aroused and directed toward the instability. In such a case, the purposeful resolution of the instability requires an exercise of freedom and consciousness marks the arena in which freedom is exercised.

Hence, I examine patterns of activity where I can relate the arousal of consciousness and the exercise of freedom to structural features associated with that activity.

In sum, I presume for purposes of this essay that an inherent goal of mental activity is the construction and maintenance of stable structures of experience. When an instability arises, consciousness is aroused. Consciousness attends the exercise of freedom through which the instability is purposefully resolved. In other words, consciousness and freedom are the light and fire through which we forge new stable structures out of instabilities. Especially important is the surrounding matrix or context of stable structure that makes this activity possible. That stable structure is the crucible in which the new structure is forged.

This description highlights some further problems with the concepts of consciousness and freedom. It appears to be impossible to discuss an exercise of freedom without involving a concept of "self" as the possessor and active wielder of that freedom. But the concept of "self," no matter how intuitively clear, involves a conceptual puzzle: how does that "self," clearly not physical, interact with the physical world. This is, in fact, another version of the clash between the concept of freedom and the concepts of science. Throughout history the most brilliant thinkers have wrestled with these problems, and the results, it must be confessed, are not very satisfying.

There is a mystery. I do not deny or avoid the mystery; rather, I derive my method from it. The stable matrix of structure surrounding consciousness and freedom serves as a foundation for exploration. But the mystery is always acknowledged and respected.

Living in an era, and working among disciplines, that *do*, at least implicitly, deny and avoid the mystery, I consider it important to set forth the large-scale principles[3] that govern my work.

(1) Our faculties of experience and action are flawed. They create limited images infected with systemic defects and susceptible, at least initially, of only awkward coordination. (A paramount example of such a defect is our perception of time, as to which we are massively confused. The confusion appears to be based, at least in part, on neuronal activity: neurons use

time to code for intensity. Because the concept of mechanism is imbedded in time, it too is flawed.)

(2) One defect is that we are not directly aware of the limits and defects. We suffer from "blind spots" that, by their nature, both veil truth and conceal themselves. (Consciousness and freedom lie within such "blind spots." We "fill in"[4] the blind spot with concepts drawn from other areas, using, for example, the notions of mechanism and agency.)

(3) Nonetheless, our faculties of experience and action are highly plastic and adaptive, and the images they generate can be modified, for the most part, to yield functionally adequate approximations. We can, through practice, develop techniques of coordination within defined contexts. (One important kind of approximation is causality or mechanism, with manifold forms highly susceptible to modification and adjustment.[5] We have not, however, been clever enough to use these forms to model consciousness and freedom; perhaps they are fundamentally unsuited to the task.)

(4) Consciousness and freedom are the means we use to carry out the modifications and to learn the techniques of coordination.

(5) Or, to sum up, we use consciousness and freedom to overcome our flaws.

"Structure," too, is a product of processes of experience; and structure also fails to solve the mysteries of consciousness and freedom. But some progress can be made, if grounded in actual observations, and if we remain faithful to the facts.

There is an inherent messiness at the heart of the enterprise. We are not smart enough to figure things out; nor are we clever enough to design our way out of confusion. (For example, I utilize the concept of mechanism where necessary.) The methods of science are not really reliable, because they are shaped by the theories they test and because their methods exclude instability and uncertainty.

Reflections on consciousness and freedom should arise, instead, from the vicissitudes of daily life. And, likewise, there return, because the value of this work, if any, will lie in the development of means to enlarge freedom in daily life and the enhancement of consciousness of that freedom.

PART ONE: A STRUCTURAL APPROACH TO CONSCIOUSNESS AND FREEDOM

§ 1 Structure and Stability

A system of structure* is derived from the principle "experiences only in combination." This principle asserts that "an experience" has meaning and effect only if connected to other experiences; correspondingly, an isolated experience would be a nullity.

The most important kind of combination, appearing repeatedly in the examples presented here, is that involving perceptions and actions. The terms "stimulus" and "response" carry meanings similar to "perception" and "action", but perceptions do not necessarily *cause* actions. There are, to be sure, combinations that can be usefully organized in terms of causal relations, but there are also combinations where a causal organization is not appropriate. Very often, actions shape perceptions, as when we discover "what we perceive" through action and communication. We see with the muscles of the eye as well as with the retina. Perceptions and actions are *coordinated*. "The appetite grows with the eating."

"Structure" denotes the appearance of an experience in a combination of experiences. A combination may include both static and active details, e.g, the combination of early morning arousal and bathroom activities, business dress, and driving to work.

Involving active details, as they may, structures are not, in general, static. They are, however, and in general, *stable*. Stability means that the structure persists even though subject (as all things are) to fluctuations ("jiggling") or to outside influences that create minor deviations ("perturbations").

The example of morning arousal and ablutions, business dress, and driving to work, presents a stable structure. The structure persists even though I wear one tie instead of another and even though I must, on a given occasion, take a detour. The structure is so stable that, e.g., I must make a conscious effort to change my driving pattern. (I will unconsciously and automatically go by the customary route unless I make a conscious effort to change it).

Although structures are, as stated above, stable *in general*, such stability is not always the case. There may be an area of structural instability within a field of experience otherwise stable. In such a case, consciousness is aroused.

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*A presentation of the system is beyond the scope of this essay. In broad outline, it resembles a "node and link" system, but there are critical differences.

§ 2 The Arousal of Consciousness

Science has achieved considerable progress in unraveling the development, anatomy and physiology of the brain.[6] It has achieved further progress in relating conclusions about the brain to behavior.[7] I do not attempt in this essay to review these achievements. They do, however, form a backdrop to my approach.

It is clear that neurons in the brain are the physical basis of experience. Neurons are intensively interconnected in groups and systems of groups. Each neuron is capable of putting more energy into a group or system than is incident upon it; it is an *active element*.

Groups and systems of active elements can participate in stable patterns of activity. Instabilities are also possible, and the focus here is on instabilities.

For example, two brain researchers (C. A. Skarda and W. J. Freeman) pursuing a highly evolved line of research conclude that models derived from the mathematics of "chaos" can be applied to the brain:

> "We think the notion of 'destabilization' provides a better description of the essentials of neural functioning than the concept of pattern completion. In an alert, motivated animal, input destabilizes the system, leading to further destabilization and a bifurcation to a new form of patterned activity."[8]

There is, in addition, evidence, although equivocal, that conscious and voluntary action involves a strong form of instability that grows exponentially (more or less), at least at the outset and until resolved in action.[9]

I conjecture that the brain of an animal is "tuned" so that it is within or near the region of instability. So "tuned," the animal is *highly responsive* to relatively slight influences that may signal danger or opportunity (e.g. food); these trigger neural instability that is resolved only in action. Quick and powerful action helps the animal to survive and reproduce. The "tuning" could be achieved chemically, e.g. by mechanisms that allow excitatory activity to reach a high level of intensity before inhibitory neurotransmitters are released.

A brain so "tuned" would be like a pot full of water on a campfire. When the fire gets hot enough, the water boils over, and damps down the fire. The dampened fire is no longer hot enough to boil the water, and the overflow subsides. Then the fire gets hot again. A modest stirring of the fire may trigger an intense reaction.

In experience, the instability corresponds to subjective tension. Forms of subjective tension include physiological drives, like hunger and sex, threats, conflicts, contradictions, unsolved problems, suspense and ambiguity. Subjective tensions, and the underlying neural instabilities, arouse consciousness.

Our lives are filled with examples. Journalists and makers of movies and television

programs are highly skilled at arousing and holding consciousness, and their products are filled with subjective tension. The "internal dialogue" in each of our minds revolves around incidents of tension, past, future or merely possible. We tend to concentrate our attention on matters that are "marginal," that tip the balance of instability one way or the other or that appear as features on the edge of a stable background. We can observe such tension in the behavior of a child in the supermarket checkout line.

In daily life, each of us has an agenda of matters, ordered according to the urgency of subjective tension. The most urgent matters occupies our consciousness; after the tension surrounding that matter is resolved, at least partially, the next most urgent matter rises up. Distraction by a new apparent urgency can re-arrange the agenda, at least briefly. Even when the agenda has been temporarily satisfied, for example when one is about to leave the house, it may be of benefit to stand for a minute, allow the mind to "quiet down," and see if some forgotten item on the agenda rises to the surface.

Functionally, this form of consciousness is always searching for some matter, internal or external, that will arouse it.

Consciousness is aroused by a "difference" or "distinction." A purely structural example is motion observed visually. In an animated cartoon, a slight difference in the location of an object in two successive frames will, when the film is projected, be experienced as motion of that object. The motion captures our attention. The illusion works because the film presents information to the eye in a form close to that in which the eye presents it to the brain. Generalizing, all action arouses consciousness in this fashion.

Similarly, a faculty of experience maintains an image of a stable world. If I move a lamp in my bedroom, the difference between the familiar scene and that actually seen arouses my consciousness until I become accustomed to the new arrangement.

Expectations constitute another class of images. While working, I pick up a cup of coffee. There springs into my consciousness the realization that the cup is cold, contrary to an expectation based on my recent preparation of hot coffee. On investigation, I discover that I have picked up yesterday's coffee cup. A children's game involves "what is wrong with this picture."

Likewise, consciousness is aroused by deviation from uniformity. The faint brown spot on my friend's white shirt arouses my consciousness. I notice a new rattle in my already noisy car. Each of these examples involves tension aroused by superimposition of images that are in conflict.

§ 3 The Structure of Coordination

Coordination is the central or "paradigmatic" problem. Coordination involves two (or more) faculties and the establishment of structural relations between them. Perceptions and muscular action are the obvious examples, but coordination includes other faculties.

Co-ordination presents a model different from "input-output." Input-output relations are causal and conceptually mechanical. According to the neurobiologist Graham Hoyle, "The biggest mistake that people make is in thinking of [the nervous system] as an input-output device."[10] Coordination involves two or more faculties adjusting to one another.[11] Energy projected by a first faculty into a second can destabilizes the second and vice-versa. There is an interplay, a *dance*, as the system searches for a mutually stabilizing pattern of activity.

In coordination, images generated by multiple faculties are, in effect, superimposed. There are so many points of coincidence that we treat these as multiple images of "the same thing." There may be, in addition, points or areas of divergence or incoherence, and these arouse consciousness.

For example, when threading a needle, we endeavor to bring three images, originally disjoint, into coincidence: the tip of the thread, the eye of the needle, and the goal of the thread in the eye. The trajectory of the thread toward the needle's eye is unstable and a conscious effort is needed to control it.

I assume in this essay that there is a single, common structure[12] that lies under experience. This single common structure is defined by those characteristics, especially time coding for intensity and synaptic interconnection, that all neurons share. The diverse faculties of experience use this common structure to coordinate with one another. I call this common structure the "substrate" of experience. It is possible that there is a region in the brain that serves as a location for coordination, but my model does not require such a region.

The various faculties of experience are erected on the substrate. I use the term "faculties" broadly to include, e.g., the senses, muscular activity, speech, writing, memory, projection of future events, empathy (attempting to construct the experience of another person) and so forth. Within each faculty is generated an "image" in experience.

In general, each faculty involves, in addition to the common structure of the substrate, refined and specialized structural features peculiar to it. Vision involves structures for the perception of color and surface texture. Speech involves syntax. Muscular action is based on the anatomical arrangement of bones and muscles.

Sometimes the refined and specialized structural features of two (or more) faculties involved in coordination fit together easily. For example, there is, apparently, a simple relationship between the nerves that sense pressure in the jaws and those that activate the muscles that bring force to bear on food. As a consequence, there is an "automatic" adjustment of the force our jaws exert on the food to safely and completely crush it. A system of nerves connects the

motion-detecting organs of the inner ear with the muscles of the eyes so that a stable visual image can be "automatically" maintained. (Compare your ability to keep your eyes fixed on a stationary finger, despite movement of the head, with your inability to follow that finger while it moves and your head is stationary.)[13] Many faculties participate in the special coherent structure called "space," despite the philosophical and theoretical problems that structure presents.[14]

When the specialized structures of the faculties fit together easily, I say that they are "congruent."

Often, however, the refined and specialized features of the multiple faculties involved in coordination do not fit together easily. The two structures are "incongruent." The incongruence is a form of tension that arouses consciousness and, as we shall see in Part Two, an exercise of freedom is necessary to resolve the tension.

The task presented by coordination is the establishment of a single stable pattern of neuronal firing that involves two or more anatomical regions in the brain. A stable patterns in one region may be "given," and the task is to establish a stable pattern in a second region that "marries" with and further stabilizes the first. Initially, however, no such pattern in the second region emerges and such patterns as arise are unstable. Coordination is then a search for mutually stabilizing patterns. For example, when learning to ride a bicycle, it is necessary to develop a pattern of muscular activity that coheres with and stabilizes the images presented by the organs governing balance and orientation (in the middle ear) and as well as the visual image. Once the muscular pattern is established, each faculty stabilizes each of the others.

Contrast opening pecans with a pliers-type nutcracker and chewing the meat of the nuts. In each case muscular force is used to crush the object; in each case a strong initial force is applied to commence the crushing; in each case the strong initial force must be relaxed after the crushing has commenced, so that the meat is not also crushed (when opening the nut with a nutcracker) and so that the jaws do not injure one another (when chewing the meat).

Opening the nut with a nutcracker requires an exercise of consciousness, but chewing the meat does not. In chewing the meat, there is, apparently, a system of automatic correction built into the nervous system that monitors the force felt by the teeth and adjusts the muscular force applied by the jaws on the meat. It is reasonable to believe that natural selection has favored the development of such a system of automatic adjustment.

No such system of correction is automatically available during the opening of the nut with the nutcracker. Several faculties must be coordinated, especially the faculty that senses force exerted on the hand by the nutcracker and the faculty that exerts force on the nutcracker through the muscles of the hand. While one is developing the skill of opening nuts with a nutcracker, it is necessary to attend to these faculties, and to assist their coordination with the faculty of vision. Other faculties, e.g. hearing, may also come into play. Once the skill of opening nuts has been developed, the task may be carried on unconsciously.

In opening nuts, the skill is easily learned. This is because, despite the incongruence based

on the generality of the faculties and one's own inexperience, both perception and action involve force. More serious forms of incongruence, where there is no "common denominator," are presented in Part Two. In dealing with such incongruence, systematic techniques of freedom may be involved.

§ 4 The Exercise of Freedom

Presented with instability, the natural tendency is to attempt to resolve it, to return the system to stability. The following list of techniques is presented in order of definiteness, with the most clear and definite presented first. I thus seek to penetrate the mystery of consciousness and freedom, recognizing that the further the investigation proceeds, the more difficult it becomes.

1) Concentration. Experience is reorganized so as to achieve the following as far as possible:

a) isolation of the instability, i.e. to separate instabilities and surround each by a matrix of stable structure;

b) centering the focus of tension, i.e., to place those features of the experience which give rise to the instability at the center of structure; and

c) suppression of other sources of tension, so that the problem is experienced without distraction.

2) Imposition of structure. In addition to the structure of the substrate, an attempt is made to impose additional structural features on the problem, in particular:

a) Exclusion relations. An exclusion relation is a collection of experiences such that an appearance of one experience excludes the appearance of each other. "'Yes' and 'No'" is an exclusion relation, when applied to a question. Similar exclusion relations, under appropriate circumstances, are numbers, colors, logical values, locations, etc.;

b) Order relations. An order relation is a collection of experiences governed by a rule of precedence, e.g. "'first', 'second', 'third'..." (this relation is imbedded in time);

c) Pairing relations. Two collections of experiences are involved in a pairing relation when any item in one collection is associated with exactly one item in the other collection. (The converse need not be true: there is a pairing relation between males and their mothers, notwithstanding that not every mother is a mother of a male. When the converse is true, there are two reciprocal pairing relations, or a "one-one relation, e.g. between persons and their brains.);

d) Causal relations. This is how we make sense of action.

3) Explication. Coordination sometimes proceeds by representing images generated in two faculties in a third faculty, and employing the common arena of representation for coordination. Such a representation makes explicit details that are implicit in the image. (E.g., for most of us, recollection of a visual image is not experienced visually, but representationally.)

4) Search for pivotal details. A "pivot" is an area of contact between two structures on which their relationship turns. So, in coordination of structures generally incongruent, we search for details of structure in one representation which is, at the same time a detail of structure in the other representation. We "follow" a moving object by attending to a portion of it that does not change; we seek to treat a discontinuity as a localized condition of an underlying substance that is the same throughout; we attempt to resolve a dispute by first identifying areas of agreement.

5) Responsiveness to detail outside the area of focus. Concentration is a tightening of consciousness and a first technique of stabilization. At a later stage of stabilization, the reach of consciousness expands outward into experience and seeks out matters of experience that can be brought to bear on the problem. This leads into:

6) Responsiveness to happenstance. Prior to the transformation referred to in item 1) above, certain details of experience might appear to be negligible or of only marginal importance. As the task proceeds, however, with the transformation of structure and other incidents of concentration, the attempt to impose further structure, the search for pivotal detail and a widening search, these details, initially negligible or marginal, assume decisive importance. We take advantage of these details as we become aware of them.

7) Suspension of Judgment. Sometimes we must simply tolerate the tension of the instability while, in effect, it "sorts itself out."

PART TWO: EXTENDED EXAMPLES DRAWN FROM EVERYDAY LIFE

§ 5 Language: Verbal Description of a Visual Image

Look around the room (or outdoor environment) in which you are now reading this essay. Consider how you might describe in writing what you see. Is there a general procedure for the task?

Consider first a mechanical procedure for production of the verbal description. Such a procedure might break up the task into three sequential stages:
(1) decomposition of the visual image into visual elements such as things, characteristics and relations; (2) assignment of words and phrases to the visual elements; and (3) assembly of the words and phrases into sentences and paragraphs.

This proposed mechanical production procedure is subject to several objections. First, as far as introspection can determine, it does not correspond to the actual process of writing. Second, because of the many possible choices, each of the proposed sequential stages is seriously indeterminate. Third, the proposed procedure omits from its scope important matters such as the purpose that motivates the description.

The difficulty of the task arises, at least in part, from the divergent structures involved in vision and language. The visual image is grounded in three spatial dimensions; all elements are simultaneously present; each element is concrete but carries historical associations; and each element displays an inexhaustible richness of detail. The verbal description is a one-dimensional string of words; each word or phrase is an abstract element that carries connotations arising from language; and any description employs a finite, relatively small number of words.

The two structures do not fit together. I say that they are *incongruent*, that the incongruence is a source of tension that arouses consciousness, that the attempt to superimpose the two structures creates instabilities, and that composing the verbal description requires an exercise of freedom.

Opening up the task for analysis requires, first of all, substituting the notion of "coordination" for that of "production." Production separates the doer from the objects of the doing; it is causal. Coordination does not necessarily imply an agent and its objects.

In actually carrying out the task there is a continuous shifting back and forth between the visual and verbal faculties. I notice new aspects of the visual image as I write about it and revise my verbal description as I go along. A production model would require "feedback" in the nature of constructing an imagined visual image from my own verbal description and comparing that imaginary image with the actual visual image, a procedure inconsistent with the facts. Coordination involves holding both the actual visual image and verbal description in mind at the same time and working out mutual adjustments.

The attraction of a production model arises from the apparent initial "presence" of the visual image (not exactly the case, as noted above) and the piecewise evolution of the verbal description. This evolution is, however, also consistent with a coordination model. A sequence

of coordinating acts can be defined.

First, while looking at the visual image, I establish a purposeful context for the verbal description, such as my image of the prospective reader, the desired effect of the description on the reader, and the length of the description. Because they create a structural context for the anticipated writing, these features are stabilizing. They will confine choices that arise later.

Second, an order relation is imposed on the task through pairing. That is, because the anticipated written description is one-dimensional, it is necessary to deal with the features of the visual image in an ordered fashion, first one, then a second, and so on. Some decomposition scheme is required. The actual decomposition scheme may depend on the purposes identified in the first step, above. If several decomposition schemes are under consideration, or if a novel scheme is adopted, freedom may be exercised. In any event, once having been selected, this imposed order relation also becomes a stabilizing feature of the context.

Third, concentration focusses on areas of the visual image according to the order of the decomposition. Areas are isolated, one from another. While writing about each one, the features of that area are reorganized so as to center those features that are most prominent, in terms of the stabilizing contextual features. While concentrating on one area, consciousness of other areas is suppressed.

Fourth, actual sentences are produced. An area of the visual image is maintained both in the visual faculty and also in the substrate. Simultaneously, in the substrate, verbal fragments are associated with visual features represented therein; and tentative assemblies of the fragments occur in the verbal faculty. There is a shifting back and forth among the following relations: (1) the image in the visual faculty and its representation in the substrate; (2) the tentative assemblies in the verbal faculty and their representation in the substrate; and (3) the two representations in the substrate. These three relations are initially divergent and their superimposition is unstable, but there evolves a stable combination.

This analysis does not describe "how" a stable combination evolves. The combination may "crystallize" about a pivotal feature or combination that is both present in the visual image and also susceptible of a simple and clear written description. Happenstance features in the visual image or in the writer's literary experience may became significant. The evolution, involving an exercise of freedom, is beyond my powers of analysis. There remains an irreducible center of mystery about the fourth step of actual writing, and similar irreducible mysteries lie at the heart of the other steps. It is this mystery that creates the subjective tension, and even dread, that accompanies the task of writing. According to Kierkegaard: "Dread is the dizziness of freedom."

§ 6 Logic: Drawing a Boundary Around a Cluster

Problem: draw a closed boundary around "downtown San Francisco." (The reader may substitute another, more familiar city.)

We may want to draw the boundary to determine membership in an organization ("downtown merchants' club") or to define an area where federal funds for urban renewal will be available.

"Downtown San Francisco" arises from an aggregate of large buildings and intense commercial activity. It is an example of a "cluster." In general, a cluster arises from an aggregate of details gathered around a center; and surrounding the cluster is a periphery where the density of details is relatively sparse.

Other clusters in physical space include: John's face, the Rocky Mountains. "Tom and Brenda's wedding" is a cluster in both time and space. Clusters may combine concrete and abstract details: automobiles, vehicles, antique cars. "Science" clusters persons, philosophies, activities and results. In general, every proper noun is a cluster.[15]

A boundary, on the other hand, and stated abstractly, is a surface that divides a space into two distinct regions such that every point in the space belongs to exactly one region.

Both boundaries and clusters are used to group phenomena. They have, however, different structural forms. The law of non-contradiction and the law of the excluded middle govern boundaries, but may not apply to clusters, which can overlap or fail to cover all cases (a philosopher is both fool and sage; no list of "ethnic foods" will cover the field.) A cluster necessarily arises from its contents; a boundary can be drawn in empty space (a desert subdivision). A boundary requires an overarching space (the "universe of discourse"); a cluster does not. The two structures are incongruent.

In actually setting down to the task of drawing a boundary around downtown San Francisco, we confront the incongruency. The task can be attempted mechanically by reference to numerical criteria that are "neutral" in the sense that these criteria are defined prior to and without reference to any actual problem. Because the mechanical method is not adaptive to the details of the task, its purposes, and happenstance circumstances, however, its results will be unsatisfactory.

One problem is that where the boundary must be drawn is where the density of detail falls off and where boundary-defining characteristics may be few.

One who draws such a boundary applies the "techniques of freedom" discussed in § 4 of Part One and applied in § 5 of this Part. Purposes are defined. The one-dimensional character of the boundary naturally invokes an order relation; however its starting point and direction (clockwise or counterclockwise) are indeterminate and may affect the result. Techniques of concentration call for isolation of various regions along the boundary as it is drawn; within each region, attention is focussed on a new center; and consciousness of other regions is suppressed.

The actual drawing of the boundary will turn on pivotal features where clustering occurs along a boundary, such as a street or other feature of topography. Happenstance features, such as ownership or history, may affect decisions.

Of special interest is the technique of explication. Both the cluster and the boundary are visual structures. In actually drawing the boundary, however, one focuses on features in an almost verbal fashion. A feature is, in effect, highlighted and lifted out of context and the associations which determine whether it should be on one side of the boundary or the other are identified.

There are, metaphorically, centrifugal forces pushing the boundary out and centripetal forces drawing it in. Where these metaphorical forces balance, a stable determination is reached. The metaphor fails, however, and it is a critical failure, because physical "forces" have a common dimension, while the influences "pushing the boundary out" or "drawing it in" may involve money, time, political influence and philosophy and elemental emotion. Weighing these disparate influences against one another requires an exercise of freedom.

The task of drawing a boundary around downtown San Francisco is a simple one, because there is only one cluster. More complex, but structurally similar problems arise when government must define voting districts or zones for allowed uses of real property. In the latter case, for example, a line must be drawn so as to exclude industrial use from a commercial area, with serious financial consequences for the landowners.

Problems of valuation may also involve drawing boundaries around clusters in a more abstract sense. Often these problems require assigning a number or grade (boundaries) to matters which are not quantifiable. A jury must award a certain number of dollars to compensate for "pain and suffering." One must decide whether the superior appearance and durability of a high-quality sofa are worth the extra price. Are grapes at $1.49 a pound a better buy than apples at 89 a pound?

Even more abstract problems present the same kinds of structural incongruency. A librarian must classify a book according to the Library of Congress system (boundary) when the book potentially belonging to more than one class. E.g., does a study of Napoleon's final illness on St. Helena belong to history or medicine? In the zoning problem, mentioned above, a particular business must be classified as either "commercial" or "industrial." A doctor's decision to operate (it either happens or it doesn't) may depend on every facet of the patient's life and circumstances (the availability of family members for post-operative care, for example). In these cases, the exercise of freedom becomes an exercise in judgment.

§ 7 Society: Resolving a Dispute Through Litigation

I construct what I believe to be the consciousness of another person. That is, I consider what my view would be if, as I understand things, I had the information available to the other person and were pursuing his interests. This construction is a *projection* of my consciousness into the other person's position. It is sometimes called "empathy" or "insight."

For example, on the freeway, I see a car in the next lane with its nose pointed toward my lane and with a flashing "turn signal." If I were in the position of the driver of that other car, I would be requesting that someone in my lane slow down and allow a space to open up so that I could slip in. Hence, I interpret these signals as such a request. In response, perhaps, I keep my eyes fixed on the car in front of me and follow it closely. If I were the driver of the other car, I would interpret my acts as a refusal of the request. In fact, I intend for him to so interpret them.

Signals presuppose a general human capacity for constructing other people's consciousness. Words are the most common signals. Conversation between two persons who know each other well can consist almost entirely of such signals, as each follows a network of associations in the other's consciousness, using words only to direct attention; e.g. to indicate choices at branch points and depth of detail. We are also able to detect areas of tension in another's consciousness and to determine where there is a tension between our views and those of another.

The ability to project one's consciousness is exercised in civil litigation, which is the employment of formal judicial procedures to resolve disputes. In brief, a decider, e.g. a judge or juror, is presented with two opposing views and chooses between them. The decider projects his or her consciousness into first one, then the other opposing view, and decides which view is more in keeping with the law, custom, reason and morals.

The following "equation" summarizes some principles of litigation:

good faith dispute = ambiguity in the written law = freedom of the decider

The phrase "good faith dispute" refers to the relations between the parties and means that the two sides present opposing positions, each having some apparently good reasons. The phrase "ambiguity in the written law" means that, under the facts of the case, the language of the written law is susceptible of two interpretations, alternatively favoring the opposite sides. The phrase "freedom of the decider" means that the judge or juror who decides the case has a right and duty to exercise freedom in reaching his or her decision.

The equals signs in the "equation" do not, of course, mean that the three phrases are identical. What they indicate is a structural correspondence between and among the three different realms (relations between the parties, written law, consciousness of the decider). Within each realm are areas of tension, that is, respectively, areas of dispute, ambiguity, and conscious indecision. The legal system is designed so that, ideally, for each such area of tension in one realm, there are corresponding areas of tension in each of the other realms.

Each area of tension occurs in a matrix of stability and repose. That is, even an acrimonious dispute arises within a common understanding that encompasses language, culture and the human condition as well as many of the facts of the case. As applied to any particular case, the written law is largely and clearly unambiguous. The freedom of the decider can be exercised only in a few particulars and within defined limits.

Ideally, where there is a good faith dispute, the written law, as applied to the case, is ambiguous, and the decider may exercise his or her freedom. Moreover, and still ideally, no ambiguity in the written law appears except in correspondence to a good faith dispute, so that no party can exploit a "technicality". In practice, and under the guidance of skilled professionals, the legal system comes reasonably close to realizing this ideal. Both the written and unwritten law are human creations and are highly plastic and adaptive, so that when practice falls short of the ideal, adjustments can be made. Thousands of professionals are at work fine-tuning the system. (This view does not endorse the expense and delay that the system entails.)

Consider an example where Defendant Dan Driver commits a civil wrong or "tort" against Paula Plaintiff. Suffering from a lapse of attention, Dan Driver fails to observe that traffic on the freeway has been obstructed by a stalled car and he is unable to stop in time. He "rear ends" a car driven by Paula Plaintiff. Under the impact of the collision, Paula's head smashes into the windshield. Paula suffers a concussion and is permanently disabled. Dan has only the minimal insurance required by law, far less than even Paula's medical expenses, and he is financially overextended so that a modest judgment against him will result in his filing a petition for bankruptcy. If Dan does file bankruptcy, Paula will receive nothing but the proceeds from Dan's insurance.

There is, however, another possible source of compensation for Paula. That is Deep Socket, Inc., a large computer sales and service company. Dan is a computer repairer who works on a particular brand of machine sold by Deep Socket. The morning of the accident, Dan got a call from Deep Socket. A machine Deep Socket recently sold to an important customer had broken down, the customer was frantic, and Deep Socket needed Dan to try to fix it. Dan had been on his way to the customer's office when the accident occurred.

Paula and her attorney want Deep Socket to pay compensation to Paula for Dan's negligence. Deep Socket does not want to pay. In a legal system like California's, there may be a good faith dispute over whether the relationship between Dan and Deep Socket is sufficiently close that Deep Socket will be held liable.

The rule of law can be summarized as follows:

> Rule 1. Deep Socket will be held liable for Dan's tort if Dan is an agent or employee of Deep Socket and if the tort was committed while Dan was acting within the scope of his employment.

Rule 1 consists of a series of terms combined in a structure. As to each term, there are

three possibilities: (1) under the facts of the case, the only possible interpretation favors Paula; (2) under the facts of the case, the only possible interpretation favors Deep Socket; and (3) under the facts of the case there is an ambiguity, or, to use the legal parlance, "reasonable minds can differ".

A lawyer or judge reading Rule 1 will do so in a special way. He or she will read it with the facts of the case in mind and will slowly roll over each of the terms in his or her mind, testing whether there is an ambiguity. In brief, the lawyer or judge will project his consciousness into the position of first one side, then the other, and, while in each such position, attempt to construct arguments that favor that side. If it is possible to construct reasonable arguments on *both* sides, an ambiguity is established. Law school teaches all potential lawyers and judges to construct and evaluate arguments in a uniform fashion; and this uniformity creates a stable professional matrix.

This way of reading a rule is sometimes called "issue spotting." A reading of Rule 1 will spot some issues in the case of Plaintiff vs. Deep Socket. (Other rules may generate other issues, primarily the rules that state what kinds of compensation, and the amounts, Paula may recover).

The first potentially ambiguous term in Rule 1 is "Dan's tort." A lawyer will recognize that if a jury should find that Dan is not liable to Paula, Deep Socket will not have to pay her compensation. Under the facts of the case, however, there is no question that Dan committed a tort: he was negligent while driving and his negligence caused Paula's injuries. Hence, there is no good faith dispute about this term, no ambiguity, and no real freedom for the decider. (If the case goes to trial, Deep Socket's attorneys may require Paula's attorneys to prove this matter, just to make life difficult for them, but no one will expect Dan to be exonerated.)

The next term *is* ambiguous, namely, "Dan is an agent or employee of Deep Socket..." Under the facts given above, reasonable minds could differ, there is a good faith dispute, and the judge or jury has freedom to decide either way. Under the facts of this case, the phrase "agent or employee" has only a *structural* meaning: it marks an ambiguity. The phrase is *functionally* obscure. This function is the reason why so many legal terms are obscure. It marks a potential ambiguity as well as attempting to correspond to facts. Of course, there are some cases where there would be no ambiguity. If Dan reported each morning to Deep Socket, worked for Deep Socket all day, received a weekly paycheck from Deep Socket, and drove a "Deep Socket" truck, there would be no question that he was a Deep Socket employee.

Under the facts of the case, and assuming that Dan was an employee of Deep Socket, there is nothing ambiguous about the term "...the tort was committed while Dan was acting within the scope of his employment."

Hence, in determining whether Deep Socket is liable for Paula's injuries, there is one good faith dispute, one ambiguity in the written law as applied to the facts of the case, and one matter where the judge or jury has freedom of decision.

In preparing the case for trial, the lawyers on the two sides will investigate many details of Dan's relationship with Deep Socket. Each side will construct arguments to persuade the judge or

jury in the exercise of his, her or its freedom. Each side will also attempt to anticipate the arguments of the other side and to meet those arguments by counter-arguments. There is a contest for the consciousness of the decider.

If the case is presented to a jury in California, at the conclusion of the evidence the judge will tell the jurors what considerations are to guide them in deciding the issue. The lengthy jury instruction is set forth in a note.[16] The lawyers will have prepared their arguments with this instruction in mind.

This problem is also an example of "drawing a boundary around a cluster," discussed above.[17]

These procedures of spotting issues, analyzing good faith disputes, and applying the facts of particular case to the written law pervade our legal system. They are practical applications of the techniques of freedom presented in Part One. These techniques are used to isolate matters of tension, to concentrate attention on them, to include and exclude matters, to resolve areas of tension in an orderly fashion, and to set up correspondences between determinations of issues (such as whether Dan is an agent or employee of Deep Socket) and results (such as whether Deep Socket has to pay compensation to Paula). In exercising his or her freedom, the decider will search for pivotal details, such as a written statement of policies Deep Socket gave Dan about working on projects for it. The decider will also respond to details outside the area of focus (Paula's children will be on display in court). Happenstance features will become prominent (perhaps Dan was planning to go to another assignment for another computer service company immediately after the Deep Socket assignment). Implicit details of the relationship between Dan and Deep Socket will be made explicit and put into testimony. Ideally, the judge or jurors will "suspend judgment" until the trial is over.

The case of Plaintiff vs. Deep Socket involves "objective facts." That is, there is only an incidental reference to the consciousness of any of the parties. Law does not, however, abstain from rendering practical judgments about the contents of another person's consciousness. If, for example, I contend that the man who sold my house to me defrauded me by suppressing facts about defects in the foundation, issues may be presented of whether he "had knowledge or belief" of the facts allegedly suppressed and whether he suppressed these facts "with intent to deceive [me] or to induce [me] to enter into the contract."[18] A judge or juror deciding the case will project his or her consciousness into that of the seller and determine, on the basis of the evidence produced in court, whether it is more likely than not that the seller did have such "knowledge or belief" or such "intent."

Projection of one's consciousness into the position of another is a universal feature of daily life; so much so that we easily construct a series of projections without concern about logic or philosophy. "He knows that music is disturbing my sleep." (2 layers) "She can't believe that I meant to mislead her." (3 layers)

The more interesting case, for purposes of this summary, occurs when I project my consciousness into two or more alternative interpretations of events. These alternatives create

foci of tension that not only arouse my consciousness, but also focus it on the competing possibilities. A common form of such alternative interpretations is presented by the classic mystery story. There is the initial interpretation, perhaps adopted by the overeager police inspector, that assigns guilt to the detective's client. The police inspector not only disregards discrepancies between his interpretation and the facts but also imputes an evil motive to the virtuous suspect. The hero/detective, both by uncovering additional evidence and also by projecting his or her consciousness into the positions of all of the principal characters, is able to devise a deeper and more satisfying interpretation. Writers and reader alike enjoy the opportunities for the play of consciousness and freedom these stories provide.

Similarly, a parent adjudicating a dispute between two children has clear insight into the consciousness of the disputants. A mother knows exactly how her son is exploiting the sensitivities of his sister to instigate a provocation that can then be used to incite her against her daughter. Can you even parse the previous sentence, with all of its pronouns, without projecting your own consciousness into the situation?

As a final example, consider how this human feature of consciousness projection could be used in connection with "the Turing Test." In this test one is communicating via a computer screen with either a human or a computer. The problem is to devise a written test to determine if the other entity is human or machine. I propose a test that calls upon that entity to project his/her/its consciousness into alternative lifestyles of a human being and to decide which alternative is more in keeping with the human condition. For example:

> "Choose one of the following sentences for discard so that those that remain make the most likely scenario.
>
> (1) John has a terminal disease;
>
> (2) John is training for the Olympic Marathon race.
>
> (3) John prays for courage."

CONCLUSION

Review of the examples presented above reveals a common theme. In each case, consciousness is directed toward adjusting one form of experience to conform to the *discipline* of another. That this theme should emerge from an investigation into freedom is perhaps astonishing.

The three examples of Part Two carry this theme even further, for in these the discipline arises from idealistic influences such as Truth and Justice. Speculation about such idealistic influences is, of course, very old; but has been almost abandoned in modern thought. Nonetheless, it doth return.

Might we not also speculate about yet another idealistic influence, namely Freedom? This too has its discipline. We recall a famous saying of the French physiologist, Claude Bernard: "Stability of one's internal environment is a condition of free life."[19]

Science and its models are pathways in the climb toward the mysteries that call to us out of the heavens. They are not answers to the mysteries but the products of the climb. Answers are beyond our reach. There is no failure in this. The climb itself is freedom.

NOTES

1. Seen on Marty Stouffer's Wild America, a series of wildlife programs distributed through public television, in an episode titled "Controversial Coyote." In another episode titled "Cottontails and Kin," Mr. Stouffer states: "Although most of us think of the cottontail as lightning fast, it can rarely sprint over 20 miles per hour. Its average running speed is only 12 to 15 miles per hour. It relies on quick reflexes, a zigzag running pattern, and *an uncanny knowledge of the few acres in its home range*."

2. Errington, Of Predation and Life (Ames, Ia; 1967) at 47. The author further concludes: "...I think that we are on safe grounds if we assume that any simple predatory feat that man can accomplish without artificial weapons, such as catching and killing with bare hands, would also be within the power of a great many other predators."

3. These principles constitute "old wine in new bottles," and perhaps the bottles are old too. Similar themes appear in *The Upanishads*, the *Tao Te Ching* and Plato.

In *The Learned Ignorance*, the fifteenth century mathematician and mystic Nicholas of Cusa argued: "The relationship of our intellect to the truth is like that of a polygon to a circle; the resemblance to the circle grows with the multiplication of angles of the polygon; but...no multiplication, even if it were infinite, of its angles will make the polygon equal the circle. It is clear, therefore, that all we know of the truth is that the absolute truth, such as it is, is beyond our reach.

More recently, in *The Concept of Mind*, Gilbert Ryle wrote that "The Myth of Volitions" arises because "the doctrine of volitions is a causal hypothesis, adopted because it was wrongly supposed that the question 'What makes a bodily movement voluntary?' was a causal question." Further, in confronting "The Bogey of Mechanism," Professor Ryle declared: "The hearsay knowledge that everything in Nature is subject to mechanical laws often tempts people to say that Nature is either one big machine, or else a conglomeration of machines. But there are very few machines in Nature."

The late Karl R. Popper once gave an address, reprinted in *Conjectures and Refutations: the Growth of Scientific Knowledge"* as "The Nature of Philosophical Problems and Their Roots in Science," where, after presenting the proposition that the original Platonism grew out of Pythagorean doctrine, he traced the origins of Kant's philosophy to the belief (now known to be erroneous) that, through Newton, "Mankind had obtained knowledge, real certain, indubitable, and demonstrable *knowledge* divine *scientia* or *epistçmç*, and not merely *doxa*, human opinion." Of course, Popper's philosophy rests on the proposition that scientific knowledge grows through the making and uncovering of error and through our power, outside of science, to know truth from error. So, I contend, we know, outside of fact or theory, the difference between freedom and compulsion.

4. V. S. Ramachandran, "Blind Spots," *Scientific American*, May, 1992, **226**, 5.

5. In mathematical physics, a differential equation involving a time derivative states a possible mechanism. The varieties and instances of such equations are very great. It is significant that modern physics employs three different formulations of its laws, namely classical (derived from Newton and Maxwell), relativistic, and quantum mechanical. Although the *results* of all three converge in most common cases, their formulations are radically different and there exist troubling divergences. None is wholly satisfactory. It is possible, of course, to create many approximations, but we believe that a "true" representation should be singular.

6. E.g., the work of Gerald M. Edelman and the Neurosciences Institute, presented in Edelman's *Neural Darwinism* (1987), *Remembered Present* (1990) and *Bright Air, Brilliant Fire* (1992).

7. E.g., William H. Calvin, *The Cerebral Symphony* (1990).

8. C. A. Skarda & W. J. Freeman, *How brains make chaos in order to make sense of the world*, 10 Behavioral and Brain Sciences (1987) 161, 172.

9. Deeke, L, Grötzinger, B, and Kornhuber, H. H. (1976) *Voluntary finger movements in man; cerebral potentials and theory.* Biol. Cybernetics, **23**, 99. The experimenters recorded the electroencephalograms (EEGs) of persons asked to flex the index fingers of their right hands at times entirely of their own choosing. The signals (presented in an averaged form), showed a curve roughly in the shape of an exponential growth, from a time approximately 1 seconds prior to the actual flexion, dropping off rapidly thereafter. The experiment is reported in R. Penrose, *The Emperor's New Mind* (1990) at 439-440.

10. Quoted in Susan Allport *Explorers of the Black Box* (Norton, 1986), p. 57 and incorporated in Calvin, *The Cerebral Symphony* (1990) at 214.

11. "The alternative view taken here, that motor and sensory structures can be understood only as coordinated selective systems, leads to sharply defined position concerning the relative roles of early signals in development and so-called higher events in the CNS; selection by early signals in both motor and sensory systems acting *together* in a global mapping is considered to be crucial in solving the problem of adaptive perceptual categorization. ... In this view, selective matching between sensory and motor systems is not the result of independent categorization by the sensory areas, which *then* execute a program to activate motor activity, which is in turn controlled by feedback loops. Instead, the results of motor activity are considered to be an integral part of the original perceptual categorization." G. M. Edelman, *Neural Darwinism* (1987) at 210-211 (emphasis in original).

12. A more complete presentation would involve a family of structural systems.

13. Milner, Physiological Psychology (1970) at 214-217.

14. See, e.g., Westfall, Never At Rest: A Biography of Isaac Newton (Cambridge 1980) at 302-304, describing Newton's preference for absolute space and the religious convictions on which it was based. In fact, "relative space" is counter-intuitive and the exclusive employment of "relative space" in the physics of relativity accounts for some of the conceptual difficulty of that subject.

15. See Wittgenstein, Philosophical Investigations, 66-71, describing the concept "games" as a complicated network of "family resemblances", overlapping and crisscrossing.

16. Adapted from California Book of Approved Jury Instructions, 13.20:

> "One of the issues which you must decide is whether, at the time of the events out of which the accident occurred, Dan Driver was the agent of defendant Deep Socket, Inc., or whether at said time Dan Driver was an independent contractor.
>
> While both an agent and an independent contractor work for another person, there is an important distinction between them.
>
> One is the agent of another person, called the principal, if he is authorized to act for or in place of the principal and is subject to the right of the principal to control his actions.
>
> An independent contractor is one who, in rendering services, exercises an independent employment or occupation, and represents his employer only as to the results of his work, and not as to the means whereby it is to be accomplished.
>
> The most important factor in determining whether one is an agent or independent contractor is whether the principal has the right to control the manner and means of accomplishing the result desired. If the principal has the authority to exercise complete control, whether or not that right is exercised with respect to all details, a principal-agent relationship exists.
>
> Other factors to be taken into consideration in determining whether a person is an agent or independent contractor are:
>
> (a) Whether or not the one performing services is engaged in a distinct occupation or business;
>
> (b) Whether, in the locality, the kind of occupation or business is one in which the work is usually done under the direction of a principal or by a specialist without supervision;

(c) The skill required in the particular occupation or business;

(d) Whether the principal or the workman supplies the instrumentalities, tools and the place of work for the person doing the work;

(e) The length of time for which the services are to be performed;

(f) The method of payment, whether based on time or by the job;

(g) Whether or not the work is part of the regular business of the alleged principal; and

(h) Whether or not the parties believe they are creating a relationship of agency or independent contractor.

One who employs an independent contractor is not liable to others for the acts or omissions of the independent contractor."

17. See also H. L. A. Hart, *The Concept of Law* (Oxford University Press 1961) at 15 (and note thereto at 234 referring to the passage in Wittgenstein's *Philosophical Investigations* cited in note 15, supra) and chapter VII.

18. The quoted portions are adapted from a rule of law stated in *California Civil Code* § 1572(3).

19. "La fixité du milieu intérieur est la condition de la vie libre." Quoted in W. Grey Walter, *The Living Brain* (1953) at 35.