PART OF WHAT A JUDGMENT IS:

A Conceptual Framework For Understanding The Making Of Judgments In The Contexts of Work

by

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ABSTRACT

Judgment has most commonly been treated as a "cognitive process", an "activity of the mind" or an "unconscious decision calculus". It is the perspective of this study that judgment deserves to be considered in its own right as judgment, and that the activity of making judgments deserves to be considered as a human activity, as something done by people (in contrast, for example, to viewing it as something done by "the mind" or by "information processing systems"). From this perspective, the need is seen for a conceptual framework which enables us to discuss, analyze, and evaluate the making of judgments as a human activity. It is the aim of this study to contribute to such a conceptual framework.

This study focuses on judgments as they are made by people in the contexts of their work and as informed by the understandings which people have of those contexts.

The case of a craft workshop is presented. A conceptual framework is developed with three purposes: 1) to make an interpretation of the case focusing on the use of judgment within the workshop; 2) to identify characteristics of judgment which can be generalized to a range of cases; and 3) to present, in conjunction with the conceptual framework, a method of institutional analysis appropriate for studying professions, crafts, and organizations as institutions of work, particularly with respect to assessing the role of judgment within those institutions.

Lastly, some speculations are made concerning the role of human judgment in the design and control of technologies and institutions, with particular attention given to ethical questions entailed in the use, abdication, and denial of judgment.

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For
Guilbert DuMont,
who taught me the question.

Our culture is the predominance of an idea
which draws after it
this train of cities and institutions.

--Ralph Waldo Emerson

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The epics of the Ancients often began with supplicatons to the gods. This gave the authors a chance to disclaim hubris: if one presumes to produce a "great work", it is perhaps safest to note that the works of the gods are greater.

That the reading of Homer has outlived belief in the divinity of Zeus might tend to dispell this formula--though time alone will tell. But in any event, Homer's deference to The Transcendent may still be seen as a legitimate expression of humility.

By the time of the Renaissance, when epics were replaced by treatises and kings took the place of gods as the objects of prescript supplication, humility remained a prerequisite of good authorship. No tract on the music of the spheres would leave any doubt as to its author's proper levitation. There was an order to things both celestial and worldly, and acknowledging this could mark the distinction between keeping one's place and losing one's head. Such was the Renaissance.

In our day, when treatises are legion and kings an endangered species, the need for humility is greater than ever. In liberating ourselves from the whims of gods and the tyranny of kings, we have come too often to be dazzled solely by our own talents. Hubris is on the rise. Even our forms

of supplication have a way of becoming self-flattery. Holy invocations are clearly presumptuous. And the "who's who" of acknowledgements is often little more than the author's way on congratulating himself on the company he keeps. (In the case on doctoral dissertations, I suppose it is the company the author hopes to keep.)

On balance our liberation has left us better off, at least potentially. But I cannot escape the sense that in the rush to dispose of the former objects of deference, we have, as well, robbed ourselves of a kind of grace. There is a clumsiness to our deference, even when it is sincere.

Yet in spite of this (or perhaps because of it) it is important, in our secular and egalitarian age, to remember that even the best work which each of us is capable of producing is never totally our own. Nor should it be. We are, each of us, members of many cultures, large and small, known and unknown. Our language and customs, our ideas, and, to a remarkable degree, our fears and longings are drawn from them. The work we do should be part of what we give back. If we are to bring a modern grace to our liberty and equality, perhaps it can be learned through deference to our fraternity.

I am indebted to my committee at MIT in many ways: to Suzann Thomas-Buckle, for strategy and conceptualization; to Len Buckle, for tactics and brainstorming; to Gary Marx, for riding shotgun on empiricism; and to all three for guidance,

great personal kindness, and for saying "stop". Thanks are due as well to Aaron Fleisher, conversationalist and navigational aide.

As I was completing this study, I received word of the death of Sir Geoffrey Vickers. The loss was real, tangible, and personal. In correspondence and on visits Sir Geoffery gave guidance which has had a profound impact on me both intellectually and personally. His influence is felt, even where it is not evidenced. He was a man of profound and tender insight, whoes life as a scholar was deeply harmonized with his life as a human being. In this there is an enduring lesson for all who knew him.

Special thanks go to several people who offered their time and reflections in discussing their work: physicians John Moses, Seymour Sacks, and Bill Kavesh; Charley Shraison, auto mechanic; Robert Siegel, interior designer; Bill Martin, woodworker and philosopher; Ed Machon and Dick Jerome of Verne Q. Powell Flutes, Inc.; and Bickford Brannen of Brannen Brothers--Flutemakers, Inc.

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INTRODUCTION

This is a study of human judgment. More specifically, it is a study of judgments made by people in the contexts of their work. The study is both theoretical and empirically oriented. It is theoretical because my major aim is to contribute to a conceptual framework for understanding the making of judgments. It is empirically oriented first, because it is developed around empirical examples and second, because the framework is intended to help people understand, evaluate and improve the making of judgments within the contexts of professions, crafts, and organizations.

In part, this study has grown out of my efforts to understand what goes on at Verne Q. Powell Flutes, Inc. "Powell" is a small workshop near Boston, Massachusetts, which, since its founding in 1927, has produced flutes considered to be among the best in the world.

As a flute player, I visited Powell in 1976 to see the source of the well-known flutes. I was so struck by what I found there--a mixture of craftshop and factory--that I returned as a researcher to see if I could find out what it takes to make a flute of the finest quality. Over the following year and a half, I studied Powell from many angles. I wrote several papers which were read by many kind people in the instrument-making business, in academia, and elsewhere.

One impression which became clear to me was that in assuring the quality of the flutes, the craftsmen relied

heavily on their ability to make judgments concerning the instruments' appearance to the eye and feel to the fingers. Certain aspects of the flutes, I was told, had to "look right and feel right." These things were never evaluated by any means other than the judgments of the craftsmen.

As I thought about it, I realized that people often make these sorts of judgments. In work, people frequently speak about the importance of "educated guesses" and "professional hunches". Flute-makers make judgments of feel. Insurance agents make actuarial judgments. Watchmakers "guess" which gear in a watch is out of balance. Administrators must often take actions based not on certainty but on their "best judgment" of a situation. Physicians make medical judgments in the diagnosis of an illness or in the interpretation of laboratory tests. And so on.

But what is entailed in the making of these judgments? I didn't know, so I looked into the literature. More precisely, I looked "for" the literature and found none. There are literatures which treat judgment from other perspectives (particularly in philosophy, psychology, and management), but there is no body of literature which can be said to treat "judgments as they are made by people in the context of their work." (1) Essentially, the question has received little attention.

So, the question "What is entailed in the making of

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(1) A notable exception is Vickers' The Art of Judgment, which looks at the role of judgment in policy-making.

these judgments?" is where this study begins. Given the conceptual sparseness of the area, my aim is to help fill out a conceptual framework which makes it possible to discuss, analyze, and understand judgments as they are made by people in the context of their work and which contributes to a conceptual and empirical foundation for further theory-building and research. In form, there are three aims to this study: first, to clarify what I take to be examples of "judgments as they are made by people in the context of their work"; second, to develop a conceptual framework for understanding those judgments; third, to examine some implications of that framework.

The structure of the study is as follows. The first part of Chapter I presents some examples of judgments which people have made in their work and raises some questions about the making of judgments which the examples imply. The second part of the chapter looks at the idea of judgment as it is treated in various literatures and further clarifies the view of judgment taken in this study.

Chapter II is a rather full telling of the history, tradition, and craft of flute-making, focusing on the story of the Powell workshop. Chapter III presents the conceptual framework and builds an interpretation of the making of judgments in Powell in light of that framework.

Chapter IV presents the conceptual framework in summary form and draws some implications concerning its applicability to further research and theoretical work, as well as its

usefulness to practitioners and institutional analysts. In Chapter V, I look at some broader social and ethical imp. ications of this work, focusing on the role of human judgments in the control of human technologies and institutions.

A NOTE ON METHOD

Chapter II is a story of flutes and flute-making. It is a rather full telling of the story. It is based on participant observation, many formal and informal interviews, and on historical research.

The fullness of the story is meant to give the reader a sense of the flute world, a feeling for it. I wanted to report not only facts (what Oliver Wendell Holmes, Sr. called "the brute beasts of the intellectual domain"), but also colors, textures, and tastes. For it is these things, as much or more than "facts", which make the flute world (or any world) real for those who inhabit it.

It is important for the reader to have a sense of the flute world because (as I argue in detail in Chapter III) it is the richness of the flute world which informs and gives meaning to the judgments made in it.

Not everything presented in the story bears directly on the conceptual framework, nor are all the major details of the story incorporated into it as examples. However, in presenting the framework I wanted to be able to give isolated

examples which the reader could appreciate by having a sense of the context from which they were drawn. Since it is the context which provides meaning to the judgments people make within it, understanding those judgments requires an understanding of the context.

Clifford Geertz (1973), in discussing theories of culture, makes the following remark. "Believing, with Max Weber, that man is an animal suspended in webs of significance he himself has spun, I take culture to be those webs, and the analysis of it to be therefore not an experimental science in search of law but an interpretive one in search of meaning." I would agree. The flute world is a kind of tiny culture. It is made up of "webs of significance" which craftsmen and flutists have spun. It is within the significance of those webs that the judgments of the flute world are made. To this extent, the effort to understand those judgments is not an experimental one "in search of law but an interpretive one in search of meaning."

The business of social science and social philosophy is to understand social phenomena. In doing so, it is sometimes necessary to get a sense of what the phenomena mean to those people "suspended" in them. There is no way by which the fullness of such meaning can be captured in laws. In a practical sense, what is essential about the fall of a stone can be fully explained by the laws of physical bodies and gravitation. But the essentials of the fall of a particular government can never be fully explained by any set of laws.

In every event of consequence in a social context, there are "webs of significance" which are both essential to the event (which an analysis of if ought to take into account) and sufficiently intimate to that particular context as to be beyond the reach of the generality of laws. No matter how many times we view a similar event, fully understanding a new one will always require an interpretation.

In making such interpretations, often what is crucial is not so much the quantity of our knowledge as the quality of our epistemology. That is, understanding a social phenomenon can depend less on how many things we know about it and more on how we organize what we know. (1) It is in building the epistemology that we tap into the webs of significance which inform the phenomena we wish to understand. In a manner of speaking, the organization of the epistemology parallels the pattern of the webs. It gives us a sense not only of what people know, but of the meaning and significance which they attach to that knowledge.

This study is an effort to understand judgments as they are made by people in the context of their work and as they are informed by the understandings which people have of those contexts. The conceptual framework developed here has three functions: 1) to make possible an analysis of the Powell workshop, focusing on judgments as they are made by the Powell craftsmen and as they are informed by the

(1) In fact, a common by-product of such understanding is the discarding of superfluous knowledge.

understandings the craftsmen have of their craft; 2) to identify those characteristics of judgment which can be generalized beyond the Powell context: and 3) to present within the framework itself a method of institutional analysis appropriate for the study of professions, crafts, and organizations as institutions of work, particularly with respect to the role of judgments within those institutions (that is, to present a way of building epistemologies which tap into the webs of significance of these institutions of work).

In making the analysis of Powell, I have followed generally the method advanced by Geertz (1973) (and borrowed by him from Ryle) of giving a "thick description". (1) By this, the analysis is built up through layers of interpretation, each layer building upon and adding to the previous layers. Ultimately, as in a cubist painting, we see the subject from enough angles to have a useful and compelling sense of the whole.

The framework, overall, is my invention. Many parts of it, though, have been borrowed from others. Most of the borrowed ideas (2) were not advanced originally to deal with the subject of judgment. I have noted, where appropriate, the way these borrowed ideas are understood within this study

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(1) In a similar vein is Gearing's (1970) notion of "successive approximation".

(2) Such as Polanyi's notion of "tacit knowledge" and Boulding's idea of "image".

and indicated how I view them as part of what a judgment is.

A NOTE ON FAITH

Every enterprise is in some measure an article of faith. No matter how broad our theories or rigorous our methods, we all begin and end with what Emerson called "a residuum unknown, unanalyzable."

If this study rests on some article of faith, it is this:

That there are elements of our human existence which are real in our experience of them; that there is, as Joyce suggests, a "reality of experience"; that the things of this reality deserve to be considered in their own right; and that they are not fully understood by examining parts into which they may be broken or by describing known or supposed underlying causes. The reality of appreciating a sunset is not fully understood by an account of the cognitive processes of vision or the electro-chemical states of the brain.

And that the "uncreated conscience" of our race, upon which the survival of our race may yet depend, is sustained by faith in the reality of experience in ourselves and belief in its reality to others.

Chapter I

THE REALITY OF JUDGMENT

We all make judgments. In the context of work we commonly refer to "educated guesses" and "professional hunches". These guesses are not simply "shots in the dark"; that they are "educated" suggests a degree of judgment and an understanding of what is appropriate to a particular context. Typically, what goes into such judgments is not spelled out, but often much of what people do in their work depends on their ability to make them. The following are examples drawn from interviews I have done.

* An interior designer talks about redesigning a room. "The moment I came into the room, I said to myself, 'This place is wrong.' I couldn't quite say why it was wrong, but I had no doubt about it.... I wandered around the room for a while noting what was there.... I was certain things weren't right, but I didn't know yet what to do.... I noticed that some things were all right. I saw that the sofa and bookcases were in the right place.... Then I focused on the plants. I knew they were wrong, and I knew some things I could do with them. You always have to 'make a commitment' to start with something, so I made a commitment to start on the room with the plants.... I re-arranged the plants against the windows and felt much better about them...

Then there was the round table against the wall. I know round tables, as a rule, work better away from walls, so I moved it out into the room and tried it in several places.... This led to trying other things, and eventually I had a design where I could stand back and say, 'Now the room is right.'"

* A physician receives the results of a series of laboratory tests for a patient. The results include an abnormally high count in part of a blood test. All else is normal. The physician notes the abnormal count, but decides to do nothing about it because his "clinical impression is that the patient is healthy and that the high level can be safely ignored."

* An auto mechanic relies on his ear to tune an engine. "I'll set up a car first by the specifications. But if I don't like the way it runs, I'll re-set it by ear.... I listen to the engine first for noises that don't belong, then for things that should be there.... A mechanically wrong sound stands out.... You get used to hearing cars run one way, and when you hear them running differently, you know something's wrong. In your mind you might think it's one thing or another, but then you listen closely, and you know what it is."

* A woodworker talks about educated guesses in joinery. "There really isn't one right way to join two boards

> together.... If you are making a miter, for example, the way you do it is different if you are making a screen door or a piece of fine furniture..., even when you're cutting them to the same size using the same tools. ...If you were mitering a series of boards to panel a wall, and you cut each board in a way appropriate for furniture, then put them together, the wall would undulate all over the place.... When you cut each board, you have to keep in the back of your mind the situation..., set the conditions around what you are making, what it is going to be and do--then the way you use the technique comes out of that. This accounts for a lot of bad carpentry: people do good work, but in a style that's just wrong for what they're making.... You don't think about these things very much; it just comes out of what you're doing.... You have to fit the technique to the scale and style you're working in."

It is this sort of judgment, made by people in the context of their work and based on their understanding of that context, that is the subject of this study.

PROFESSION, CRAFT OR SULLEN ART

Judgment has a place in every occupation. In some it is central, in others incidental. Clearly, it is a focal point for a judge, a fashion designer or an architect, but it is by

no means completely missing from the work of a bricklayer, a barber or a shop clerk. The judgments we are called upon to make can vary considerably in nature from one job to another and in a single job from one situation to the next. But there are very few jobs in which one never has to make "educated guesses".

There is a common understanding of the "educated guess" which touches on several areas of current interest in the study of professions and organizations. For example, there has been a good deal of research in recent years on the role of "discretion" in agency-related occupations (see Lipsky, 1978). This is pertinent to the issue of judgment since making judgments is commonly involved in exercising discretion. The research indicates that even in highly bureaucratized settings, where regulations would seem to guide a bureaucrat's every move, discretion is often crucial to getting work done, even when the discretion becomes unofficial. In fact, at some points, it appears that increased regulation can simply drive discretion underground: the bureaucrat begins to exercise personal discretion covertly to get work done or in some cases simply to thwart the imposition of regulations. So, within such discretion, we might reasonably expect to find people making judgments necessary to their work, even in places where regulation is extreme or where the discretion is not "official".

Other examples are to be found in the programs for "shop-floor management" recently championed by the US

automobile manufacturers and other major industries. These are derived from work in "socio-technical systems" (e.g., see Emery and Trist, 1960) and have been used in Japan and Europe--particularly in Scandinavia--for well over a decade. These programs make efforts to involve line workers in decisions about the organization of work and company management, which have traditionally been the sole prerogative of management. Implicit in such efforts is a recognition of the value in the perspective and expertise of line workers to the work at hand. This expertise can include what might be called "shop floor judgments". That is, the ability of the line workers to make judgments about the work being done, based on their intimacy to the work itself (something often beyond the reach of management since they lack that intimacy).

There is a distinction drawn traditionally between the crafts and the professions. The philosopher Alfred North Whitehead articulated the distinction in a way which has become almost a commonplace. For Whitehead, a craft is "based upon customary activities and modified by the trial and error of individual practice", while the activities of a profession, he felt, are "subject to theoretical analysis and are modified by theoretical conclusions derived from that analysis." (Whitehead, 1948)

In this study, I do not follow any distinction of this kind. In a contemporary light, such distinctions appear quite limited in their utility. "Professional standards", on

close inspection, often assume norms embodied in "customary activities", and the "practice" of professions is certainly not immune to the lessons of "trial and error" (though the "credo" of a professional society may, at times, lag behind habits of its practitioners). Crafts, meanwhile, are increasingly subject to "theoretical analysis"--from the stultifying "time-motion" studies of Taylorism (Taylor, 1910) to the work of the Tavistock Institute on the social structure and technological contexts of the crafts and trades (e.g., Trist and Bamforth, 1951).

This study deals with judgments which are made in the contexts of work. The "contexts" I have generally in mind are the professions, crafts, and organizations viewed as "institutions of work", but I make no significant distinctions among them. The case presented in Chapter II of this study is the craft of flute-making. The conceptual framework developed in Chapter III focuses on the interpretation of judgments made in this craft. However, in Chapter IV I will identify some implications which the conceptual framework has for other "contexts of work", whether profession, craft or sullen art.

A NOTE ON THE LITERATURE

In this study I view judgments as they are made by people in the context of their work and as they are informed by the understandings people have of those contexts. I mean

this view to be taken literally.

I do not, as many in the literature do, view judgments as being made by "minds" or by "information processing systems". I view them as being made by people. Some view judgment in terms of "cognitive processes", while others treat it as a form of "decision-making". I wish to treat judgment as judgment. Further, my interest in judgments as they are informed by the understanding people have of the contexts within which they are made is an interest literally in "the understandings people have", not in how they "get information from their environments" nor in how they "respond to proximal stimuli".

These other perspectives make up most of the work on judgment to be found in the literature. Though I have some serious reservations about certain claims and applications of these perspectives, I do not take the position that they are generally and inherently invalid. I am, however, taking a different perspective, which I see as valid in itself.

I wish to view the making of judgments as an activity of human beings--whole human beings. I see this as an important and valid perspective because I believe that it is as whole human beings that people can and ought to make judgments, and because it is as whole human beings that people can be affected by the judgments of others. This perspective is developed and refined in the following look at the literature.

The three main literatures which have recognized claims

to the territory of judgment are found in the fields of philosophy, psychology, and management. I will look at representatives of each briefly to note those things which are relevant to the cast of this study and to allay any confusion regarding those sorts of things which might be construed as relevant here but are not.

More has been written on judgment in the field of philosophy than in psychology and management combined. This is so, I believe, for two reasons. First, philosophy contains more divergent opinions about the subject than the other two fields. Second, philosophers have been about their business two thousand years longer than psychologists and managers. Nonetheless, in philosophy there are a few themes concerning judgment which have predominated. I will touch on these here.

The eighteenth-century philosopher Thomas Reid remarked, "Judging is an operation of the mind so familiar to every man who has understanding, and its name is so common and so well understood, that it needs no definition." (Reid, 1969; p. 532) Reid was both right and wrong. As a major figure of the "common sense" movement in philosophy, he maintained that the difficulties of philosophy come from a habit common to philosophers of refusing to view things simply and for what they are. In the best spirit of this view, Reid was right: our common understanding of judgment works quite well for many things. We all have generally useful notions of "educated guesses" and "professional hunches", and when

someone says, "Use your best judgment," we know what he means (even if we don't always know what to do). But life is not always simple, and even in trying to view things for what they are, we often have to subject our common sense ideas to uncommon scrutiny. In such cases, Reid's maxim could not be more misleading. Judgment under scrutiny has a history as an illusive and often unyielding notion which has been viewed in many different ways by many different people--among them, several philosophers.

Reid argued that judgment is "an act of the mind, whereby one thing is affirmed or denied of another." In this statement Reid captures two themes about judgment which have predominated in philosophy. First, that judgment is a source of knowledge. That is, when "one thing is affirmed or denied of another," we get knowledge. For example, when we say, "This rose is red", we are "affirming" the redness of the rose. That is, our knowledge that the rose is red is got by judging it to be so. Similarly, when we say, "A horse is an animal" or "Stealing is not good," we are "affirming" "animalness" of horses and "denying" "goodness" to stealing. We know these things because we judged them as such.

The second theme is that judgment is "an act of the mind". That is, if there are judgments being made, a mind is making them. This theme is incompatible with the focus of this study. The focus here is on the making of judgments as an activity carried out by people, not as an activity carried out by minds. There are, indeed, things which I argue are

entailed in the making of judgments that are carried out in the mind, but in considering them I do not want to shift the primary focus of attention from human activities to mental acts or capacities. I do not question as a whole the legitimacy of viewing judgment as a mental act or capacity, but I hold that there are things about the making of judgments which are not within the grasp of this view. Considering judgment to be solely an "act of the mind" is akin to considering kissing to be an "act of the lips". The view is not meaningless, but it does not capture certain things which are real parts of the human activity of making judgments (or of kissing). The distinction between saying, "My lips kissed you" and "I kissed you", or between "My mind judged it to be wrong" and "I judged it to be wrong" is a real one which I do not wish to lose sight of.

On the first theme (that judgment is a source of knowledge), the key figure in philosophy is Kant. In outline, Kant (1952, 1929) held that all knowledge is derived from judgment. Judgment for Kant bridged a gap which he saw existing between our perceptions (or experience) of the world and our knowledge of it. When we see a tree, for example, the gap between the impression of the tree in our vision and our knowledge of it in our mind is bridged by the judgment that what we see is a tree.

Kant's concern with judgment was, in fact, primarily epistemological. He treated the subject almost exclusively in terms of its relationship to questions of knowledge.

While I am clearly concerned in this study with epistemological issues (for example, with the knowledge we need in order to make judgments), I focus on these issues only to the extent that they bear on the subject of judgment.

Kant also argued that in order to judge something, we need to have a concept of it. When we see a tree, for example, we need to have a concept of "tree" in our minds by which to judge it. Echoes of this notion appear in Chapter III of this study, in the discussion of "fitting to an image".

Further, unlike Reid and many others, Kant sees the act of judgment as an act of the "self". This is much more in keeping with the orientation of this study, in seeing judgments as carried out by people.

In philosophy there is a tradition of drawing distinctions among types of judgments. Kant held that there are several types of judgments, which are the source of several different types of knowledge. (The types, which he derived from the logic of Aristotle, are based on the categories of quantity, quality, relation, and modality.) However, the distinction which has had the greatest influence derives from Plato. By this tradition, there are three types of judgments which are irreducible and which account for all possible types of judgments. They are: factual, ethical, and aesthetic. In making factual judgments, we judge that something is in fact so. For example, to judge a building to be twenty meters high is to judge that it is, in fact, twenty

meters high; to judge that Mr. Smith is innocent is to judge that he is, in fact, innocent; to judge that it will rain tomorrow is to judge that it will, in fact, rain. Ethical judgments are, just as they would seem, judgments about good and evil, right and wrong; they are the bases of ethical "oughts" and social norms. Aesthetic judgments are judgments of taste and style. (1)

To these traditional types of judgments, Vickers (1965) adds "instrumental" judgments. These are judgments which concern how to go about doing something or which determine the best way to achieve things which have been specified by judgments of fact and value.

As a general point, I am in agreement with these four

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(1) Aesthetic judgments are commonly considered these days to be unimportant or "merely a matter of personal taste". This was not always so. Plato, for example, saw his three types of judgments to be of equal importance since true knowledge, true virtue, and true beauty were all, in his view, "illuminated" by the same thing--namely, the ideal of The Good. The low esteem accorded currently to aesthetic judgments is based on the assumption (usually unexamined) that they are hopelessly relative, that one aesthetic judgment is as good as another, and that we do not find people "wrong" or "evil" for making particular aesthetic judgments (as we do in the case of factual and ethical judgments). I think that this is an improper way to view aesthetic judgments. That I am free to find beautiful something which someone else is free to find ugly does not mean that the making of aesthetic judgments is not important to either of us or to our society. I know of no human culture which is without an aesthetic system, and every such system is sustained by aesthetic judgments made by people in that culture. Aesthetic systems are, in my view, part of what we are as cultural beings. The patterns, norms, and regularities of the aesthetic judgments of a culture are "webs of significance" just as real to that culture as those of ethics and fact. Aesthetic systems are part of the contexts within which people make judgments and, thus, are of concern in this study.

types. They rest as assumptions behind several points made in this study, though it is not my primary aim to draw such distinctions.

The 20th century pragmatist John Dewey sees judgment as treating issues which are neither "certain" on the one hand nor "obscure" on the other. He says that if a matter "suggests, however vaguely, different meanings, rival possible interpretations, [then] there is some point at issue, some matter at stake" which is appropriately "settled" by judgment. (Dewey, 1910; p. 102) For Dewey, judgment defines an issue by selecting appropriate facts as evidence and by interpreting those facts. Therefore, he sees judgment as being both analytic and synthetic. Dewey is ultimately interested in "good judgment" and how education can foster it. "A man of good judgment in a given set of affairs," Dewey says, "is a man in so far educated, trained, whatever may be his literacy." (1910; p. 101) He warns, "Educational methods that pride themselves on being exclusively analytic or exclusively synthetic are therefore (so far as they carry out their boasts) incompatible with normal operations of judgment." (1910; p. 114)

That judgment "in a given set of affairs" can be fostered by education, that is, that it can be taught and learned, is an important point. To the best of my knowledge, Dewey is the first philosopher to make a deliberate point of this issue. Generally, judgment is viewed as a sort of talent which either one has or does not have. When we speak

of people having a talent for playing the piano or for sport, we don't think of that as something they have learned. We tend to think of talent as inborn. Similarly, we tend to see judgment as neither learnable nor teachable; or if we see it as learnable ("he has learned to be a good judge of character"), we tend to see the process of learning it as mysterious. In this study I argue that the ability to make certain judgments within "a given set of affairs" (that is, within a context that informs and gives meaning to those judgments) can be taught and learned, that it can, indeed, be taught and learned in remarkable detail, and that that detail can be kept with striking constancy over generations. In this I agree with Dewey.

I disagree with Dewey, however, on the notion that judgment concerns only things which are between "certain" and "obscure". Having certainty does not always, in my view, obviate the need nor free us of the responsibility to make judgments. Confronted with facts which we take as certain, we are often, for example, in the position of making ethical or aesthetic judgments about them. Also, in a sense which is not trivial, we often need to judge whether or not a particular fact is "in fact" important or relevant. That is, certainty about things does not always automatically do away with the need to make judgments about those certainties, not even the need to make factual judgments about them.

Hannah Arendt was beginning a study of "judging" at the time of her death in 1975. She left only a few notes which

focus on her interpretations of Kant. Though these notes have been published (Arendt, 1977, 1978; Vol. 2), what she had fully in mind for her study is unknown. Arendt's earlier parallel study on "thinking" (1977, 1978; Vol. 1) has, however, prompted some speculations I have made in my last chapter. In attending the trial of Eichmann, Arendt was struck by the "thoughtlessness", rather than any calculating evil, that was behind Eichmann's actions. In her study she explores the role which "absence of thinking" can have in ethical and political actions. On a much smaller scale, I explore some ethical aspects of the use or absence of judgment. Specifically, I am concerned with the abdication or denial of the human element in some views of judgment and with the consequent dehumanization of the understanding, evaluation and control of human technologies and institutions when such views are applied. I argue that judgment is a human activity and that human beings can be ethically obligated to judge.

The perspective which the psychological literature (both in cognitive psychology and social psychology) takes on judgment is almost entirely incompatible with the focus of this study. A major focus in cognitive psychology is on "the relationship between the judgment and the object judged." (Cohen, 1973; p. 2) Typically, this is investigated in experimental situations where the aim is to "identify those probabilistic relations that exist between observable, proximal stimuli and the observer's judgments." (Cohen; p.

9) That is, this approach in psychology has been to identify the sorts of judgments subjects made when presented (usually by the experimenting psychologist) with things to be judged. The results of such experiments are then usually used as the basis of models of the particular cognitive processes which the author has identified with an aspect of judgment. (1)

Like the philosophers who treat judgment as an "act of the mind", the psychologists who study "cognitive processes" are looking at phenomena which are a layer or two removed from the focus of this study. This work on cognition is not irrelevant to this study (specific references are noted in the chapters that follow), but since the focus here is on "the making of judgments by whole human beings", the difference between a judgment as the product of a cognitive process and as an action of Mr. Smith must be respected.

Another section of the psychology literature looks at judgment as a cognitive process from the perspective of information processing. (2) It is argued within this view that "intuitive judgments are made on the basis of information which has been processed and transformed by the human mind. Consequently it is appropriate to consider the characteristics of the human mind as an information-processing system." (Hogarth, 1980; p. 4) This

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(1) Restle's (1961) very formalistic treatment of "judgment and choice" and Tversky's (1977) work on judgments of similarity are representative examples.

(2) Hogarth (1980) and Kleinmuntz (1968) are representative of this approach.

obviously differs from the perspective I am taking, since it attributes the making of judgments to "the human mind as an information-processing system" whereas I am attributing it to people. But there are two other points where the view I am taking on judgment differs significantly from the information-processing perspective. Each requires comment.

First, I do not view judgments as being "made on the basis of information" but rather as being made on the basis of someone's understanding. "Information" as it is fundamentally defined in information theory is devoid of meaning. The words "chat", "chatull", "gato", "feles", and "gath" are, in a sense, informationally equivalent, but they carry no meaning at all unless you know the languages they are written in. From the perspective of communication or understanding, information is an incomplete concept, since it tells you nothing about the organization of the receiver. You can send a message to a friend, but he would understand nothing if you have written it in a language (or code) unfamiliar to him: he would have the information, but no meaning. (1) If your friend needed your message in order to make a judgment, the information in your message would do him nc good unless he understood it. Even if the language were familiar to him, it is quite possible that he could base his judgment on an understanding of your message which you did not intend. Thus, I view judgments as based on

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(1) In this argument I have been influenced by Vickers.

understanding, rather than on information. For example, when the auto mechanic mentioned earlier tunes an engine by sound, he does it not on the basis of information in the sound but on his understanding of the sound. Presumably, the same information is available to my ear, but I do not understand it, so I can not judge the engine as he does.

The second point of difference is that the information-processing perspective does not focus on the reality of making judgments as we experience it. I understand what it is to judge the weight of an object by its heft, the approach of a train by its movement, the feel of a flute by its touch, or the mood of a friend by his manner; but the idea of judging something on the basis of information is meaningless to me, given my experience of what it is to judge things. Further, I do not find thinking of my mind as an "information-processing system" particularly helpful in understanding the making of judgments. I have no doubt that there are some valuable things which the information-processing model can illuminate. Psychology, for example, is concerned with phenomena going on in our minds (or in their stubbornly material counterparts, our brains) that may be reasonably and usefully understood as "information-processing". However, these things have no reality in our experience. We experience the heft of an object as the heft of the object, not as information about its heft or, for that matter, as a cascade of synaptic firings. When I judge the mood of a friend or the feel of a

flute, I do not find it helpful to view the making of these judgments as tasks of processing information (no more than I would find it helpful to see them as efforts to produce the right series of electro-chemical states in my brain). When we judge the weight of an object by its heft or the feel of a flute by its touch, the heft and the touch and the judging are sufficiently real to us in our experience of them that they deserve to be considered, discussed, and understood in their own right. It is this aspect of judgment--this reality of judgment--that is the primary focus of this study.

There is another section of the literature, more in the area of social psychology, which gives some particular attention to judgment. Works in this area usually view judgment as a means for dealing with uncertainties which cannot be dealt with by such analytic means as decision theory. Mack (1971) considers uncertainty to be natural and "as necessary as the air we breath," but something which in certain situations (business and government, particularly) can have costs. She suggests several analytic decision techniques for reducing these costs and for dealing with uncertainty. Given uncertainty, she argues that "one cannot deal constructively with the problems raised by uncertainty without remembering that some men, under some circumstances, are virtuosos in the art of judgment." (1971; p. 64) Thus, under uncertainty, she sees judgments of fact to be ways of establishing probabilities of outcomes and value judgments as ways of assessing the utility of possible outcomes. That is,

she sees judgment as a sort of artful way of doing cost/benefit analyses when uncertainty makes explicit techniques impossible. The essays in Shelly and Bryan (1964) focus on the role of judgment in formal decision techniques where "all the required objective measures are not available, and the only substitutes are human judgments." Hammond et al. (1975) argue that the environment contains "causal ambiguity", that there are "probabilistic, entangled relations among environmental variables." They contend that people attempt to reduce or eliminate the causal ambiguity by manipulating the environmental variables through various cognitive processes. When people cannot do this, "They must do the best they can by passive rather than active means to arrive at a conclusion regarding a state of affairs clouded by causal ambiguity. They must, in short, exercise their judgment. Human judgment is a cognitive activity of last resort."

This perspective is quite antithetical to the orientation of this study. I do not consider human judgment (whether viewed as a cognitive activity or otherwise) to be a "last resort". The perspective which the above authors represent appears to take as a basic assumption that explicit techniques and objective measures are inherently preferable or superior to human judgment; that judgment should be replaced wherever possible by more explicitly manipulable techniques; and that judgment should only be employed in the face of uncertainty and at the default of such techniques. I

do not share this assumption to any degree. (Indeed, I think it is potentially inhumane, as I will argue in my last chapter.) Such techniques, in my view, do not displace the need to make judgments. They deal with "objective measures" which are important only if we judge them to be so, and they produce "outcomes" the value of which we must actively judge. They enable us to manipulate quantitatively probabilities and utilities, but the distinction between a cost and a benefit can only be made by human judgment. The role of judgment, in my view, is not as a technique of "last resort" but as a practical and ethical human necessity of the first order.

Within the management literature, aside from the growing volume of work from the decision-making perspective, there is surprisingly little attention given to judgment. Some authors in this area view judgment much like those just mentioned--that is, as a way to fill in gaps inaccessable to more desirable methods of decision making. Others view "good judgment" as a talent about which there is little we can say.

Herbert Simon, as a key figure of the decision-making perspective in management, argues that the need to make factual judgments arises when the facts are not at hand. "It is here that judgment enters. In making administrative decisions, it is continually necessary to choose factual premises whose truth or falsehood is not definitely known and cannot be determined with certainty with the information and time available for reaching the decision." (Simon, 1976; p. 51) Simon argues that value judgments are decisions which

"must take as their ethical premises the objectives that have been set for the organization." (1976; p. 52) This is incompatible with the view taken here since, as I argued above, even when the "truth or falsehood" of "factual premises" is known, there still can be a need to make judgments, even factual judgments about them. In referring to value judgments as decisions which treat organizational objectives as ethical premises, Simon has said that value judgments are not judgments but decisions, as well as that they have nothing to do with judging or setting values since they "must take as their ethical premises" things which "have been set" elsewhere. This is contrary to my view of judgment.

Chester Barnard, in his classic study (1968), argues for the importance of the "non-logical" and the "intuitive" aspects of the executive process, judgment among them. He sketches many examples of situations where an executive's "intuitive" abilities prove to be of value. One intuitive element that Barnard identifies, for example, is the importance of "sensing the whole" or the "total situation" in dealing with specific situations, particularly difficult ones. This is in keeping with the importance attached in this study to a person's understanding of the context within which he makes judgments. However, Barnard does not specify in any great detail what he sees as entailed in having a "sense of the whole", and in the end he treats it as a matter of talent, with the implication that its source is mysterious

and that there is little else we can say about it. He concludes, for example, that "a conception of the whole is rarely present, perhaps rarely possible, except to a few men of executive genius...." (1968; p. 239)

Sir Geoffrey Vickers (1965) addresses the subject of judgment directly, focusing on its role in policy making. Within a "systems" perspective, he argues that an administrator's job entails several interrelated tasks and several different sorts of interrelated judgments. Like a figure skater who must at once keep his balance and execute fine patterns, the executive, Vickers points out, must keep the mechanisms of an institution running smoothly while also directing those mechanisms toward the realization of policies. Each process, in part, sets the scope and limits of the other. The executive must make judgments of fact about the "state of the system" and judgments of value concerning the significance of those facts; his concern in policy making is with "the evolution and modification of the course, the norm, the standard, the governing relation which is inherent in every policy and the selection and ascertainment of facts relevant to it." (1965; p. 39) He must also make instrumental judgments which determine how the institutional mechanisms can best be used, given the "course" set by policy. (1)

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(1) There is a parallel worthy of note between this view of executive policy making and Plato's notion of wisdom. The greatest wisdom, Plato argued, is that of the ideal ruler who

Vickers' perspective is of value to this study in several respects. Reference will be made in the course of this study to other points, but of particular importance here is the fact that he treats judgment as a human activity and gives an account of it within particular contexts (i.e., settings of policy making). I agree with Vickers that judgments are often made in interrelated sets and that they reflect facts and values judged within specific contexts. Though the focus of this study differs from the one Vickers has taken (I address a broader set of questions about the making of judgments), I believe what I have to say is consistent with his general view.

WHAT'S IN A JUDGMENT?

The four examples given earlier of judgments made by an interior designer, a physician, an auto mechanic, and a woodworker suggest several questions: What is entailed in making judgments? What do we need to know in order to make them? How dependent are judgments upon the contexts within which they are made? Is making judgments an ability that can be taught and learned? Is it only learned through experience? Do we make judgments by a systematic process or do they just come to us? Can you spell out rules for making a judgment? Can judgment be replaced with a more objective

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must at once set the aims of society and also design the means by which society may move toward those aims.

process? How is making a judgment different from making a decision? Can you be certain that someone's judgment is right or that it can be trusted?

Other, very specific judgmental issues have surfaced in interviews I have done. For example: a medical administrator wants to account for variations in individual styles of medical judgment in evaluating patterns of laboratory usage among physicians in a major clinic; in designing a program to establish neighborhood justice centers in a large city, officials need to set policies for hiring and training mediators whose "talent" is viewed as a crucial component in the success or failure of the program; within the crafts, several practitioners have pointed to the need for apprentices not only to master the techniques of the trade, but also to "get a feel" for how things ought to be done.

These questions concern judgments as they are made by people in the context of their work and as they are informed by the understandings people have of those contexts. They underscore the need for a conceptual framework which enables us to discuss, analyze, and understand the making of judgments as an activity of human beings--whole human beings. It is the aim of this study to contribute to such a framework.

I take as my audience those whose interests touch on the making of judgments within institutions of work--specifically, social theorists interested in the

sociology and culture of the workplace, consultants and managers who must deal with situations which require people to make judgments in their work, planners and institutional analysts who need to design and evaluate organizational policies and programs in which judgments are a factor, and those who train people to do work which entails the making of judgments.

The next chapter is a story of flute-making. It does not discuss the making of judgments per se but, rather, gives an example.

Chapter II

PART OF WHAT A FLUTE IS

A STERLING LEGEND

One day around the turn of the century, in Fort Scott, Kansas, a young man named Verne Powell heard John Philip Sousa's band and decided then and there he wanted to do nothing else but play flute and piccolo. Or so the story goes.

Today, in the flute world, Verne Q. Powell Flutes, Inc. is a legend. It is a small workshop near Boston, Massachusetts which makes flutes of the finest quality. Some say the Powell flute is the best in the world.

Flute players and their students, instrument repairmen and music teachers all know about Powell flutes. Many of the flutists with the major symphony orchestras in the US and around the world own Powells. People play them, talk about them, and tell stories and pass on rumors about how Powell flutes are made, who makes them and what they are made of:

> "They use secret tools that they lock in a vault every night."
>
> "It takes over five years to make each flute."
>
> "Powells are made entirely by hand following Old World craftsmanship."
>
> "They are made out of a special kind of sterling silver."

"A Powell's tone is set by hand adjustments that can't even be measured."

The stories, never really complete, and always in some part mysterious, fill out a popular legend about how the Powell workshop is a special place and why the Powell flute is the best there is.

It is considered an unwritten obligation for a flute player to visit the Powell workshop if for any reason he comes to the Boston area. As a flute player interested in maintaining my good standing in the flute world, I paid such a visit in 1976.

When I entered Powell my image of the legendary workshop exploded. Powell turned out to be a modern light-industrial factory with rows of neon lights suspended over lines of workbenches which were stocked with drill presses, power tools, and casting equipment. It was a machine shop full of metal-workers. I found the scene unsettling. It all seemed too ordinary, too hard and mechanical to match the image of Old World craftsmen working special metals with secret tools. It was not the stuff of legends.

I knew flutes to be machines. I had studied their acoustics and metalurgy and had even taken my own flute apart a couple of times to overhaul it. Flutes are, indeed, mechanical devices. And the kind of factory I found when I visited Powell could certainly produce such things. So the fact that Powell turned out to be a modern machine shop at

least made some sense to me. But the popular image of a legendary flute made at an Old World workshop was too powerful for me to believe that what I had seen at the flute factory was all there is to Powell craftsmanship. I didn't expect to find elves and alchemists spinning flutes out of metaphysical substances; but I did expect to find some confirmation of the legend. Surely, I thought, the Powell flute is not simply the product of good equipment and precise measurement. Anyone can do that, and this wasn't anyone--it was Powell. There had to be something else, something special. But what?

Over the next year and a half I visited Powell often. I watched the flutes being made and learned about their materials and the steps of manufacture. I talked with the craftsmen about their work, the history of the company, and the flute itself. Slowly, a story of Powell emerged.

The barest facts about Powell are themselves impressive. Since 1927 Powell has produced several thousand flutes. Each one has been accepted by flutists as an instrument of the finest quality. The craftsmen have never made a single inferior instrument. And though each Powell flute is in some ways unique, a knowledgeable flute player would never fail to recognize a Powell by the way it feels and plays. In this respect, a Powell made 50 years ago plays the same as does one finished last week. Further, this constancy of style and quality has been maintained even though, today, each instrument is the product of several craftsmen and, over the

last half of a century, the workshop has passed through several generations of craftsmen.

These facts certainly make sense in terms of the legend. But what at Powell makes them possible? What do Powell craftsmen know how to do that enables them to make flutes of unvarying style and quality? Where can this be seen in the manufacturing process? How do they teach it to new generations of craftsmen? Is there something you have to add to good equipment and precise measurement to make a flute worthy of being a legend?

To answer these questions, the story of flutes and flute-making has to be told rather fully. One needs to understand something about what flutes are and about the history and tradition of flute craftsmanship. The story is one of facts and of legends, since both have an important place in the flute world.

On one of my earliest visits to Powell I had a conversation with Ed Machon, then president of the company, about the early days of the workshop. I had often heard the story that since most fine flutes are made of sterling silver, Mr. Powell, in order to make his first flute, had melted down his wife's sterling silver spoons. The story was famous, but I was never certain of its truth, so I asked Ed to tell me what really happened. "Is the story about Mrs. Powell's silver spoons really true?" I asked. Ed replied, "I won't comment on it one way or the other. I mean, why comment on a legend?"

I was surprised and amused by Ed's answer. He was saying nothing--but rightly so. To have commented would have turned a powerful legend into a simple matter of fact. And legends, it would seem, can be just as solid as machine tools, even under the scrutinizing glow of industrial neon.

So, Verne Q. Powell Flutes, Inc. began when Verne Powell, in order to make his first flute, melted down his wife's sterling silver spoons. Or so the story goes.

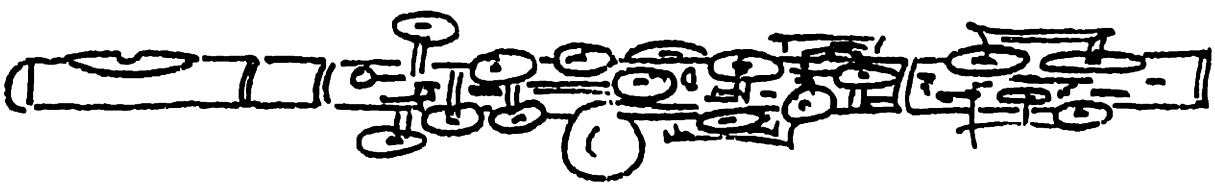
FLUTES IN TIME AND PLACE

The flute is an ancient instrument. King David, as all good shepherds, played the flute. So did Frederick the Great. The flute has been known to China since the earliest times, and it was the major melody instrument of the American Indians. In fact, the flute, in one form or another, appears in many cultures at many points in history.

The fundamental design shared by all flutes is very simple. Basically, a flute is a tube with holes in it. It is sounded by blowing across a hole at or near one end (called the "embouchure" hole), while its different notes are played by opening and closing holes along its length (called "tone" holes).

The number of tone holes can vary from a few to many, as long as there is a way of opening and closing them. (There are "flutes" without tone holes, though they are commonly thought of as pipes--such as the pipes of Pan.) A flute can have one key, or several keys, or none at all.

A typical keyless flute



A caricature of a flute with a key mechanism

The embouchure hole is usually located on the side of the tube, with that end of the tube itself stopped. There are, however, "end blown" flutes, such as the Japanese "Shakuhachi" flute or the ancient "nay", most likely the flute of King David. With an end blown flute, the player holds the instrument vertically--the most natural posture for blowing across an embouchure hole at the end of the tube. When the embouchure hole is on the side of the instrument, it is held horizontally (again, the most natural posture); therefore, such flutes have been called "transverse" flutes.

The vertical flute The transverse flute

Almost any material which comes as a tube or which can be made into one has been used to make flutes. Bamboo and other reeds have been the traditional materials for "simple" flutes. There have been flutes made of clay, wood, metal, glass, plastic, wax, and other materials.

THE MODERN WESTERN FLUTE

The familiar modern flute is a transverse flute with a range of about three octaves; it is made of metal, usually silver, with about 16 holes along its length that are opened and closed by an elaborate mechanism of keys. This flute--the kind made by Powell--is the latest product of a craft that goes back for centuries.

Flutes appear in European art and literature as far back as the early Middle Ages. In religious painting, for example, angels are often seen playing some form of flute. The earliest known description of a flute outside literature appears in the 12th century encyclopaedia, Hortus Deliciarum, which identifies a flute that appears in a miniature painting of the period.

The earliest surviving direct forerunners of the modern orchestral flute were made in the mid-16th century. These "Renaissance" flutes are described in some detail in treatises of the perid (notably M. Agricola's Musica Instrumentalis Deutsch of 1528 and M. Mersenne's Harmonie Universelle, published in 1636). Renaissance flutes are

wooden, with a basically cylindrical bore. They have six tone holes with no keys and a functional range of about 2-1/2 octaves. Their tone is generally soft and reedy. The design of a Renaissance flute is, in general, very simple, and variations of it appeared in Europe for several centuries.

In the 17th century the flute began to undergo substantial changes. The most notable of these were modifications in the shape of the bore--from cylindrical to conical--and the addition of a key. The main effect of these changes was to make certain notes on the flute more easily playable and to simplify some fingerings. These characteristics typify the Baroque flute. With these basic features in common, Baroque flutes varied significantly, by manufacturer and region. With the exception of an occasional ivory flute, Baroque flutes were typically made of wood. The type of wood varied due both to factors of availability and appearance and because of the tone each type could give to the finished flute. Different players preferred different tones, so flutes were made of different woods. There was some disagreement as to which differences in tone a particular wood could provide, but everyone agreed the effect was there.

From the mid-1700's to the mid-1800's, the flute underwent considerable variation in design. The bore changed a great deal, the size and arrangement of the tone holes shifted, and the number of keys grew. These changes were prompted by several factors, particularly notable among them

were two shifts in the general musical aesthetics of the time.

First, there was a desire for a stronger, fuller, louder tone from musical instruments. This paralleled a trend in composition which called for larger ensembles which played in larger halls for larger audiences. (1) Second, the fluctuations in flute design came also in response to a shift in what was considered the desired intonation. This requires some explanation.

Playing a scale "in tune" or a note "on pitch" is a relative matter. There is no universal standard that says a particular note has to be at a particular pitch or a scale in tune in a particular way. The note "E" could just as well be where we would expect to find "E-flat", or it could be half way between "E" and "E-flat", or it could be at "G-sharp", or anywhere. It is nothing more than convention that makes a note the pitch it is. The same is true of what makes a scale in or out of tune. That is, how far you have to go down from "E" to get to "E-flat", from "E-flat" to get to "D", and so on through the scale is a matter of convention. Further, these matters of pitch and distances between pitches have not always been the same.

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(1) I do not wish to imply any cause and effect here. These factors were mutually influencing. Larger compositions didn't cause a need for louder instruments. In fact, a "larger" tone also became desirable at this time for solo recitals in small halls. Nor did louder instruments made big ensembles and halls possible. Composers would not have written such works if they hadn't been considered aesthetically desirable.

Currently, the note "A" is set, by convention, at 440 cycles per second. That is, if a string on a Stradivarius violin, or the column of air in a Powell flute, or the body of an old milk bottle is set vibrating 440 times a second, the sound it will give off is called the note "A". When a violin or piano is "up to pitch", its "A" strings vibrate 440 times a second. When a flute or trumpet is built properly by today's conventions, it plays "A" at 440. This is the current custom. There are exceptions: some musicians and orchestras today play at 442 and a few at 444. You can tune pianos and violins accordingly. And instruments can be ordered built to these pitches. In the Baroque period, however, an "A" was generally around 415, though it varied considerably from place to place. In the late Renaissance, it was often near today's 440 and sometimes a bit higher.

Likewise, scales can be "in tune" in any number of ways. Octaves are fixed by a fact of acoustics: in going up from octave to octave, the length of the string or column of air, for instance, is reduced by half, and consequently the number of vibrations per second doubles. Thus, the "A" an octave above "A" 440 is "A" 880. But the way the octave is divided up is, within the capabilities of the human ear, quite arbitrary; it can be divided into three parts or three hundred. In absolute sense, it makes no difference. (1) In

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(1) Actually, there are certain notes which are "suggested" by acoustical properties. Dividing strings by varius common fractions, for example, can yield a scale approximating the conventional modern Western scale. But there is nothing that

Western music, the convention has emerged that the octave is divided into twelve parts--the notes A to G with all their sharps and flats added in. The sizes of these parts--that is, the distance between notes--like the pitches themselves, have varied considerably from time to time and place to place. So, to be "in tune" in France in 1690 is not necessarily to be in tune in Germany in 1790.

Variations in scale and pitch are reflected in the instruments which have survived from the different periods. In flutes, for example, you can see how the size and location of the tone holes vary depending on the date and location of manufacture. The different arrangements of tone holes yield different "scales". The length of the instruments, meanwhile, reflects the accepted pitch of a time and place. For example, "A" could be 415 or 430 or 440; the shorter the instrument, the higher the pitch.

In the late-1700's, as I said, the standards of intonation were changing. One way of dividing up an octave into a scale of twelve parts is to make the distance between all the notes equal. This notion--called "equal temperament"--has been around at least since the early 1500's; it had been experimented with by J.S.Bach and others, but had never really become popular. In the late-1700's it

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makes such a scale more "natural" or "right" than any other. In fact, there are limits and exceptions to all such schemes for producing scales. However, the acoustical "suggestions" are strong ones, and as a consequence, though there is considerable variation in scales across cultures, most tend to follow the acoustical suggestions in some way.

caught on, and by the mid-1800's it had been adopted throughout Europe. It has been the convention for being "in tune" ever since. The design of instruments, meanwhile, has changed to fit the convention.

So the initial changes in design which departed from the typical design of the Baroque flute were a result of many factors. These included adapting the flute to equal temperament, along with efforts to make its tone fuller and louder and to make the tonal character of its notes more even through its range. The process of modifying the flute's design with respect to these factors was a tricky business. A change in one factor could require a change in another. Modifying the bore to make the tone stronger, for example, might throw the pitch of certain notes off equal temperament, which could prompt a change in the size or arrangement of particular tone holes. The new arrangement of tone holes, meanwhile, might prompt the addition of a new key. And so on. As it turned out, no design proved perfect. Some were better than others. Among the best instruments, each had its strengths and weaknesses.

By the beginning of the 1800's, this process produced a problem. Adding keys to the flute proved to be a great way to adapt to equal temperament and to achieve a strong tone. But by the time the instrument commonly had six to ten keys, it was becoming harder and harder to play, since the keys themselves were awkward to operate and some of the fingerings they required were clumsy. A ten-keyed flute is, in many

ways, harder to play than the single-keyed Baroque flute. The fact that players were willing to put up with these difficulties in order to play in equal temperament testifies to the aesthetic appeal which equal temperament had gained. But they didn't put up with it silently, and soon instrument makers began to give attention to designing keys and mechanisms that played more easily. The difficulty of the keys was attacked, in the spirit of the 19th century, by the addition of more keys and the development of an elaborate mechanism which made their operation easier.

This process resulted in a rapid and substantial shift in the overall design of flutes. In 1832 Theobald Bohm, a goldsmith, flutist, and inventive flute-maker in Munich, took the radical step of producing a flute which, rather than having keys added on to compensate for "weaknesses" in basic design, instead incorporated the idea of a fully integrated, easily-operated key mechanism into the basic acoustical design of the instrument. The result was a flute with keys that played easily, a scale that was well "in tune" by the standards of equal temperament, and a tone that was strong and remarkably even through the instrument's range. The ten-keyed flute of the 1820's is basically a Baroque flute with modifications. Bohm's flute of 1832 is, in essence, the modern flute of today.

This transformation is, I believe, a wonderful example of the 19th century mind. Renaissance and Baroque flutes were not spare of keys because of deficient technology; they

simply did not require them to play well, given the musical and aesthetic demands of the time. Other wind instruments of the Renaissance and Baroque periods had keys, and lots of them. Judging from the technological history of such things as clockwork, the mechanical flute of the 19th century made use of technology that had been available for generations. What made the flute of 1832 an exemplary child of the 19th century was that its transformation into a mechanical device was not the result of tackling the difficulties of the ten-keyed flute, but that it was the way those difficulties were attacked. (1)

In 1847 Bohm made another design change which had a substantial impact. Prior to this point Bohm and others maintained a basically conical bore derived from the traditional bore of the Baroque flute. Bohm's 1847 flute had a bore which was cylindrical except for the head joint (the section containing the embouchure hole), which was slightly conical. (2) This new bore made the instrument's tone even fuller and louder. Meanwhile, with his key mechanism and modifications in the tone holes, Bohm was able to achieve characteristics of intonation which previously had required

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(1) I cannot resist the undefended aside that it is not merely coincidental that the flute should be transformed into something of a machine during the Industrial Revolution. Likewise, it is a provocative parallel that the idea of equal temperament should become popular in music just at the time when the idea of social and political equality was fueling the French and American Revolutions.

(2) Or, more accurately, parabolic.

very subtle adjustments in the configuration of the conical bore. Bohm's new flute was a great popular success. In terms of the mechanism of 1832 and the bore of 1847, Bohm's acoustical design is still the basic pattern for flutes today.

In the late 1800's flute makers began making flutes out of metal as well as wood. Metal gave the instruments a brighter, more ringing sound, and this quality of tone became popular with many musicians. The most popular metal turned out to be sterling silver, though other metals were also used, including brass and gold. Wooden flutes continued to be made well into the 20th century, and, though they were rapidly being displaced by metal instruments, they remained the preferred instrument of many musicians. The composer and conductor Gustav Mahler, for example, much preferred the tone of a wooden flute and, until his death in 1911, flutists in orchestras he conducted were required to use them.

Louis Lot, who held Bohm's French patent and was his agent in Paris, began making his own flutes in 1855. Lot followed Bohm's acoustical design but made substantial changes in the aesthetic appearance of the instrument. Lot's design was very elegant and graceful in comparison to Bohm's, and his flutes became very popular. It is Lot's aesthetic style which is followed by most modern flute-makers--including Powell.

After twenty years of flute making, Lot sold his business in 1875. The company continued into the 20th

century, but the general opinion is that the instruments were never as good as those made by Lot himself. Many of Lot's instruments are still around. According to Robert Hericher, my flute teacher from the Paris Conservatory and an owner of a Louis Lot, every instrument made by Lot himself is accounted for; and, with the exception of a few in museum collections, they are all being played. Hericher told me the only time he has heard of anyone acquiring a Louis Lot is through inheritance.

HAYNES AND POWELL

William Haynes, a silversmith living in Boston, Massachusetts, began making flutes in 1888. No one knows how or why he took up flute-making, but people are glad he did. The Wm. S. Haynes Company, founded in 1900, is still in existence manufacturing very fine instruments.

There were no major flute-makers in the States in 1888. So, a fair guess is that Mr. Haynes, as a silversmith, was approached by musicians, perhaps friends, to repair their European-made flutes. In any case, Mr. Haynes began copying the European-made instruments in 1888, making them both of wood with a sterling silver key mechanism, and entirely of sterling silver. We know he copied the European instruments very precisely because a number of Mr. Haynes's earliest instruments are still in existence. Haynes records go back to 1900, when the company was incorporated, and they begin

with flute number 500. Flutes with earlier numbers (that is, instruments made before 1900) still come into the Haynes workshop now and then for repairs and upkeep. And those early instruments are Lot style Bohm flutes, very much like the Haynes instruments of today.

In the earliest years Mr. Haynes made slight modifications in his flutes, always within the guidelines of Lot and Bohm, until he had developed a design which symphony players liked and ranked as good or better than anything available from Europe. Mr. Haynes stayed with this design, making flutes by himself, and became well known in the States and abroad. The demand for Haynes flutes grew. By the 1910's Mr. Haynes had hired a few craftsmen to work in the shop. Production at this time was around 120 flutes per year.

In 1914, a young man from Ft. Scott, Kansas named Verne Powell came to work for the Haynes Company. Powell mastered the craft of flute-making under Mr. Haynes and became an outstanding craftsman. Over the years Powell advanced in the workshop, taking on more responsibility, and eventually became Director of the company. Then, in 1927, Powell left Haynes and established Verne Q. Powell Flutes, Inc.

The Haynes Company grew steadily in size and reputation. By the mid-1930's the workshop was made up of about fifteen craftsmen and was producing about 500 flutes per year. At this time Mr. Haynes retired. His wife and brother-in-law took over management of the company, and after Mr. Haynes's

death in 1939, they became sole owners.

Mr. Haynes, and after him, his wife and brother-in-law, maintained unilateral control of all aspects of the company. Haynes Company was a family business, and the Haynes flute was made to the exacting standards established by Mr. Haynes. Responding to desires of flutists, they made a subtle but significant change in the flute in 1953 in order to improve the facility with which the instrument was able to play in equal temperament. In addition to this, a few extremely minor changes in the flute's appearance have been made and some manufacturing techniques have been updated. But to the greatest extent, the instrument has remained just as Mr. Haynes designed it at the turn of the century.

By 1961 the Haynes Company had grown to about 45 people and was turning out approximately one thousand flutes per year.

Louis Deveau came to work for Haynes in 1941. He walked into the workshop off the street. It was the end of the Depression, and he was looking for a job. He knew nothing about flutes. In 1965, having mastered every phase of manufacture, Deveau became general manager. Mrs. Haynes, though by this time in her 80's, continued to come into the workshop almost every day.

In the mid-1960's Deveau and others at Haynes felt that the quality control system at Haynes was not what it could be. So Deveau, as general manager, reorganized production procedures and brought quality control up to standards he

could be satisfied with. As a consequence of this reorganization, the rate of production fell from the level of about one thousand per year to 700 to 750 per year. The number of craftsmen remained around 45. Thus, Haynes was puting about 30% more time into the manufacture of each flute. Mr. Deveau was pleased with the reorganization and felt that the company was then producing instruments consistent with what the company calls the "tradition of excellence" established by Mr. Haynes. The number of craftsmen and the level of production have remained the same since.

Mrs. Haynes died in 1971, and the ownership of the company devolved to other members of the Haynes family. Mr. Deveau, meanwhile, began taking on almost autonomous control of the everyday running of the company. Finally, in August of 1976, the Haynes family sold the Wm. S. Haynes Company in its entirety to Louis Deveau.

A NOTE ON THE CRAFT

The craft of making fine flutes comprises a tradition which we can trace back directly through individual makers and workshops for at least three hundred years. That tradition in many cases has been handed down personally from one master-craftsman to the next. In all cases new craftsmen have immersed themselves in the work of masters before them. This is often reflected in precise and unambiguous detail in

their instruments. That Mr. Haynes copied and built on the work of Bohm and Lot we know because his instruments testify to it. The flutes themselves are physical evidence of the concepts and conventions of their day.

Within this tradition is a body of knowledge, the "folk wisdom" of the craft. These are the "tricks of the trade", the caveats and commandments of flute-making. Some of this knowledge is explicit and has been written down by makers or built into the physical dimensions of their instruments. Other bits of the knowledge are subtle and, as I will argue in detail later, have their reality only in the fingertips.

This body of knowledge has grown, changed, and evolved over the generations of craftsmen, just as the instruments themselves have developed. But it would be a mistake to see this evolution primarily as progress in knowledge or as steady improvement of the flute. To say that the modern flute is "better" than the Baroque flute is substantially meaningless. It is true, for example, that the Bohm flute of 1832 is an "improvement" over the ten-keyed flute; but it is only true within the context of the playing and aesthetic demands of the time. Conversely, a modern flute is in a way "inferior" to a Baroque flute when it comes to playing certain Baroque pieces with grace and style. The Baroque flute lends itself much more easily to such pieces. (1)

The design of a flute of a particular period is largely

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(1) The solo pieces of J. J. van Eyck are a good example.

the result of three mutually-influencing factors: technology, playing technique, and aesthetics. All three are bound by time and place. You can't make instruments with technology you don't have. But this does not mean that instrument design advances with technology. Bohm's flute was, as I have argued, technologically simple for the 19th century. Likewise, the Baroque flute was technologically very simple not because the 17th century had nothing fancier to offer, but because there were no aesthetic or playing demands for it to be otherwise. Baroque-style flutes are manufactured today using modern technology which makes them easier to make, but they are no better as musical instruments than flutes made in the Baroque period.

The ten-keyed flute of the 1820's was an "improvement" over the flutes which came immediately before it because it played more "in tune" with equal temperament. But by the same token it was not an improvement over a Baroque flute since in the Baroque period playing "in tune" was not playing in equal temperament. And it makes no sense to say that equal temperament is an improved way to be in tune, since there is no standard by which to judge that except the demands of aesthetics, and those change with time and place.

Likewise, period treatises on playing technique tell you how to operate the technology of an instrument effectively in order to achieve the kind of sound which the aesthetics of the time favored. Baroque treatises on harpsichord playing, for example, prescribe fingering techniques which are

essentially very effective ways to operate the type of mechanical levers then used as harpsichord keys and to produce the tone then considered desirable.

Also, the technology of an instrument or of its manufacture can influence prevailing aesthetics. When Bohm and others began to experiment with metal as a material for flutes, the idea caught on and eventually the tone produced by silver came to be favored over the tone of wood.

The point I wish to make very clear is that the design of musical instruments, in this case flutes, is substantially a reflection of the mutually-influencing factors of technology, playing technique, and aesthetics of their day. It is not a measure of monolithic progress or the march of industry.

WHAT MAKES A FLUTE GO?

The flute is a gadget for making noise. So, how does it do it?

The sound of a flute begins with the vibration of the column of air inside the tube. This column of air is to the flute what a string is to a violin. The column is set vibrating when the player blows across the embouchure hole. But the way the player's breath induces vibration in the column is elusive and was not well understood until the middle of this century.

Roughly speaking, when the column of air vibrates, it

goes back and forth as its air pressure alternates. (When it alternates 440 times a second, the flute is playing the note "A".) But the jet of air from the player's lips does not alternate; it comes out in a steady, direct flow. So how do we get from the "direct current" of the jet to the "alternating current" of the column? As I have said, the player blows across the embouchure hole, not into it. The jet does not go in one end of the flute and out the other like water through a hose. When the player blows across the hole, the air jet first starts into the flute where its force begins pressurizing the column of air. When the force of the compressed column becomes greater than the force of the jet coming into the tube, the jet is pushed back out the embouchure hole. Once the jet is forced out, the pressure in the tube drops, which allows the jet to enter again. The jet flips in and out of the tube like this several hundred times per second, and the alternation of the pressure in the column of air radiates out from the flute as sound. If the jet were too soft, it would pass over the embouchure hole without flipping in and out, and the flute would make no noise. If the jet were too strong, the compression of the column would never be strong enough to push the jet back out the embouchure hole, and the air then would flow through the flute like water through a hose.

When all the keys on a modern Bohm-style flute are closed, the column of air in the tube is about two feet long. When this column is vibrating properly, the note the flute

plays is "C"--the "middle-C" of the piano. To play the next note up ("c-sharp") the player opens the first key at the end of the flute. This shortens the column, makes it vibrate a bit faster, and the flute plays "C-sharp". And so on through the scale of the first octave.

The fingerings for the second octave are pretty much the same. The player makes the flute play an octave higher mainly be increasing the pressure of the jet slightly--just enough so that the column responds by compressing into two segments equal in length. The segments, being half the normal length, vibrate at double the rate, and thus the flute plays an octave higher.

The third octave fingerings resemble the first octave more remotely because, for the most part, they open keys which help break the column into four equal parts--thereby making the notes yet another octave higher.

Accomplishing such acoustical feats is one of the things flutemakers have in mind in devising arrangements of tone holes and in designing key mechanisms. It is one of the major attractions of the Bohm flute, for example, that its key mechanism allows the flute to accomplish such things with fingerings which are fairly simple.

As a gadget for making noise, the flute is not very energy efficient. Of the energy in the air jet entering the flute, only about 3% is radiated as sound. This "low efficiency" is not a negative quality, however. If it were much lower, the flute would be too hard to sound--you would

be out of breath before you made a peep. If it were much higher, it would sound so easily it would be difficult to control. Looking at the acoustical characteristics which make the flute "inefficient", we can see, in part, how it works.

The loss of energy starts at the embouchure hole. As the jet is flipped in and out of the hole, lots of turbulence are created which "slosh" about without adding to the alternating compression of the column. The processes of converting the "direct current" of the jet into the "alternating current" of the column is itself inefficient. More energy is lost inside the flute due to friction. The inside wall of a silver flute may seem smooth to the finger, but to an air molecule it is sufficiently rough that when the column is vibrating back and forth hundreds of times a second down the center of the tube, at the wall there is hardly any movement at all. Irregular amounts of carbon-dioxide and water from the player's breath make the air column non-homogeneous. This makes the air vibrate more irregularly than pure air would, so more of the energy is lost. But the biggest loss of energy is through the body of the flute itself. As the sound radiates out from the air column, almost all of it is absorbed by the instrument.

Since each of these steps (along with a few others) has such a substantial impact on the eventual sound radiated from the instrument, it follows that changes in design at these points can significantly affect the sound of the flute.

POWELL: A HISTORY OF THE COMPANY

Verne Powell, jeweler, engraver, and flute player, began working at the Wm. S. Haynes Company in 1914. He quickly mastered the craft and ultimately became Director of the Company.

The Haynes flute was well known by this time, and flutists from the States and abroad often visited the shop. So Mr. Powell, particularly during his time as Director, got to know many major professional flutists.

In 1927 he left Haynes and started Verne Q. Powell Flutes, Inc. He made very fine flutes, and through contacts made at Haynes, word of the Powell flute spread quickly; business looked good.

There is a story that Mr. Powell and Mr. Haynes did not part on friendly terms. Mr. Powell, the story goes, had ideas of his own about the design and making of flutes, which did not square with Mr. Haynes' notions of his flute and his workshop. They had a difference of opinion, and Powell left to start his own company.

According to another story, Mr. Powell was not interested in changing the Haynes flute but instead wanted a separate department of his own at Haynes, which would make clarinets. This was too much for Mr. Haynes, so Mr. Powell left. Why, then, Mr. Powell didn't open Verne Q. Powell

Clarinets, Inc., no one is sure. In fact, the Powell company has never made clarinets at all. The only thing which stubbornly refuses to let the story die is a single prototype Haynes clarinet still stowed away at the Haynes company.

Whether the parting was friendly or not may never be known. The story, nonetheless, is still passed around among flutists (often in conversations beginning "Which flute is better, Haynes or Powell?"). In any event, I have it on good authority that Messrs. Haynes and Powell were seen in friendly company on several occasions after 1927 and before the early 1930's, when Mr. Haynes moved to New York. And the companies today--who knew not Pharaoh--are on fine and friendly terms.

In 1928 Mr. Powell moved his workshop into a small space on the third floor of an office building on Huntington Avenue in downtown Boston, across from the New England Conservatory. By 1929 his one-man workshop was well established--just in time for the Great Depression.

Business for Powell during the Depression was irregular. The company remained open, and Mr. Powell continued to make instruments, but there were many periods when his sales were not enough to support the workshop, himself, and his family. During those times, Mr. Powell made his living and supported the company by playing flute and piccolo at night in dance orchestras and big bands. He was known as an excellent flutist.

In the 1930's, at times when business was good, Mr.

Powell occasionally hired one or two people to work in the shop. Some of these people stayed with him for a while; others were hired for temporary work. A few were hired for part-time work or to do piece work outside the shop. In all cases, these craftsmen worked only on small aspects of manufacture, such as fitting pads into keys, assembling the key mechanism or making specialized tools.

Mr. Powell maintained absolute control over quality. Everything was inspected and approved by him. All work and every flute had to match his standards for what a Powell flute should be.

By 1939, after twelve years of operation, Verne Q. Powell Flutes, Inc. had produced exactly 365 flutes. This is a well known fact in the flute world because flute number 365 is a famous flute, for several reasons. It was the first flute Powell made out of the precious metal platinum. It was an exceedingly fine and beautiful instrument with a dark, rich, solid tone. It became well known when Mr. Powell exhibited it at the New York World's Fair of 1939, where it attracted the attention and praise of countless flutists. Among those who examined the flute was William Kincaid, one of the greatest flutists of the 20th century. Kincaid liked the flute very much and subsequently bought it. The fame of the flutist added to the fame of the flute. Kincaid used the platinum Powell in performance for the rest of his life. After his death, the famous flute, then owned by Kincaid's family, was locked away in a safe deposit box in a bank vault

in New York.

Four years earlier, in 1935, the Haynes workshop had produced a similarly famous flute. It was a platinum flute made for the well-known flutist Georges Barrere. Its tone, like the later Powell instrument, was considered to be rich and dark. Barrere fortified his impressions of the instrument's tone by having it and his playing subjected to several electronic tests carried out at the Bell Laboratories. As to the effect of platinum on the flute's tone, these tests were convincing to some but not to others. However, they did contribute to the growing debate about the effects of materials on tone. (1) Barrere's platinum flute received more attention when the composer Edgard Varese composed a now-famous piece for Barrere and his flute called "Density 21.5"--the density of platinum.

In the early years of World War II the Powell workshop was doing well. It had stabilized in size, with a couple of full-time craftsmen along with Mr. Powell and occasionally a few others doing some piece work outside the shop.

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(1) The great materials debate continues today. The central issue is what effect, if any, gold, silver, and platinum have on a flute's tone. A good deal of sophisticated research has been done, but to date no one has been able to identify any characteristics of these metals which can be shown to have an influence on flute tone. Nor is there any metalurgical theory which explains or discounts an effect. There have been several scientists, some of them flutists, who have concluded that a flute's material has no input whatsoever on its tone. Others argue just as strongly the other way. Most flutists, however, take it for granted that there is an effect and often have strong preferences for the tone of one metal over another.

The War itself presented a problem for Powell. Cork, an indispensable material for items essential to the war effort (such as gaskets and life jackets), was in sort supply. The areas of the Mediterranean where it is chiefly cultivated were then enveloped by the War. So any cork which became available was commandeered by the military. Cork, however, is alsc an indispensable material in the manufacture of flutes. The head joint is plugged with cork just above the mouth piece, and the key mechanism is cushioned and regulated at points with strips of cork. So the war had a direct impact on the making of flutes. But Mr. Powell found a way around this problem. The military not only wanted cork; they also wanted flutes and piccolos. Mr. Powell focused his attention on orders from the military (mostly for piccolos for the Service bands) and was supplied with commandeered cork in quantities sufficient for him to keep up his normal operations. This is largely what kept the company going during the War.

In the first years following the War, orders for flutes went up as the economy was becoming stronger, so Mr. Powell began to hire a few permanent, full-time craftsmen. By provisions of the G.I. Bill, during the post-war years, veterans could be hired for on-the-job training, and for a year and a half the federal government would pay the bulk of their salaries, the hiring company paying only $25.00 per person per week. Between 1945 and 1950, Mr. Powell hired and trained three craftsmen under this program.

By the mid-fifties, there was a solid core of five to six long-term well-trained craftsmen in the workshop along with Mr. Powell. Each craftsman was responsible for a small cluster of tasks; there was little overlap among them. Mr. Powell was the only person who knew all the steps of manufacture, and he maintained overall control of the workshop. He was the final judge at every step from the beginning to the final product.

Mr. Powell was a perfectionist, a stickler for detail. If a bit of work didn't meet his standards exactly, it was not accepted. The work needed not only to be excellent; it had to be precisely the way Mr. Powell wanted it.

Knowing that precise adherence to the design and style of work laid out by Mr. Powell was the only way their work would be accepted, the craftsmen, in the course of their training, incorporated Mr. Powell's standards into their day-to-day work. Ed, one of those early craftsmen and later president of Powell, told me that in those years, even though after your training "you became your own quality control" for routine matters, ultimately "quality control was him [Mr. Powell] alone." Whether a piece of work was done by Mr. Powell or by one of the craftsmen, the fact that the instruments coming out of the shop were consistent in style and quality testifies to the strict adherence to the standards conceived of by Mr. Powell.

As the years progressed, Mr. Powell continued to work regularly in the shop. He was The Mastercraftsman and was

respected as such. He still worked on every step of manufacture but mostly concentrated on making head joints.

The head joint is considered by flutists to be the most vital and "personal" part of each instrument--the "heart" of the flute. It is held to be the thing most responsible for the idiosyncrasies and "character" of an individual flute. If, for example, a particular flute plays very, very softly more easily than the average flute (including the average Powell), it is often attributed to some characteristic of the head joint, typically an unknown characteristic. According to one story, Mr. Powell once said he figured some of these characteristics to be a result of unknowable and unmeasurable changes in the embouchure hole that happen in the final hand polishing of the mouth piece.

These things may be a matter of happenstance. And the image of the head joint as the "heart" of the flute may be more myth than fact. But in any case, while over the years from the beginning of the company until the mid-fifties, the craftsmen at Powell acquired the know-how necessary to make every other piece of the flute, Mr. Powell made all of the head joints himself.

Mr. Powell, quite naturally, was the president of Verne Q. Powell Flutes, Inc. He was also secretary and treasurer. The positions of vice president and clerk were held by his daughter. Together, they managed the business of the company. They bought supplies, set prices, scheduled the filling of flute orders, and made the decisions on all

company policies and operations.

Mr. Powell worked very closely with the craftsmen on manufacture, but in matters of business, employees had little voice or knowledge. According to Ed, the employees "didn't know anything that went on. Mr. Powell and his daughter met in the office every morning, and everything that got done was strictly between the two of them. There was no communication. I mean, you were there, you were a worker, and that was all you were. There was a strict line between owners and workers, and it was never really and truly broken."

The employees' closest contact with business operations was in ordering supplies. But just as Mr. Powell was the final word on quality control, so was he the final word on purchasing and cost control--tempered a bit by his daughter. "I would just give him a scratch pad with what we needed," Ed recalls. "He very seldom looked at them. He would only look at the bill when it came in, and then he'd hit the roof. But fortunately his daughter understood very well. She was clerk. She'd say, `Gee, we've got to have these things,' and that would usually end it. He'd come tearing out, and she'd calm him down."

This is not to say that things were not friendly. From all indications they were. This was simply how things got done. It is my sense that the Powell flute and the Powell workshop were extensions of Mr. Powell's personality--his conceptions made real in the world. His concern first and

always was making flutes--the best flutes. Running a company was never anything more than a necessary means to that end.

Through the end of the 1950's the company was stable. By then, there were five or six craftsmen who had been with Mr. Powell for several years, and there were always a few short-term or part-time people who came and went. The senior craftsmen mastered more and more of the tasks; eventually, one or two even gained the know-how for making head joints. In these years the workshop was putting out about 130 flutes per year. Orders came in steadily, growing in number, until eventually they exceeded the rate of production and Powell began keeping a waiting list. Most people had to wait about two years for their instruments. The wait was acceptable to the customers (as they were a faithful lot), and to the company it represented a sort of polite and comfortable security. The flute never waivered in style or quality, and the methods of manufacture were stable.

Then, in 1961, Mr. Powell sold his company to four of his senior craftsmen and retired--at the age of 82. The sale was complete: neither he nor any member of his family retained any control or stock in the company. However, Mr. Powell's personality, not surprisingly, remained a part of the workshop. For many years, even after Mr. Powell was no longer living, it was not unusual to hear someone in the workshop refer to "the old man". And always with respect.

THE NEXT GENERATION

With the change in ownership the company had to set up a new organizational structure. By Massachusetts law a corporation must have a board of directors, a president, and a clerk. This structure was carefully superimposed on the small staff at Powell. I asked one of the new generation of owners how this worked. He said, "Well see, there was no problem because the stock holders and owners were the board of directors, and they were also the labor force--outside of maybe two other people." Executive decisions were made and management skills learned at the workbench, in the regular course of making flutes.

With the departure of Mr. Powell and the shift in management duties, production in 1961 and 1962 fell to a rate of about one hundred flutes per year. Then Powell began a slow, deliberate growth. I asked Ed how decisions were made about what direction the company should move. "They were made by all of us," he said. "Everything was virtually unanimous. It had to be. That was actually to protect us from each other.... We didn't have too many problems. What it amounted to was we were trying to survive."

"Survive", I think, is the key word. Against a two-year backlog of orders, Powell began a slow, cautious growth. They occasionally hired a new craftsman. The number of

flutes produced slowly increased. This trend continued through the sixties, and the company became secure and stable once again.

Throughout its history, whether in good times or bad, Powell has never made a profit. Nor has it ever attempted to. The company has never paid dividends on its stock, nor has it ever had a program for bonuses or profit sharing. The price of the instruments has been set at the end of every quarter to cover the projected costs of the next quarter. Mr. Powell was interested in making flutes, not money, and this principle remained with the company.

Likewise, Powell has never advertised. Nor has it ever needed to. In the early years, Mr. Powell had personal contacts with flutists around the world. If orders came in, they came through these contacts. Advertising would not have been Mr. Powell's style. In later years, with the two-year backlog of orders, there was clearly no need to advertise. Mr. Powell exhibited flute #365 at the New York World's Fair, and there are annual flute conventions where makers, including Powell, show their wares. But these are events in the flute world, contacts with flutists, not advertising.

What might be accomplished in a different industry by advertising has been done at Powell through word of mouth. The informal network of communication in the flute world works very well. It not only passes along the rumors and stories that make up legends; it also flashes out news with remarkable speed and accuracy. Once, for example, there was

a period of twelve years when Powell discontinued making piccolos. When they started up again, they sent the first one completed to the person at the top of the waiting list, a man in California who had placed his order twenty-three years earlier. The fellow called up Powell on the day he received the piccolo and told them how delighted he was with it. The next day Powell received two other phone calls from California, along with calls from Louisiana, Michigan, and Tennessee, all with the same question: "Is it true you are making piccolos again?" As one craftsman put it, "You don't have to advertise in this business."

By 1970, with a core of ten full-time craftsmen, production had grown to about two hundred instruments per year. Orders continued to come in at an increasing rate.

With the growth in staff over the 1960's, the workshop had become uncomfortably crowded. Since they expected to continue their slow growth, they moved in 1970 from the downtown location where Powell had been since 1928 to a modern, single storey, light industrial building in the Boston suburb of Arlington. The move quadrupled their workspace, while keeping overhead and taxes at a reasonable level.

In the late sixties and early seventies, the flute became more popular than it had ever been. More people were learning to play the flute, and more were reaching the level where they wanted top quality instruments. Also, there was a trend to buy Powells and Hayneses among students who could

have done just as well with lesser instruments. (The delight of owning a Powell or Haynes is not solely a matter of need.) With the increased popularity, Powell's waiting list grew. By 1970, the waiting time for a flute was almost four years.

With a growing backlog of orders and the elbow room of the new building, Powell put some cautious effort into improving and speeding up production. They mostly made improvements in tooling--updating machinery and designing new hand tools. Overall, they were pleased with the changes.

This work was coordinated by Bickford Brannen. Bickford had come to Powell in 1962. He had been studying for a conservatory degree but felt the chances for employment in music were not good. When an opportunity to work at Powell opened up, he took advantage of it. Bickford apprenticed at Powell for four years, then went to Elkhart, Indiana, where he worked for the Armstrong flute company. Elkhart is the band instrument manufacturing capital of the US. There are several companies there which make instruments of all sorts. Armstrong is a respected maker of very good--not excellent--flutes. Bickford worked on Armstrong's top line flute. In addition to making instruments, he worked in research and development designing and improving tooling and machining. He stayed with Armstrong for about three years. Then, in 1969, he returned to Powell, where he continued to pursue his interests in design and development.

With the improvements in production of the early 1970's, the added space, and additional craftsmen, Powell's

production rose. By 1973 they had about fifteen full-time craftsmen and were producing about 250 instruments per year. This was a 25% increase over the 200 instruments of 1970. However, there was also a 50% increase in personnel for the same period. The disparity was to be expected, though, since apprentices do not produce at the same rate as mastercraftsmen. In fact, since a mastercraftsman has to use his time to train an apprentice, his production can go down as well. At Powell, the training period for apprentices is about five years, so in 1973, the new personnel were not completely trained and the workshop was not yet fully productive.

With all these changes, and particularly with half the workforce not fully trained, quality control could have been an issue. Mr. Powell had been gone for ten years, and no one person had taken his place. In fact, at this point, no single craftsman in the workshop could, as a matter of course, make a complete flute from start to finish. How, then, were style and quality held constant? I asked Ed this question. "[The flutes] are looked at by enough people," he said, "and there is no one in the shop who makes flutes or keys up flutes that wants to see even one key come back to his bench because it isn't straight or it isn't soldered or anything, because we have a hell of a lot of pride in workmanship. Everyone wants to believe he makes the best damned flute in the world."

Quality control is the responsibility of each craftsman

at every step of manufacture. There are several steps in making a Powell flute. The tubes are made outside the workshop to Powell's standards. Screws, steel rods for the mechanism, and stock silver are bought. The keys are cast at Powell, though prior to the 1970's they were made outside the shop. First, all the parts are polished; then the body is made. The tone holes are put into the tube, and the structure which holds the key mechanism is soldered on. Then the key mechanism is precisely fitted together and fit to the body. Next, pads are put into the keys and the mechanism adjusted to remarkably fine tolerances. The head joint is assembled and hand finished. Finally, the flute is polished, packed up, and shipped to its owner. At any given time, there are usually several flutes at each step of manufacture. It takes approximately two weeks for a flute to go from start to finish. Typically, each instrument is worked on by six or seven different craftsmen. Most craftsmen at Powell concentrate on one or two steps of manufacture. Over time, those tasks usually shift, and the longer a craftsman stays at Powell, the more jobs he is likely to move through.

Basic quality control goes on at each of these steps. Every craftsman is expected to do his job correctly as a matter of course. If one craftsman, finishing his work on a flute, hands it on to the next in less than proper condition, it is given back to him for correction. The second craftsman's work usually requires the first's to be precisely correct. And so on down the line. Quality is

maintained through these hand-to-hand checks.

When a flute was completed, a craftsman, usually Dick Jerome, an accomplished flutist and one of Powell's owners, would give it a final check to catch the occasional exception. I asked Dick what he checked for specifically when he gave a flute its final inspection. "Nothing really," he said, "just to see if it feels right." Usually it would. But if it didn't feel right, Dick explained, he had to figure out what exactly was wrong and take it to the appropriate person to be fixed. Very few things, though, would get all the way through that weren't exactly right. And besides the specific checks, Dick added, at every step, just as at the end, everything would have to "look right and feel right."

Not everything was checked only by appearance and feel. There were things which were measured explicitly. Parts of the head joint, for example, were measured with calipers to see that the dimensions were exactly as they should be. But "looking right and feeling right" seemed to be the chief criterion overall.

This certainly makes sense. We all do things by look or feel, often without being able to say specifically what we are seeing or feeling. We know, for example, when the steering in our car doesn't "feel right", though we might not be able to say exactly how. The "feel" of flutes is famous. The Powell flute has a definite feel which an experienced

flutist couldn't fail to recognize. So does a Haynes; so do all the others. But the way a Haynes or a Powell feels is part of what makes it a top quality flute. No flutist familiar with Haynes and Powell flutes would ever confuse one for the other. They feel different to the fingers, and they feel different to play. What the feel of a Powell is, however, is not necessarily something a flutist can say. "The feel of a Powell flute" might be broken down to the contour of the keys, the resistance of the key mechanism, the pattern of different resistances among the keys or the way the flute vibrates under the fingers when it is played. It could be a combination of some or all of these things, along with other things. Or it could break down to different things for different flutists. Certainly it has to be something about the physical object the flute is. It is not a metaphysical property or elfin alchemy. But what is real about the feel of a Powell flute for a flutist is not at all what that feel might break down into. "The feel" is not the resistance of the keys. Flutists don't say, "You can tell a Powell by the resistance of the keys"; they say you can do it by "the feel". They say this not because they are inarticulate, but because they are reporting the truth: what they experience and recognize and praise and value is a feel, not resistance in a mechanism.

If this is true for flutists, then certainly it can be true for flutemakers. But what makes it particularly interesting in the case of flutemakers is that they mostly deal with the flute "broken down". They mold the contour of the keys and set the resistance of the mechanism. The "right feel" could be different for the craftsman who shapes the contour than it is for the one who sets the resistance. The "right look" might be different for the craftsman who solders on the tone holes than it is for the one who makes head joints. Yet the flutes are always within Powell's exacting standards. Powell flutes always have the Powell feel.

The different craftsmen, in fact, talk about the flute differently. A craftsman who mainly assembled the key mechanism once said to me that the flute was a "fine machine". His comment is best understood knowing that he works on the most machine-like aspect of the instrument. Another craftsman, who mostly worked on head joints, referred to the flute as "a gem". The kind of hand-shaping and polishing he did and the attention he gave to the way light reflects off the instrument are things one would do working with an actual gemstone.

It would follow from this that each craftsman has an "image" of the flute. The image contains what he knows about the instrument. It contains legends, as well as very explicit measurements. It includes things like the "right feel", which the craftsman knows only in his fingertips,

and visual images like the proper reflection of light or the right alignment of a key. It is intimately bound up with his know-how and the specifics of the particular work he does on the instrument.

In a way this is nothing unusual. We all have lots of these sorts of images. We have an image of our home, for example, which is made up of very explicit things like a light switch that doesn't work right, as well as many much subtler things like the smell of a particular room or memories attached to a special chair. An autoworker would have an image of the car he works on, and an architect, an image of a building he is designing. So why shouldn't a flutemaker have an image of the flute?

But there were two things very special in what Dick was telling me. First, the "image" (the look and feel) was not only part of manufacture and quality control but was central to it. Second, the many different images held by the various craftsmen were what made possible the single "right feel" of the flute--the feel which had not changed in over half a century. In working intimately with one another, in making one craftsman's work dependent on the previous craftsman's work, in making their hand-to-hand checks, the "right look and right feel" were made central to manufacture at every step and were "harmonized" into the single "right look and right feel" of the finished flute.

The training of apprentices, which I observed in operation, fit into this interdependence of tasks and also

reflected the centrality of knowing the right look and feel. When an apprentice came to Powell, from the very beginning he worked at an essential manufacturing task. There really wasn't "simple work" that apprentices were all sent off to do. Typically, a new apprentice would sit next to a mastercraftsman and begin doing the same task, with the mastercraftsman giving guidance. The apprentice would be slow and make a lot of mistakes which the mastercraftsman would point out and the apprentice would correct. Eventually, he would make fewer and fewer mistakes, and his work would begin consistently to have the "right feel". He might go on and learn another task or two in the same fashion. One of the things that marked the end of the apprenticeship was when the craftsman could check his own work for the right look and the right feel.

When Powell underwent the expansion of the early seventies, even though about half the workers were apprentices, the quality and style of the instrument never waivered because a flute couldn't make it through the series of interdependent, hand-to-hand checks without coming out with the "right look and the right feel".

I asked Bickford how much of the final right feel of a Powell was due to the know-how of the craftsmen and how much was really due to the design of the flute and the actual intrinsic characteristics of the parts themselves. He said it was certainly both, but that it was mostly the work of the craftsmen. "What would happen," I asked him, "if I gave you

a complete set of Haynes parts and asked you to make a flute? Would it be a Haynes or a Powell?"

"A Powell," he said, without hesitation. He added that it would be an odd Powell, but clearly a Powell; and he said this would be true for any craftsman in the shop.

"Why?" I asked. "There is no other place," he answered, "which will train them [the craftsmen] the way we train them. A person from Haynes, for instance, cannot come in, sit down, and make a Powell--simply because he is using our parts versus Haynes parts. It doesn't work out the same way. Their whole concept of how a flute should be made and how the parts should be handled and shaped and so forth is totally different." There have been a few times when a fully trained craftsman has moved from Haynes to Powell. In each case he has had to go through a period of retraining, even to do the same job he had done at Haynes.

So producing a flute with the "right feel" was not solely a question of level of accomplishment: the Haynes craftsmen who came to Powell were every bit as accomplished as Powell craftsmen. Nor was it simply a matter of using that skill with careful measurement: the craftsmen newly from Haynes had all that and still could not produce the "Powell feel". Their "concept of how a flute should be made" had to be changed. They had to retrain their fingertips. They had to learn the Powell "concept", learn what "looks right and feels right", and form for themselves a new image of the Powell flute.

This seemed special to me. The Powell craftsmen knew something which enabled them to make a flute of unvarying style and quality. That know-how was bound intimately to the daily work of each craftsman; it was a fundamental part of Powell's quality control system, and learning it was part of an apprentice's training. It was not a level of skill, nor was it simply the use of good equipment and precise measurement. It was something Powell craftsmen added to all this in order to make a flute worthy of being a legend.

THE COOPER INNOVATION

Beginning in 1974, the Powell flute and the Powell workshop underwent dramatic changes.

Every Powell flute is unique. Each one has oddities, special qualities and, occasionally, certain weaknesses. But all Powells are unambiguously within the standards of Powell quality and style. For example, a friend of mine has a Powell that is particularly fine: it has a wonderful, singing tone and is very easy to play, but the "E" in the third octave is stubbornly difficult to hit. Once you get to know a particular Powell, you discover its individual personality.

This is true of other types of flutes as well. But since constancy is such a major theme of the Powell story, it is important to note that the instruments are far from being clones. Also, the way Powells are the same and different is

significant.

Though not clones or identical twins, all Powells have a family resemblance. There are always features which leave no doubt that the flute at hand is a Powell. Feel is the best example. But just as families persist in producing cousins with green eyes or a great uncle with a talent for painting that no one can trace to any known ancestor, Powells pop up with personality traits whose cause is unintended and unknown. The source of my friend's stubborn "E" is likely to remain forever obscure.

Some characteristics of individual Powells, however, can be identified and even traced to their sources. Bickford once showed me some flutes which had come back into the workshop for repairs and upkeep. By subtleties in the way each was made, he told me, he could almost always tell which craftsman made each part of the flute. (He showed me some examples, but I'm not at all certain I was able to see what he could see.) He found it most difficult, he said, to tell the difference between work which he had done and the work of one other craftsman at Powell--his brother, Bob.

Some differences among Powells are a matter of explicit design choices. Powells can be ordered with different options. A standard Powell reaches low "C", but they can be ordered with an additional key so they go a note lower, to low "B". There are some optional keys that help with trills and high notes. Powells can be built to play at "A" 440 or "A" 442. Normally, they come in sterling silver, but they

can be made in solid gold (at four to five times the price) or in gold with silver keys or in platinum. They can be ordered in the "no frills" standard model or with fancier keys and hand-soldered tone holes. And so on. But in all cases, their membership in the Powell family is never questioned by anyone.

Powells have also changed over time, as has the way they are manufactured. Powell considers the physical changes to be "minor improvements", but they are nevertheless real changes in the flute. Bickford once detailed some of them for me. There were small changes in the shape of a key or slight modifications of the design of the mechanism. Some of the key mechanisms used to be die cut; now they are cast. New tools have been brought in from time to time, and because of better equipment which produces better quality rough pieces, the amount of hand finishing necessary has been reduced. As a result of these things, Bickford says, "...the consistency, both appearance-wise and musically...is greater."

But what is essentially "The Powell Flute" has remained constant. After Bickford recounted the long series of changes the flute had gone through, I said, "So, there has been a gradual evolution of the Powell flute." "No," Bickford replied emphatically. "It's not an evolution of the instrument; it's an evolution of the company." He was right: if the feel of a Powell is more a product of the craftsman's work than of the parts--if Bickford could make a Powell out

of parts for a Haynes--then small changes in the design of a Powell's parts need not change the flute as a whole. If the changes can fit into Powell's "concept of how a flute should be made," then the instrument remains the same. The image is unchanged; the style and quality are constant; and the "right feel" never varies.

In the early 1970's there was a former Powell craftsman living in Europe, working as an instrument repairman. One day a flute came into his hands which had been made by an English flutemaker named Albert Cooper. He was so impressed by the instrument that he wrote to Powell suggesting that if they wanted to continue to make the "best damned flute in the world", they ought to contact Mr. Cooper.

Albert Cooper lives in London. For many years he has had a one-man workshop where he has built a few flutes every year and carried out some of the most inventive bits of research on flute design of this century. His flutes are highly regarded, and his research is now famous. One piece of research he did was on the flute's scale. Over a period of fourteen years Cooper had experimented with variations on the Bohm scale. His aim was to improve the ease and consistency with which the flute would play in tune by equal temperament. He succeeded. His scale was exceedingly fine, and it was this that caught the attention of the craftsman who wrote to Powell.

Powell was intrigued by the matter and wrote to Mr.

Cooper expressing interest in his scale. Mr. Cooper responded cordially, and Bickford flew to London. The two of them spent several days, from morning to night, at Cooper's small workshop in the West End, discussing flutes, scales, general ideas, specific techniques, Cooper flutes, Powell flutes, and business matters.

Bickford returned to Boston with a stack of notes, several hours of tape recordings of his conversations with Mr. Cooper, and the impression that they were onto something. They made a prototype Powell with the Cooper scale and were impressed with the results.

Then they had to make a decision: should they adopt the Cooper scale? This entailed several questions. The Powell flute had always been made with the adaptation of the Bohm scale devised by Mr. Powell. The Cooper scale had advantages over the Powell scale, but was it clearly better overall? If they adopted the Cooper scale, should they shift over to it entirely or only offer it as an alternative to the traditional Powell scale? And most important: would the Cooper scale, no matter how fine, fit into Powell's "concept of how a flute should be made"? Would Powell's style and quality remain constant? Would "The Powell Flute" remain unchanged?

If the head joint is the heart of a flute, the scale is its soul. The scale cannot be seen; it can be expressed in acoustical calculations or represented in schematical drawings or surmised from the arrangement of the tone holes,

but it only comes to life when the flute is played. It is part of the character and identity of the instrument.

The questions Powell was considering were difficult ones. They touched the "image" of the flute deeply. If the Cooper scale were truly an improvement, then "the best damned flute in the world" ought to have a Cooper scale. But Powell could not use the Cooper scale if it meant they would no longer be making Powell flutes.

The issue was discussed throughout the workshop for weeks. If the Cooper scale were adopted, it was decided, there would be no real impact on a craftsman's daily work. Once the retooling was done, a craftsman would work on a flute with a Cooper scale just as he would work on one with the Powell scale. So the innovation would present no direct threat to the style and routine of work in the shop. There was no apparent reason to be worried about competition from someone else doing the Cooper scale. Mr. Cooper himself made only a few flutes per year. Haynes was happy doing what they were doing. Powell's backlog of orders and legendary reputation in the flute world was a daily source of security. A Powell with the Cooper scale, they finally decided, could still "look right and feel right". So if flutists might want a Cooper scale, perhaps Powell should offer it.

Powell's board of directors made the decision official. In October of 1974, Powell began to offer the Cooper scale as an option for the Powell flute. Late that year, they took Cooper scale Powells to a national flute convention in

Pittsburg and, as Ed puts it, "blew the whole flute world out of its mind."

Over the following year, orders for flutes trippled, increasing from about three hundred per year to well over one thousand, with 90% asking for the Cooper scale. In response, Powell took on new apprentices at a rapid rate, going from fifteen craftsman in 1974 to twenty-four by the end of 1975. Orders continued to pour in. The backlog grew. And the waiting period for an instrument rose from four years to six.

Powell responded to the increased demand through expansion, rather than by absorbing everything into the growing backlog, because of the success of its small expansion of the early 1970's. They felt sufficiently comfortable with the idea of expansion and with their ability to keep quality under control that they saw expansion as the best way to deal with the demand.

Along with expanding, they put more effort than ever before into improving and updating equipment and production procedures. These efforts, as well as the Cooper innovation itself, were directed by Bickford, who by this time had been made General Manager of Powell. Bickford also was the person most responsible for monitoring the training of the new apprentices.

Being at Powell was considered a pleasure and a privilege by most of the craftsmen--particularly the new ones. The Powell legend held strong meaning for them, just as it always had for flutists. They spoke of Powell as "a

special place with a special atmosphere". One apprentice told me he was happy to be at Powell because he didn't want to be "just another worker in just another company." Powell had an Old World sense about it, an identification with traditional craftsmanship, which made it especially attractive to young people who had grown up with the disenchantment and idealism of the late 1960's. As one craftsman remarked, "I'm always proud to tell people I work at Powell."

But things were not perfect. Around the beginning of 1976, the craftsmen, particularly the younger and newer ones, began to worry about job security, advancement, and pay increases. They talked among themselves and eventually formed a workers' group. They held meetings to discuss these interests and concerns. The topics of talks broadened to include health insurance and a retirement plan. Some spoke of profit sharing, and one fellow, who had previously lived on a kibbutz, suggested that Powell become a cooperative. The group eventually clarified its concerns and presented them to the management.

As General Manager, Bickford represented the management in dealings with the workers' group. However, since ultimate authority was in the hands of the owners, Bickford felt himself to be in the position of an intermediary. He would meet with the workers over their concerns, then report to the owners, and then meet with the workers once again. At times, emotions ran high. The workers felt their concerns were

well-founded and urgent. Management was much less animated but felt they had reached "a point where we have to make some changes."

In general, things were peaceful. But the division of Powell into management and workers was odd and straining for everyone--particularly since they still spent most of their time sitting side by side making flutes. Sometimes, Powell was behaving like a small traditional workshop, and at others it was behaving like a more ordinary, larger company. The image which Powell had of itself that allowed it to take on the Cooper innovation and feel comfortable with the idea of expansion was now beginning to feel strained.

The owners gave Bickford some guidelines and directed him to devise a plan for addressing the workers' concerns, while also keeping an eye on the improvement of production, the training of apprentices, and the maintenance of quality.

Bickford produced a plan which included a promotion schedule, cost of living increases, and seniority benefits, as well as policies for vacation, leaves, sick time, and health and life insurance, all of which had never been formalized at Powell. The plan also included a new system for earnings. Each craftsman was put on salary, based on seniority and current rate of pay, and set to a fixed level of production. To receive full salary, a craftsman had to produce at the fixed level (for example, a certain number of head joints per week). If he fell below this level, his salary went down accordingly. If he went over, his salary

went up based on the type of work he did and the number of pieces he completed. This "piecework bonus" was meant to work both as an incentive for those who wanted to increase their salaries and as a means of increasing production.

Bickford presented his plan to the management and the workers' group. It was cautiously accepted by both and put into effect, with a few modifications. The management was worried that the piece work incentive system might cause quick and sloppy work, so Bickford laid out some explicit check points as part of quality control. A policy was written up which stated, "It is expected that all work will be of quality consistent with the standards set by the management.... Starting with the inception of the incentive bonus system, work will be inspected on a regular basis." Specifics spelled out included "finish on all parts; soldering of joints; straightness of keys; fit and tolerance of keys; adjustment and regulation of mechanism; and general appearance." All of these had always been of concern and were part of what the craftsmen had in the back of their minds when they "informally" checked a flute to see that it "looked right and felt right". But none of this had ever been spelled out before. Dick, who for years had been checking flutes over to see if they "felt right", was made Quality Control Officer.

Bickford put a good deal of work into the new quality control system. He saw it not only as a way to keep tabs on quality but also as a way to improve production. He worked

out several new production techniques which also functioned as formal quality checks. One such technique was the use of specialized feeler gauges to check the fit in parts of the mechanism. Another addressed the matter of straightness of keys. It turned out that most of the craftsmen who worked on keys had astigmatism, so a method of checking straightness from different angles was worked out to deal with that problem.

Not everyone was happy with the new arrangements. Some found the piece work system a great way to increase their salaries; others were not excited by it at all. A few craftsmen found the formalization of quality control distasteful. Some of the members of the workers' group felt their concerns were not really being addressed. Bickford became increasingly less comfortable as middleman. The owners were uneasy with the continual upset.

Around the middle of 1976, Bickford drafted a description of the job of General Manager. He had had his fill of the position, and the job description was to be used to hire someone from outside, perhaps a person with business experience. In the meantime, the description served to define the boundaries of his authority and responsibility. Simultaneously, the position of Shop Foreman was created and filled by Conrad Marvin, a Powell craftsman for several years. The foreman took on some of the duties relating to quality control and apprentice training. Futher, Bickford drew up a formal organization chart delineating areas of

activity and lines of authority. The chart distributed Powell's twenty-four employees over eighteen different categories.

At this time, the piece work incentive system was beginning to have an unintended consequence. Once reaching their production level for the week, several craftsmen were taking the rest of their time off, rather than putting it in on piece work for "bonus" pay. This not only meant that the incentive system was less effective in increasing production; it also meant that the workshop was open and set up for operation while some of the craftsmen were absent. To deal with this, management installed a time clock and required all employees to put in a minimum forty-hour week.

No one was enthusiastic about the time clock. The management considered it a necessity, however unpleasant. Several of the people from the workers' group considered it simply offensive--counter to their image of Powell as a "special place with a special atmosphere". Old World craftshops, after all, didn't have time clocks. Some of the workers objected. There were heated debates. Finally, three of the workers walked out.

The issue continued for several weeks. The three who walked out said they had done so as a protest and wanted to return. The management contended they had quit. A formal appeal followed, and one of the workers was rehired. The atmosphere at Powell was shaken by the whole affair, and it took some time for the dust to settle. Ultimately, there was

a release of tension, and the workshop began to be quiet once again. Though the time clock remained.

In January of 1977, seeing no way to better his situation at Powell, Bickford left the company. No effort was made to find a new General Manager. Bickford's responsibilities were parceled out to others in the workshop or simply dropped.

I talked with Ed in the Summer of 1977. He spoke of "normalization". Things, he said, were going smoothly. The organization had become more informal again. While some of the procedures of the formal quality control system had been absorbed into the traditional checks for "right feel", many had been abandoned. Production, Ed said, was in hand, and the backlog was still around six years. I asked if they were planning any further expansion. He said they expected only a slow and deliberate growth. "Any giant expansion at all," he said, "leads me to believe you are going to lose control of quality, and that is the last thing in the world we'd let go of. The name has always stood for the best, and that's the way we're going to keep it: the best there is, period."

Ed was speaking of legends again. "The best there is"--as much part of his image of Powell as it had been for flutists around the world for almost half a century. The style and quality of The Powell Flute had remained constant through a change in ownership, a major innovation, expansion, and organizational turmoil. Now, finding security in the Powell tradition, Ed looked forward to a period of calm.

BRANNEN BROTHERS--FLUTEMAKERS, INC.

Bickford Brannen did not vanish from the flute world. In 1974, Bickford and his brother Bob had started Brannen Brothers--Flutemakers, Inc. The company was little more than a hobby. While working at Powell, Bob had become interested in the idea of making a modern version of Bohm's original 1832 wooden flute. He did some tinkering and some serious research and decided the project was worthwhile. So he and Bickford set up a shop and started their company. Over the next few years they made only a few instruments.

After Bickford left Powell in January of 1977, he rented a small shop space around the corner from Powell and in May opened Brannen Brothers as a full-time venture. When I first visited him at the new shop, he greeted me and, with a chuckle, said, "Welcome to the humble beginnings of my vast industrial empire."

At that point, Brannen Brothers was making two types of instruments: the Brannen Brothers piccolo and, under sub-contract, the Powell piccolo. Bickford was the only person in the shop full-time; Bob was still working at Powell.

But making piccolos was not the only reason for opening the shop. Bickford said that Brannen Brothers gave him a place to "think about flutes". He had a number of things on

his mind. In a long conversation he spoke about his continuing interests in research and development of flute design, the pros and cons of importing flutes from Japan, the wooden Bohm, and what he referred to cryptically as "new dimensions in flute-making."

The overall commitment of Brannen Brothers was to excellence in flute-making; and in this age, Bickford said, that required excellence in research, design, craftsmanship, and production techniques--all of which were under study at Brannen Brothers. Bickford is considered unsurpassed as a craftsman, and his hope was to make Brannen Brothers unsurpassed as a flute company.

Bickford also had something else in mind. "In the spirit of American ingenuity and free enterprise," he said, "you ought to be able to make money in this business." He wasn't simply after a personal fortune. The research and development necessary to make the best flute possible had to be paid for, and that was the business Bickford saw himself in. Personal rewards would have to be secondary to that.

On the opening day of the 1978 Convention of the National Flute Association in Washington, D.C., Brannen Brothers created a stir. To everyone's astonishment, they presented a new instrument, the Brannen-Cooper flute. Also, they announced that Albert Cooper had joined Brannen Brothers as Vice President and Director of research and acoustical design. With that, Mr. Cooper himself walked onto the convention floor.

The surprise was total. No one had had the slightest idea that Brannen Brothers was up to anything special, much less that they were in cahoots with Cooper. Mr. Cooper had not stopped thinking about flutes after the success of the Cooper scale. He went on to make further improvements in the scale and to work on the design of head joints and the embouchure hole. These later developments were what apeared in the Brannen-Cooper flute.

The Brannen-Cooper flute was very well received. Word spread quickly through the flute world, and within a few months Brannen Brothers had a backlog of orders which they figured would take eight years to fill. They hired a few craftsmen, some of whom had been at Powell. By this time, Bob Brannen had left Powell and was full-time at Brannen Brothers.

In 1979 the company moved to larger quarters in Woburn, Massachusetts, a suburb along Boston's Route 128, an area famous for its research and development firms. Orders contiued to come in at an unbelievable rate. The company hired two more craftsmen. Bickford continued to work on improvements in production techniques. His aim in such improvements has been to improve the quality of the parts produced by machine, so that the craftsmen would be able to spend less time on rough tooling and focus their efforts on the all-important hand finishing.

In 1980 Brannen Brothers made a healthy profit. They expanded a bit, improved production, received more orders,

purchased a large piece of property near the workshop, and in 1981 made a profit again. By the beginning of 1982, the company was consulting architects on the design of a new workshop to be built on their property. Their plans for the new workshop call for more than double their present industrial space and include provisions for a small recital hall. By 1982, the company had grown to ten people, eight of whom had formerly been with Powell, including Bickford and Bob as well as Powell's foreman, Conrad, and Powell's secretary. Production was about 150 flutes per year, and the waiting period on an order stood between six and ten years.

CODA: A LEGEND RETOLD

Things did not remain calm at Powell. Craftsmen came and went as never before. In 1979, Ted Jerome, Dick Jerome's son and a Powell craftsman for several years, left Powell and joined another former Powell employee, Michael Geoghegan, in the new Geoghegan Company, which makes a very elegant, modern looking flute called the "Phoenix" (named after the mythological bird that is consumed by fire, to be reborn from the ashes). This is the first quality flute to depart substantially from the Louis Lot design. In 1980, Dick himself left Powell. He retained his ownership in Powell, though without any active control, and became Vice President of the Geoghegan Company. Also joining Geoghegan was physics professor and flutist Edward V. Powell, son of Verne Q. Powell.

In March of 1981, having turned 65, Ed Machon sold his interest in Powell to the other two owners, Dick Jerome and Elmer Waterhouse, and retired. Waterhouse was one of the original craftsmen who bought the company from Mr. Powell, but since about 1970 he has not worked in the shop. Since Ed's retirement left Powell without an owner-in-residence, Dick left Geoghegan and became a sort of senior consultant to Powell, coming in one or two days every week. Dana Sharidan, who came to work at Powell two days before Bickford left, became General Manager after Ed retired, but he quit later that year to move to Brannen Brothers. By the beginning of

1982, of the twenty-four craftsmen at Powell, three-fourths had been there for fewer than four years.

Since he bought the Wm. S. Haynes company in 1976, Louis Deveau has made a virtue out of stability. He has not seen any reason for change and has not made any. In keeping the style of production and the organization of the company steady, Deveau's aim is to preserve the Haynes "tradition of excellence".

In Japan there are several companies making very fine flutes. It is the aim of some of these Japanese companies to make instruments that would compete with Haynes, Powell, and Brannen Brothers. To date, however, they have missed the mark. Their flutes are very good; they are instruments they can be proud of, but they are not of the finest quality. Every year, it seems, the Japanese flutes get better, but they always lack something. The Japanese technology is very good. Their workmanship is excellent. But if something is missing, I would guess that the Japanese craftsmen have not evolved (at least not yet) their own image of "the right feel".

Dick once told me that years ago when flutists would visit the Powell workshop, Mr. Powell would never explain the making of the flute in great detail--"preferring," Dick said, "to always leave a little magic."

A friend of mine, when told by a repairman that her flute needed to be oiled, asked him if he would oil it in his backroom so she wouldn't have to watch. Like most of us who

turn our heads when we get an injection, to her the idea seemed a violation. There was, for her, something mysterious, something a bit magical about her flute which made its mechanical need to be oiled unsettling.

The images which flutists have of their instruments often include a little magic. They also include hard-learned musical truths, a sense of beautiful tone, and perhaps even some understanding of acoustics and metalurgy. Also, there is the intimate knowledge of how a fine flute should feel. All these things are part of what a flute is. Ultimately, they determine whether or not an instrument is a flute of the finest quality.

The business of making flutes is, today, technologically advanced and developing quickly. It is an international industry and a profit-making venture. Major personalities and companies in the flute world are in motion. The future, though inscrutable as ever, hints of changes to come. But to make a flute of the finest quality requires, as it always has, knowledge of "the right feel" and the ability to apply that know-how with technical finesse and traditional style. It is knowledge which resides only in the fingertips of a few mastercraftsmen. No one has ever made an excellent flute without it. I doubt that anyone ever will. It is what you have to add to good equipment and precise measurement to make a flute worthy of being a legend.

Surely in that there is room for a little magic.

Chapter III

JUDGMENT RECAPTURED

The constancy and quality of Powell flutes has depended upon the ability of the Powell craftsmen to make subtle and sophisticated judgments of their work and to agree among themselves about the judgments each of them makes. In this there is a little magic.

Judgment always leaves a little magic. We can never fully say what goes into our judgments. This is what makes a professional hunch a hunch. If we could spell out everything the hunch included, it would be a calculation, not a judgment.

That there is magic in the making of judgments does not mean, however, that they are dangerous quagmires of chaos to be avoided and distrusted. The fact that so much of what people do in their work depends on educated guesses and that these sorts of judgments can be made with remarkable finesse and dependability testifies that they are neither inherently chaotic nor fundamentally untrustworthy. To the other extreme, the magic of judgments does not mean that they are unapproachable and pristine arts which should be appreciated but never touched for fear that they would be made vulgar.

The study of judgment elicits two common reactions which reflect the extremes of calculation and art. One assumes that it is an effort to establish some explicit analytic model of the "decision process". In the other, the person

tosses his hands in the air and says, "Ah, it's an art." The first implies that to study judgment is to attempt to bring rational order to chaos and that analytic models are, of course, the obvious source of order. This is not my aim at all. I do not believe that judgments are inherently chaotic nor that analytic methods are an automatic source of rationality. My understanding of the role of such models in the machinations of the Pentagon in the late-60's, for example, leaves no room for this assumption.

As to the second response, I have no doubt that judgment can be an art. But the implication of this response is that since it is an art, there is obviously nothing we can say about it. Indeed, some people have gone so far as to indicate that it would be best if I didn't say anything at all.

Our world and our experience of it is narrow, but not so narrow that between the hum of calculation and the hush of awe, there is nothing we can say. Indeed, it is there that most of us live most of our lives. It is in this direction that people point when they give examples of their "better judgment". And it is there that I aim to look.

TREATING JUDGMENTS AS JUDGMENTS

People make judgments. In their work people speak of judgments they make, and they point to examples. There is a "common understanding" of judgment reflected in the ideas of

"educated guess" and "professional hunch". In general, when people speak of judgment (as when we say, "Use your own judgment"), there is no confusion about what they mean. We experience judgments as judgments, and the reality of this experience deserves to be considered in its own right. This seemingly simple point has some important implications. In this study I wish to view judgment as "unique" and "whole". By "unique" I mean that I understand judgment to be judgment, not a mistaken form of something else or a convenient but inaccurate way of referring to something which in a more deliberate light would prove not to be judgment at all. Likewise, in viewing judgment to be "whole", I maintain that it is misleading or fallacious to assume that judgment can or ought to be reduced to parts which are taken to be more real or more fundamental.

When a flute-maker checks a piece of work for "the right feel", I understand him literally to be judging the feel. When a physician, like the one in the first chapter, makes a diagnosis based on his "clinical impression", I understand him to be, in fact, judging his patient's condition.

There are many authors who do not follow this argument. There are those, for example, who hold that the physician is really following an analytic decision calculus, even if he is not fully conscious of it. That is, they would argue that judgment is really a form of decision analysis. It is my view that judgment deserves to be considered as judgment. Therefore, I cannot argue that it is really something else.

Further, since my experience of making judgments is unlike my experience of doing anything else, I have no personal basis for making such arguments. Also, I find these arguments to be inadequate for understanding a good deal of what appears to be involved in making judgments.

There are many things which can be determined by judgment, which can also be determined by other means. For example, a flute-maker can judge the straightness of a key by judging it by eye or by checking it against a known straight edge. But are other means to be preferred over judgment? It is my contention that the answer to this question must be based on the context of specific cases and not on viewing one means as inherently superior or inferior to another. Judgment is not, in my view, inherently inferior to any other means of evaluation or choice. It should not, therefore, be considered an option to be used only at the default of some superior and preferred means. If you need to know the length of a board with great precision, judging its length by eye could be inferior to using a tape measure. Conversely, if you are setting the tension in the key springs of a flute, judgment by feel is preferred over using a gauge. The only way you could be sure the gauge is right would be to check it by feel. In either case, it is the context, not inherent superiority, which determines preference.

JUDGMENTS PRESENT THEMSELVES

Judgments, in part, "present themselves" to us. There is an aspect of judgment over which we have no apparent control. Making a judgment, in this respect, is akin to forgetting and remembering. For example, you can try to remember Aunt Esther's phone number to no avail. The next day, while washing your face, it "presents itself" with no conscious effort on your part at all. Or, you may try to forget a monotonous tune and never shake it, while in the time it takes you to get from the sink to the telephone, Aunt Esther's number has slipped away again. The same is true of making judgments. If you are a personnel officer trying to decide which of two applicants is best for a job, and you cannot judge between them, there is no way you can force yourself to reach a judgment. If you have considered everything you can think of and paced the floor, and still neither candidate stands out, there is no trick available that would guarantee that a judgment would present itself. Conversely, if your "better judgment" tells you that one of the applicants is clearly superior, then only by self-deception can you tell yourself that you really prefer the other.

That we have no direct control over this element of judgment does not mean that our ability to make judgments is inherently unreliable or unpredictable. If it were, the pattern of our judgments would be chaotic, and this is not

the case. One of the reasons we rely on judgments when we do is because they can be very dependable. Definitionally, a "good" personnel officer, relying on his judgment, usually hires the right applicant. At Powell, judgments of feel have held style and quality constant for over fifty years without exception.

There are circumstances where you can avoid making a judgment. If a judgment has not "presented itself" to the personnel officer, for example, he might flip a coin or have someone else choose for him. But these are not mechanisms for reaching a judgment or tricks that prompt judgment to "present itself"; they are decisions not to judge.

Just as we have no conscious control over judgments "presenting themselves", once something has been included among things being judged, we cannot deliberately exclude it from our judgment. It would not make sense, for example, to say, "I am going to judge which novel is best, but I'm not going to allow it to be this one." You could refuse to read it or you could decide it really is a collection of short stories and should not be judged as a novel, but if it is a proper thing to judge among the others once you have included it, it cannot be consciously excluded--except by self-deception.

The issues I have raised up to this point are reflected in the following observations about flute-making.

The Powell flute company has produced flutes of unvarying style and of the finest quality for over fifty years. This constancy has depended upon the ability of the craftsmen to make judgments of feel and sight with respect to their work. These evaluations of quality and the record of excellence in the company's product cannot be accounted for without considering the judgments made by the craftsmen. And those judgments must be understood as judgments.

The craftsmen use several means to check their work. Judgments of feel and sight are used along employing exacting measurements employing straight edges, calipers, feeler gauges, templates, gigs, etc. However, if one method is established as the appropriate way to do a particular bit of work, it is never displaced by another in normal operations. In particular, judgments of feel or sight, once established, are never displaced by explicit measurements. Different means are preferred in different contexts. Digital calipers are the preferred means, for example, in laying out the interior dimensions of the embouchure hole, since judgments of the eye are not accurate enough for this task. The hand finishing and polishing of the interior of the embouchure hole, however, are done by judgments of the eye, since the dimensions involved cannot be meaningfully measured and because there is variation from one head joint to another. The preference of one means over the other is determined by the context in which it is used. One is not inherently preferred by the craftsmen over another.

The judgments of feel made by the craftsmen are not made at the default of a preferred explicit method. That is, the craftsmen are not constrained to rely on judgments of feel in setting the tension of a key spring, for instance, because they lack the tools for measuring that tension explicitly. Indeed, the tension of a key spring could easily be measured explicitly. However, if that were done, the only way to check the accuracy of the explicit measure would be through judgments of feel. In the context of evaluating key spring tension, making judgments of feel is the preferred method.

Even though judgments of feel and sight are hard to pin down, the craftsmen's ability to make such judgments is dazzlingly precise and consistent. Even though the craftsmen cannot directly induce their judgments of feel to "present themselves", and even though the craftsmen speak of these judgments in inexact terms, the consistent production of flutes of the finest quality and exacting style are a direct result of making such judgments.

FITTING TO AN IMAGE

We commonly think of making a judgment as picking among alternatives. We pick a blue shirt over a green one. We pick mocha ice cream as our favorite over thirty-six other flavors. We choose where we want to go on our vacation. Or we pick a course of action which is the most ethical of those open to us.

This characterization of judgment follows through much of the psychological literature on human judgment. In discussing judgment, Restle (1961; p. 25), for example, argues that "Both behaviour and mental life flow continuously, but the attention of the psychologist is turned to the choice-points or critical decisions which occur from time to time. At these points there are alternative acts or experiences, and the subject chooses one of them."

This theme is, of course, a mainstay of decision analysis; but its influence can be seen in other areas. It has, for example, carried over into the analysis of decisions in the management literature, where decisions are seen as clouded by the uncertainties of the business world. "The responsible executive," Schlaifer states, "must choose one definite course of action among all those open to him, even though the consequences of some if not all of the possible courses of action will depend on events that cannot be predicted with certainty." (Schlaifer, 1969; p.3) Similarly, Mack (1971; p.96) argues that part of dealing with such uncertainty is the process of selecting among alternatives itself. "As the decision profile moves away from the highly structured side of the attributes table, it becomes intuitively clear that there is no possible way to consider a comprehensive set of states of the world. Instead it is necessary to select a few alternatives which seem to be of special interest."

All this is, on the surface, quite reasonable. We are

often faced with alternatives among which we must pick particular items or courses of action. And we often bring our judgment to bear in such cases.

But there are judgments which we make that the "alternatives" model does not fit well at all. Picking a rose as the most beautiful among a bunch is easily seen as picking among alternatives, but judging a single rose to be beautiful is not, nor is judging a novel to be "moving". Alternatives can sometimes be imagined in such cases, but they seem rather artificial. I could argue that in judging a single rose, I pick between the alternatives of "beautiful" and "not-beautiful". But this could lead to the need for the alternatives "not-quite-beautiful" and "not-exactly-ugly", and any number of other "alternatives" which you may need to characterize the rose at hand. These alternatives seem, though, to have little bearing on the actual judging of a rose.

This reflects a problem inherent in the alternatives model. Analytically, in some cases, following the alternatives model would require an "infinity" of alternatives. If, for example, a planner judges a plan for a housing development to be "almost right", what sort of "alternative" should we understand "almost right" to be? If "almost right" is viewed as an "alternative", then between "almost right" and "right" we might find a need for an alternative called "better-but-not-there-yet". Between that and "right" we might find need for yet another, and so on.

Analytically, the "alternatives" model can lead to what I call the "conundrum of infinite alternatives": the impossible absurdity of having to pick among an infinite number of options (surely an activity few of us have the time for, particularly if we would have to assign values to each option). In a practical light, such cases do not confront us this way, but they do require us to make judgments about things where there are no alternatives which are presently or can be delineated. The planner may not be able to delineate any "alternative" to the housing plan, but he might still be called upon to judge whether or not it is adequate. (At minimum, that he can not delineate the "right" plan follows from the need to design one.)

Further, making a judgment should not be confused with the result of having judged. "This rose is beautiful", "this flute feels right", and "this car sounds out of tune" are not judgments, but the results of people having made judgments. Whether a flute-maker says "this feels right", "this isn't quite right" or "this is way off", the process of making the judgment is the same and can entail the same elements. Different results do not mean different judgments.

This is a major issue in trying to understand what goes on in the flute factories. Craftsmen are making judgments all the time as to whether a piece of work "feels right" or "looks right". The possibilities for the craftsmen are not only "right" and "not-right". A piece of work can be "almost there" or "way off" or any number of other states. (It

varies often with the particular piece at hand and the particular craftsman working on it.) So the "alternatives" model of judgment is not very helpful in understanding what making a judgment of "right feel" is.

I propose a different model centering around the notion of "fitting to an image". (1) Following this notion, a flute craftsman judges a piece of work by fitting it to an image in his mind of how that piece should look or feel. If it fits, the piece "feels right". If it does not fit, the craftsman recognizes this and typically goes on to discover how to make it fit. (2)

The notion is "image" is, in fact, hinted at in the conundrum of infinite alternatives. "Almost right" begs the question: "Almost" with respect to what? I suggest it is "almost" with respect to an image. The planner, for example, may have an image of the housing project, which the proposed plan does not fit. The planner's image may be sloppy, full of scraps of impressions, disorganized facts, and notions

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(1) Sir Geoffrey Vickers has suggested the idea of "matching to a standard". This idea has influenced my thinking a great deal, but I have departed from Vickers' terminology for two reasons. First, I do not want to superimpose anything I have to say onto his terminology, which stands on its own. Second, "image" has a looser connotation than "standard", and I wish to take advantage of that looseness.

(2) The idea of "image" is derived from Kenneth Boulding's classic work (Boulding, 1956), in which he argues that we have images of the things, persons, events, times and places around us, and that those images, which include facts and values, make up a "subjective knowledge structure" within which we construct our understandings of those things and the actions we take with respect to them. The specific meaning of "image" I intend will develop as the chapter progresses.

about what works and what doesn't, but when he has to judge a proposed plan, his image is evoked to do so.

In one sense an image is not terribly specific; it is not a fixed schematic. If you have an image in your mind of an oak tree, you can judge whether or not a tree is an oak with some accuracy. If you are particularly good at judging oak trees, you might be able to pick out oaks at great distances or distinguish them in poor light or even judge a tree to be an oak when it is an extremely unusual oak. A person who "knows his oaks" (perhaps because he has lived among oaks for many years) can be very good at such judgments because he can evoke an image in his mind which is specific to oaks, but not specific to any particular oak. Further, though an image can be based on some piece of knowledge, it is not itself knowledge. (I would not say "I know an image of an oak tree." I would say, "I have an image of an oak.")

The notion that an image is specific to a general category and not to actual individual examples is important in understanding what goes on at Powell, since every single Powell is judged to "look right and feel right", yet no two Powells are exactly the same. Every craftsman who judges feel in a Powell has an image of how a Powell should feel. That image of feel is accurate enough so that even though each flute is made by several different craftsmen, and over the last half-century there have been several generations of craftsmen, every flute ever produced by Powell has had a feel which a knowledgeable flutist would not fail to identify with

the Powell flute. Yet no two instruments feel exactly the same.

The image is not a specific exemplar nor a schematic in the mind, but rather, in a manner of speaking, an "embodiment" of family resemblance. No two members of the Jones family look exactly alike, but we can have an image in mind which enables us to recognize the family resemblance among them or to guess (or judge) that someone belongs to that family. (The endless numbers of unmistakable Kennedys come to mind.) (1)

Though the word "image" suggests the idea of a visual image, I do not mean to imply that an image used in making a judgment is solely or primarily visual. The image a flute-maker uses in judging the feel of an instrument is the obvious example of an image which is not visual. Further, we should be cautious in what we understand visualization to be in any case. A Powell craftsman told me, for example, that he knew that the shape of a piece he was working on was not right because he could "see what it should look like" in his "mind's eye". On the surface this makes good sense--we all have a casual understanding of what is meant by "mind's eye". But on closer examination the idea becomes problematic. It

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(1) For a discussion of family resemblance in philosophy, see Wittgenstein, 1958. Also, Goodman's (1972) discussion of "similarity". In psychology, a representative treatment of family resemblance and similarity can be found in Rosch and Mervis (1975) and Tversky (1977).

is really a metaphor with limited usefulness. If we followed it further, for example, we would have to argue that in order for the mind's eye to work, it, like the body's eye, would have to be connected to a brain (presumably, the "mind's brain"). At this point the metaphor becomes more trouble than it is worth. Whether or not we really have a mind's eye, we do, in fact, visualize things, and we can judge things visually. When I asked the craftsman if he could imagine two pieces like the one he was working on, one right, the other wrong like the one in his hand, and "see" the difference with his mind's eye, he said "no"--the difference was too little. But looking at the piece in front of him he had no trouble seeing how it was off from the image of the "right" shape he had in mind.

I do not know what form the images we use in judgment take in the mind. Personally I experience them in many different ways, sometimes associated with the senses, as in visualization, sometimes not. Often they are a hodgepodge, and often I have no subjective experience at all of an image associated with a judgment, though I infer its presence from my ability to judge. In any event, the form images take in the mind is not really of concern in this study. We have some conscious experience of images as indicated by the notion of "mind's eye", and this is sufficient to suggest a concept of image which can be built upon in the effort to understand how images function in the making of judgments. Turning again to the flute factory we can see how the concept

of fitting to an image applies.

A Powell craftsman frequently makes judgments of feel and sight. When he does, he is not confronted with alternatives among which he must choose; rather, he is confronted with a flute or a piece of work he must evaluate. The evaluation entails fitting the thing at hand to an image the craftsman has in mind as to how the thing should look or feel. This is part of the process of making judgments. The result of a judgment might be something like "this feels right", "this is way off" or "oops, I have to go back a bit." These are characterizations of work which has been done or needs to be done; they are not themselves judgments. A craftsman characterizes his judgments in many different ways, and different craftsmen at times characterize the state of the same piece of work in different ways. Thus, these "results" or "characterizations" are not usefully thought of as "alternatives".

An image can have several aspects. A particular image, for example, can include things about the flute which are intimate to the particular work a craftsman does on the instrument. Thus, the craftsman who polishes the embouchure hole called the flute a "gem", while the craftsman who assembles the key mechanism called it a "fine machine". An image can be made up of very specific senses of feel and sight. This is demonstrated in the remarks of the craftsman who knew the shape of a piece was off because he could see it

correctly in his mind's eye. (1) Images may not be expressed exactly (the mind's eye is a tricky metaphor), but they allow the craftsmen to produce work of remarkable accuracy and consistency.

An image which a particular craftsman has of the work he does on a flute is not a specific template or a schematic in the mind. A craftsman fitting keys into flutes can shape the same key differently in each flute, and those variations can all be necessary in order for each flute to feel right. As long as a flute is within Powell standards, no particular variation is considered a "deviation" from some "ideal" standard. Thus, the image the craftsman has in mind for the fit of a key is a likeness akin to a family resemblance: no two keys are identical, but they are all recognizable as proper members of that "family" of keys. This is also compellingly reflected in the fact that all Powells have the same "Powell feel", yet no two Powells feel exactly the same.

JUDGING PARTS AND WHOLES

Making judgments is akin to recognition. Indeed, making a judgment can entail recognition. You see a tree in the distance and say to yourself, "I know that kind of tree. Now, what is it? Ah yes, it's an oak." You see the tree and know it is familiar to you; you recognize its kind. Then you

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(1) The physical dimensions being judged in this case were on the order of thousandths of an inch.

judge what kind it, in fact, is.

Both recognition and judgment entail fitting to an image. You recognize the tree in the distance because you can fit it to an image in your mind of an oak; or seeing the tree evokes the image. You judge the tree to be an oak because you understand it to have a family resemblance to an image of oaks you hold in your mind.

The two phenomena are similar, though they should not be confused. I am not prepared to argue fully their similarities and distinctions. But briefly, recognition of the tree (to stick to the example) does not necessarily include judging what kind it is. You might recognize a tree you take to be an oak and then, on closer examination, judge that it is, in fact, not an oak: "Oh, this isn't an oak. I recognize the shape, but now I see by the leaves that it is not an oak. Though it is familiar to me, I can't say what it is." Conversely, one can judge things one has never seen before. If, for example, you know a lot about baobab trees but have never seen one, you might find a tree you would judge to be a baobab, but it would make no sense to say that you recognized it.

An important aspect which recognition and judgment share is their ability to occur without reference to any specific characteristics or features of the thing recognized or judged. You can recognize your Aunt Esther walking down the street without having to bother with the specifics of her appearance. You don't have to say "Oh, I know that nose,

those ears, that hair. Why, that's Aunt Esther!" Or, when Aunt Esther walks into the room and you recognize her, you don't have to check her nose, ears, and hair to make sure it is really she. Likewise, with judgment. The interior designer from the earlier example made the judgment that the room was "wrong" before he could point to any specifics that were wrong. Similarly, the auto mechanic can judge by ear that an engine is running well, without checking any specific part of the engine or any particular part of the engine's sound.

Recognition can be part of making a judgment. When listening to an engine, the auto mechanic might recognize a particular sound, then judge that that sound is "wrong", and then judge that the wrong sound was due to misfiring of the sparkplugs. (He then would check to see if that was, in fact, what was wrong and if so, fix it.)

In arguing that we can recognize and judge things without referring to specific characteristics, I am not suggesting that these processes are witchcraft or ESP. Clearly, when a flute-maker judges that a flute feels "wrong", there is a real, solid, physical property of the flute which has something wrong with it, and, clearly, that is the reason why the craftsman judges the feel to be "wrong". Flutes are physical objects, not transendental ones. But, in the recognition and judgment of the "wrong feel", the craftsman often has no awareness of the specific physical thing that is out of whack: he cannot say what it

is; he doesn't know what it is; in fact, he has to go look for it before he can fix it. Indeed, he would not know to look for it without first having judged the feel to be wrong.

In this sense, the feel of a flute is a real thing. It has a reality in the craftsman's experience of it. He recognizes it the way we recognize a familiar face. When we recognize Aunt Esther, we can recognize her countenance without having to identify the specific features of her nose, ears, and hair. Likewise, Powell flutes have a feel which anyone familiar with Powells can recognize without having to isolate the specifics of key contour, spring tension, etc. These physical properties underlie the "Powell feel", but the feel has a reality of its own, and it is that which is recognized by craftsmen and flutists. It is also the feel which is judged. A craftsman has an image in his mind of how the flute should feel, and he judges an instrument by fitting its feel to that image. When the fit is good, he recognizes it as such and judges the flute to "feel right". When it is off, he judges the flute to "feel wrong".

JUDGMENT IS NOT CATEGORIZATION

We always judge the specific. We cannot judge something by placing it in a category or by deducing things from general categories to which it may belong.

A rose is not beautiful because it is a rose. (1) It is not meaningful to say that since Mahler symphonies are moving, this symphony is moving because it is by Mahler. In judging something, we have to attend to the specific thing being judged.

A Powell flute does not "feel right" because it is a Powell flute. Nor is it a flute of the finest quality because it is a Powell. The quality and style associated with Powells are only to be found in specific instruments. If shown a Powell flute, we might say, "This is a Powell, it ought to have the Powell feel." This is not a judgment; it is a deduction from a general category to a specific member of it. But the flute may not "feel right"--perhaps because it is badly out of adjustment (though it is still a Powell). The only way to judge whether or not it has the right feel is to check it out.

This is not to say that we do not bring preconceived notions, both good and bad, to a judgment. Indeed, we often do. A Powell craftsman has all sorts of expectations of a flute when he picks it up to judge it. But in judging a flute, he attends to the flute at hand. He cannot judge a particular flute by assuming categorically that it has the characteristics his expectations say it ought to have. Finding out that it in fact "feels right" is precisely why he has to judge it. Allowing preconceived notions to interfere

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(1) See Arendt (1978).

with the need to attend to the thing at hand underminds our ability to judge it. Prejudice is not judgment.

JUDGMENT IS NOT RULE-DRIVEN

Once we have learned how to make a particular type of judgment, we can judge virtually any specific thing of that type. Once the auto mechanic learned how to judge the sound of an engine, for example, he could then judge almost any engine of that type.

Once we have an image of an oak tree, we can spot oaks of different sizes, shapes, and forms. In fact, given the general ability to judge oaks, the degree of variation among samples of oak trees which we can judge is truly remarkable (if for no other reason than that no two oak trees are exactly alike). The better we are at judging oaks, the more variation among samples we can deal with. A really good judge of oak trees is likely to be very good at judging a truly exceptional oak to be an oak, just as a good medical diagnostician is good at diagnosing (that is, judging) particularly unusual cases.

In being able to make these sorts of judgments, we are able to judge specific cases which we would not have been able to specify or perhaps even imagine beforehand. That is, we can judge things which are new or exceptional to us. Our ability to judge things can always be in advance of our ability to make explicit the things which we can judge. For

example, we can judge things without being able to write a list of rules for judging them.

If you wrote a list of rules about oak trees, for example, it is possible that you could happen on a particularly odd sort of oak which you could judge to be an oak, but which had things about it that you would not have known to include in your rules. Further, it is likely that someone else would not have been able to identify the tree as an oak by using your rules. We have the ability to judge things which we have not predicted beforehand and even some things which would be impossible to predict.

A flute-maker who is a master at judging the shape of keys, for example, can judge vast numbers of keys exhibiting a great deal of variation. A particular key might be unlike any he has seen before, but he could still judge it for its fitness to his needs. He could find the key "odd, but OK". There are unpredictable and exceptional cases--things not "covered by the rules"--which can still be fit to an image and judged.

THE MOVING IMAGE

In making a judgment, in fitting something to an image, we can modify the image. In a sense, every judgment can confirm the image it entails or modify it. Just as a legal decision can be based on or establish a precedent, so can a judgment add to or change an image.

If you see a tree which you judge to be a "typical" oak, that judgment adds to your image of an oak tree in that it further confirms what you take to be typical of oaks. If you judge it to be an "odd" oak, your judgment can be seen either to expand your image of possible oaks or to strengthen what you understand as a type of exception to typical oaks. Thus every judgment can have a modifying impact on an image. (1)

In the flute factory, every judgment of feel or appearance entails fitting to an image. When a craftsman judges the feel of part of the mechanism, for example, he fits what he feels with his fingers to the image of proper feel in his mind. If the feel of the mechanism is right, it confirms the image. If the feel is "odd, but OK", he accommodates the oddity into the image. In a broader perspective, when Powell decided to go through with the Cooper innovation, the craftsmen had to modify their images of the Powell flute to accommodate the Cooper scale.

This process, while allowing for movement and growth of images, is not without constraints. If every encounter with a tree had an unconstrained impact on our image of an oak, we could end up with no notion of a typical oak, and eventually we could be identifying willows, elms, and anything with a trunk and bark as an oak. Likewise, the conservatism of the process is reflected in the constancy of style and quality in

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(1) Kuhn's discussion of the ostensive nature of "learned perception of similarity" (1977; pp. 293-319) is a useful parallel, particularly in his treatment of resemblance among individual cases as it relates to the make-up of classes.

Powell flutes.

In dealing with odd cases and exceptions, that is, with cases which might deviate from an image, some are rejected. Some trees are judged not to be oaks, just as some work on flutes is judged to be "wrong". But when do you judge something to be an "acceptable exception" and when do you judge it unacceptable? A common way of putting this question (in all sorts of matters) is: Where do you draw the line? I think this is an inappropriate and misleading metaphor in talking about judgment. The metaphor suggests setting a boundary or limit beyond which the case at hand and any like it is not acceptable. It appeals to the establishment of a general rule, and that is inappropriate to the making of judgments. The business of making judgments is to judge, not to check something against a set of rules. This is particularly true when dealing with exceptional cases. An exception is by definition an exception to "the rules" or "the norm" or "the image". If you "draw a line", you can be denying, implicitly and wrongly, that what you are judging is an exception and, thus, falsely obscure or distort the case. Further, since where you draw a line is typically set by a judgment, and since future exceptions to that line would typically be dealt with by judgments, "drawing a line" or "setting a rule" is of little practical utility. The acceptability or unacceptability of exceptional cases is the province of judgment, not rules.

JUDGMENT AS AN EVOLVING SYSTEM

Fitting to an image allows us to judge a great range of specific cases accommodating considerable variation. Further, particular judgments can have an impact on the image itself. This makes the process of making a series of related judgments an evolving system.

At any time over the last three hundred years, there have been a handful of craftsmen and workshops producing flutes of the finest quality. Over this period of time the design of the flute, including the requirements for a flute of the finest quality, have changed remarkably. At times this change has been slow and subtle, at others, revolutionary. Yet at any point, the making of flutes of the finest quality has depended upon each flute being made to exacting standards.

The image of the flute, including the images of right feel and right looks in all their detail, has changed over the history of the flute. Yet no change in flute design has required that one image be dropped totally and a new one put in its place. The new images have always been soluble in the old. In judging a new design to be desirable, the image of the flute has been modified. Adding keys to the basic design of the baroque flute was judged desirable because it made it easier to follow equal temperament tuning. The image of the new keys, guided by the aesthetics of intonation and tone, was judged soluble within the image of the basic baroque

flute. After that, a flute of the finest quality was made by exacting adherence to the standards of the new image. Likewise, Bohm's mechanism was judged desirable within the context of preferred tone and ease of fingering and, thus, modified the image of the flute in his day. Through the Cooper innovation, the image of the Powell was modified to incorporate the new scale. Yet the Powell image remained stable enough to assure that the style and quality of the Powell flute never varied.

JUDGING AND KNOWING

Making judgments entails implicit factors: things we know but cannot say. Part of what we need to know in order to make a judgment is knowledge which we cannot make explicit. That is, judgment relies on tacit knowledge.

A flute-maker can judge the feel of a flute because he has the knowledge of how the flute should feel. That knowledge of feel cannot be put into words or numbers or in any way be made explicit. Once the craftsman has the tension of a spring set, for example, you could measure that tension with a gauge and express it explicitly--say, it turns out to be 4.5 grams. But the knowledge acquired by using the gauge is not the same knowledge the craftsman has used in setting the tension. The knowledge of feel is tacit knowledge.

The concept of "tacit knowledge" comes from the scientist and philosopher Michael Polanyi. In his work

(1958, 1966) he argues for the existence and significance of things we know but cannot say. This is provocatively demonstrated in an example about bicycle riding. In asking people who know how to ride a bicycle which way they turn the handlebars in order to remain upright when they begin to fall, most claim not to know. But they must know which way to turn; otherwise, when they ride they would constantly be falling over. To ride a bicycle, you need to which way to turn; but you do not need to know how to express it. This is knowledge which you have, but cannot say. It is tacit knowledge.

When you begin to fall to the right on a bicycle, you turn to the right, into the fall. But knowing this explicit fact and knowing how to turn (how much, how fast, etc.) are two different things. They are two different pieces of knowledge. The explicit knowledge, "turn into the fall", is something which can enable you to help someone learn to stay upright on a bicycle. The tacit knowledge of knowing which way to turn enables you to stay upright when you ride. If you have only the tacit knowledge, you could not tell someone which way to turn. If you have only the explicit knowledge, you could not stay upright when you yourself ride since the explicit knowledge does not tell you "how much, how fast, etc."

The example goes further. If you studied bicycles and physics, you could write an explicit description of how to ride a bicycle. You could spell out a list of rules, based

on sound physical principles, for how to ride a bike, which if they could be followed to the letter would keep anyone upright and on his way. But you could not teach those rules for riding a bike to someone who has never ridden one and expect him to be able to hop on and ride off. One sort of knowledge does not provide the other. They are parallel: they are both knowledge <u>about</u> the same things, but they are not both knowledge <u>of</u> the same things. They are not equivalent.

Judgments always entail tacit knowledge. This is almost a matter of definition, because if everything entailed in the making of judgments could be made explicit, then those things could be "added up" or "followed to the letter" by anyone, and "adding up" and "following to the letter" are not judgment. There are several things implied in this. First, just as with the "rules for riding a bike", the "rules for making a judgment", would not enable someone to make such judgments.

You cannot give someone a rule that lets one know exactly how it feels to keep yourself upright on a bicycle. Nor would a rule for setting spring tension in a flute enable someone to judge the feel of that tension. The rule, "set the spring to 4.5 grams tension", could be followed by anyone who could use a tension gauge properly, but knowing that rule is not knowledge of feel and following the rule is not judgment.

Here one might argue that the knowledge in a judgment

can be totally explicit, but that the process of making the judgment must in some way remain implicit. An insurance agent, for example, might set a risk by looking at all sorts of explicit statistics and making an implicit judgment about them. The knowledge (statistics) is explicit; the process (the actuarial judgment) is implicit. But this is misleading. The reason why it is so rests on the distinction between "knowing that" and "knowing how".

The philosopher Gilbert Ryle (1949) argued that what we know is expressed both in terms of "knowing that" and "knowing how"--for example, knowing "that" Carnegie Hall is on West 57th Street, and knowing "how" to get there. In the case of the bicycle, the distinction is between knowing "that" you turn into a fall, and knowing "how" to keep yourself upright. Following this, I would argue that the insurance agent "knows how" to make actuarial judgments and that what he "knows" is knowledge which is tacit.

Further, I would argue that the insurance agent is able to make actuarial judgments of risk because he has an image of acceptable risk to which he fits the individual cases he judges. Like bicyclists who cannot say which way to turn to avoid a fall, he cannot say fully what is in his image, but it is based on something "that" he knows. So tacit factors can be found both in what he "knows how" to do and in "that" which he knows.

This is also reflected in the case of making flutes. The following shows the distinctions between "knowing how"

and "knowing that" and between tacit and explicit knowledge in the case of setting spring tension on a flute.

	TACIT	EXPLICIT
KNOW HOW	feel the tension	check the tension
KNOW THAT	set at "right feel"	set at 4.5 grams

This table reflects two significant points. First, that knowledge entailed in the making of judgments can be tacit. Second, that images used in judgments can be based on things "that" we know. That is, if you "know how" to judge oak trees, there must be something "that" you know in order to do so. (1)

(1) Ryle argued that things which we "know that" come to us all at once, while things we ""know how" come to us in degrees. We come to "know that" Lincoln is the capital of Nebraska all at once--either we know it or we don't. While we come to "know how" to ice skate in degrees over time. This is an important distinction, but I do not believe it applies universally. We learn to judge things little by little. Some people "know how" to judge oak trees much better than other people. A mastercraftsman in the flute

EXPLICIT, IN PART

Some things entailed in the making of judgments can be made explicit. The statistics on risk which the insurance agent judged are clearly entailed in his judgment.

Some things entailed in judgments can even be made explicit in the act of making the judgment. In judging a tree to be an oak, for example, you might say, "Ah yes, that's an oak, I can tell by its round shape." Before judging the tree, you might not have been able to say what shape you thought oaks to be.

Significantly, in making judgments we often make explicit things which do not fit to our image. For example, in judging a tree not to be an oak, you might say "It can't be an oak, it is much too vertical in shape." Or in the example of the auto mechanic, when listening to an engine he says, "A mechanically wrong sound stands out." These things do not fit the image, and the parts which are off stand out and are made explicit.

Jean Piaget makes the observation (1972; p. 144) that "If the difference between objects strikes us sooner than their resemblance it is because their resemblance is subjective, it is the product of our own thought....

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factory "knows how" to judge the feel of a flute much better than an apprentice does. The apprentice slowly becomes better and better at judging feel. He does so as he acquires the knowledge which enables him to judge feel more consistently. This knowledge is something "that" he knows, but which he comes to know in degrees over time. This appears to be an exception to Ryle.

Difference, on the other hand, is objective, i.e. is given by the things themselves." By "their resemblance is subjective" I don't think Piaget is saying that the roundness of coins, for example, is all in our heads, but that if we select "roundness" as the criterion for resemblance among coins, then resemblance by way of roundness is subjective to us. Given this criterion, a square coin would stand out among round ones. If the criterion were "shininess", then the square coin could blend in and a dull one would stand out. The phenomenon of fitting to an image is similar. When the auto mechanic has in mind an image of a smoothly running engine, "a mechanically wrong sound stands out" because of the difference between the image and what is heard.

When a flute-maker judges a piece of work, he has in mind an image of what that work should look like. If something is wrong with the work, he notes that it is wrong, and often what is specifically wrong will stand out. Similarly, when a apprentice does a piece of work and takes it to a mastercraftsman, the mastercraftsman judges it by fitting it to his image of what the work should be like. When the work is wrong, sometimes what is wrong stands out to the mastercraftsman and he is able to point it out to the apprentice explicitly.

KNOWING BY JUDGING

What we know can depend on how we come to know it. Wittgenstein (1958) argues that our concept of length, for example, can derive largely from our having measured things. One way of coming to know things is by making judgments about them.

A flute craftsman's knowledge of proper feel derives from his having made judgments about the feel of flutes. An apprentice judges his own work and then takes it to a mastercraftsman to be checked. The mastercraftsman not only checks the work, he also checks the apprentice's judgment. Knowing when a flute "looks right and feels right" comes from knowing how to judge that it "looks right and feels right", since in order to <u>do</u> the work correctly, the apprentice must <u>know</u> when it is correct. This knowledge is acquired by making judgments.

THE BOARD OF DIRECTORS PHENOMENON

The making of judgments, as I have argued, cannot be wholly reduced to explicit knowledge treated with analytic techniques. It is not, for example, a form of decision analysis. Since decision analysis can be used to indicate a preference for one thing over others, it might be seen as an appropriate substitute for judgment. There are cases where this can be true, but if such substitutions are made they

should not be based on the assumption that the two methods are equivalent. (1)

The fact that making a judgment and using an explicit analytic technique are different is demonstrated in what I call the "board of directors phenomenon".

Imagine a large company which must make a major corporate choice among three plans, A,B, and C. Corporate lieutenants are dispatched to study the three plans. The lieutenants produce an elaborate study which includes very impressive decision trees and cost/benefit analyses. They do very good work. Their final analysis indicates that the highest utility would most likely come from following plan B. They make a full presentation to the board of directors indicating the benefits of plan B over plans A and C. Then the board of directors thinks things over and decides to go with plan C.

Was the board crazy? Not necessarily. Let's assume the company ends up doing better with plan C than they ever would have with either B or A. Was the analysis of the corporate lieutenants inadequate or poorly done? Again, not necessarily. Let's assume that it was the best analysis possible.

The board made a judgment. That is their job. The lieutenants made an analytic study and gave recommendations. That is their job. But no matter how elaborate, precise, and

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(1) The practical and ethical implications of such substitutions will be touched on later in this study.

sophisticated the analytic study, the board was under no obligation to follow it. If a board were obligated to go along with the recommendations of a cost/benefit analysis, there would be no need for the board.

The example fits, of course, no matter which plan the board favors. If the analysis shows the highest utility to rest with plan B, and the board agrees, it would still do so (or should) by making a judgment. As I said, that is their job. What the directors and the lieutenants do are two different things. One should not be substituted for the other. Each has it has its strengths and weaknesses. That is why there are both lieutenants and boards of directors.

This phenomenon holds on the individual level as well. When we are confronted with an analytic treatment of a decision or an evaluation of something in our lives, there is nothing inherent in such analyses that obligates us to accept the analysis. We can judge the indication of the analysis to be the best thing and go with it. Or we can override it and follow our "better judgment". (1)

A good board of directors may occasionally favor a plan that proves bad for the company. But when this happens, it does not necessarily mean that the board's judgment was irresponsible. If in making their judgment they failed to

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(1) There is a third option, which is to go along with what the analysis indicates without judging one way or the other--without "asking any questions", so to speak. This would amount to making decisions by tossing a coin. But, making such "non-decisions" and taking actions based on them can be ethically wrong. I will return to this point later.

consider matters relevant to that judgment, this may raise a question of irresponsibility. But making a judgment which proves to have bad consequences does not in itself imply irresponsibility. All other things being equal, the quality of the board's power of judgment is reflected in consistency over time, not in the consequences of individual judgments.

Nor does a judgment which proves to have unfavorable consequences necessarily imply that judgment is an inappropriate way to determine which plan to follow. If the board votes for plan C, and it proves costly to the company, that does not necessarily mean that the choice among the plans should have been made by different means. To raise the question of appropriateness in this case would raise it for all such cases. In determining the appropriateness of judgment to such cases, it is, as with the issue of irresponsibility, consistency over time and not the consequences of individual cases that needs to be considered.

Further, if one member of the board differs in judgment from other members, this in itself does not raise questions about the responsibility or appropriateness of his judgment. The integrity of a justice of the US Supreme Court is not called into question simply because he dissents. If dissent were not allowed, one could not judge.

Lastly, if the company has determined that certain corporate policies and plans are to be set by judgments of the board, then the only way such a judgment can be "overruled" is by another judgment of the board (or by

changing the rule regarding such judgments). This is true of all judgments: if judgment is held to be appropriate to a certain sort of case, then one such judgment can only be displaced by another . (1)

In Powell, judgment is held to be an appropriate means for determining the quality of much of the work on flutes. There are other instrument companies where the emphasis on judgment is not nearly as strong. In these companies, certain quality control measures which at Powell would be done by judgment are done instead by explicit measurements with calipers, for example.

The straightness of certain parts is determined at Powell by judgments of the eye. In these cases, one such judgment can only be displaced by another of similar type. If, for example, one craftsman judges a piece to be straight and another sees it as not straight, this is typically resolved by working the piece until both judge it to be straight. In some cases, the piece can be shown by a ruler to be physically not straight, but this does not displace the judgment of the craftsmen. If the piece is judged straight to the eye in the context of the flute it is a part of, then it is accepted as judged, not as it is shown to be physically by the ruler.

Good craftsmen sometimes make errors. What makes a good

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(1) Similarly, Vickers (1965; p. 13) remarks that "Judgment, it seems, is an ultimate category which can only be approved or condemned by further exercise of the same ability."

Powell craftsmen is consistency over time, not being right all the time. An apprentice often judges work to "feel right" which actually "feels wrong", but this is to be expected. This is also why the work of an apprentice is judged again by a mastercraftsman. Even though the apprentice is often wrong, it is not inappropriate for him to make judgments--indeed, this is how he learns. In general, the fact that craftsmen sometimes make mistakes does not imply that making judgments is an inappropriate way for Powell to make flutes. I would argue that judgment has proved worthy to the task in that it has enabled Powell to produce excellent flutes consistently for over half a century.

Within the Powell standards of quality, there is a sense in which the craftsmen dissent among one another in their judgment about the flutes. This is seen in the fact that it is possible to distinguish work done by different craftsmen. Variation in work, which implies variation in judgments about that work, is acknowledged among the craftsmen. It is common for one craftsman to adapt his work to work done by someone else who "does it differently".

LEARNING

Though making judgments entails things which we know but cannot say, we can, nonetheless, learn how to make judgments, and we can teach this ability to others.

The history of craftsmanship reflects this. Mastercraftsmen know how to make very exacting judgments about their work--judgments which often entail a good deal of tacit knowledge. In working with a mastercraftsman, an apprentice learns to make those judgments himself. The work of a good apprentice often comes very close to the work of the mastercraftsman; sometimes they are indistinguishable. In fact, it is common in craftsman/apprentice training for the mastercraftsman to insist that the apprentice attempt to copy his work exactly. This requires the apprentice to learn how to make the judgments necessary to produce such copies.

The artist Peter Paul Rubens had a famous workshop where he trained apprentices. There are instances where paintings "of the workshop" are not easily discernable from those by Rubens himself. Often Rubens would "finish" or "add touches" to paintings mostly done by an apprentice or by several apprentices. These group works have also been mistaken for work done wholly by Rubens. In his letters (Rubens, 1955) we find him explaining (and often certifying) that this painting or that was of his own hand.

In the flute workshop, this is best demonstrated by the fact that the flutes have maintained such constancy of style and quality. The very subtle and sophisticated judgments one needs to know how to make in order to make a Powell flute have been taught and learned through several generations of craftsmen. Even though today a single flute is made by several different craftsmen, it is within the same standards

of style and quality as one made years ago solely by Mr. Powell. Mr. Powell knew how to judge the feel and looks of the flutes, and this is reflected in the instruments he made. An intimately similar set of judgments is reflected in the instruments made today by teams of craftsmen.

The ability to make a particular type of judgment is a skill which is learned by degrees over time. It is learned through repeated exposure to examples or tasks. No one is born knowing how to judge whether or not a tree is an oak. When you begin to see oaks, you begin to form an image of an oak tree. Each successive oak further refines your image. Finally, you are able to pick out an oak with great skill.

In the flute workshop, an apprentice begins by working on a task along with a mastercraftsman. The apprentice does a bit of work and shows it to the mastercraftsman who judges it and tells the apprentice what to do next. Along with such repeated trials, the apprentice develops an image of how the work should be, and eventually he is able to judge it satisfactorily himself.

Further, learning to make these judgments by way of repeated exposure to examples or tasks does not amount to filling out a list of rules or a set of explicit criteria. Learning to make a particular sort of judgment is, if anything, learning how to deal with cases not "covered by the

rules"--that is, it is being able to judge the new or the unexpected. (1)

CULTURE, LINK, AND IMAGE

We view the events of our lives through the lenses of our impressions, sensitivities, predilections, expectations, understandings, and assumptions. These things are part of who we are. They come from our experiences and our interests. They are nourished by where we live, what languages or variations of languages we speak, our historical, social and ethnic backgrounds, our formal and informal education, and the intimacies of the type of work we do. They are embodied in what we find meaningful and in what escapes our attention. They are fixtures of our lives drawn from the different communities or cultures to which we belong.

Each of us is a member of several cultures, some overlapping, some separate. Our membership in a particular culture is constituted, in part, by our sharing, with other members of that culture, similar responses to and

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(1) In saying that we can learn to make judgments I do not wish to imply that human judgment--the general human capacity to make judgments--is itself learned. Whether it is or is not is, I believe, irrelevant to this study. By way of speculation I would guess that, basically, the capacity of judgment is not learned, but rather is part of how our minds work. However, it seems clear that the ability to make certain sorts of judgments is inextricably bound to abilities which have a developmental aspect (such as measurement, conservation, etc.) or which are socially acquired.

expectations of things, events, and each other.

CULTURAL CONTEXT

Judgments are made within what I call "cultural contexts". By this I mean the "thick soup" of those things mentioned above which inform our responses to and expectations of things and events, and which give ground to meaningful action within a particular setting. A cultural context is both internal and external. It is both the "lenses" through which we view and understand a particular setting and the actions and expectations, shared with others, which make up that setting. It is a set of "webs of significance" held internally but spun externally.

I mean the word "culture" to have the same richness it has in its more common usage in phrases like "Western Culture" or "Italian Culture", but within a different scope. There are cultural contexts of family and home, of ethnic and social groups, of clubs, occupations and interest groups.

The focus of this study is the making of judgments in the context of work. Our work can be one of the cultures to which we belong. In order to understand judgments made in work, we often need to understand that context as a "cultural context". (1) I referred to a cultural context as a "thick

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(1) The idea of "cultural context" is not the first idea of its kind. There are many similar notions. I will mention a few for two reasons. First, I want to give some sense of the "family" to which I intend "cultural context" to belong.

soup". This description is apt. A cultural context can be

Second, I do not wish this notion to be conflated with any of the others.

One view of human perception and knowledge is that we live in a world which is solid and unambiguous and that we can have certain knowledge of that world simply by opening our eyes widely and looking at it with an honest and open mind. This view is largely supported by much of our everyday experience. We go through life expecting walls to be solid, blue to be blue, and our friends to maintain their identities from day to day. Usually these expectations are confirmed. But as a way of scrutinizing more than the ordinary or for looking below the surface of things, this view does very poorly. As a formal worldview it has largely been abandoned. One sort of exception, however, is its popularity among those who wish to hold that their view of the world is the only possible right view and that that view should be clear to anyone with open eyes and an honest mind. Taking the certainty with which we all commonly address the solidity of walls as the basis for embracing a social or political doctrine has been responsible for most of the evil mankind has inflicted upon itself.

Kant (1929) suggested that we are all born wearing epistemological spectacles. That is, what we know of the world does not simply pour in through wide eyes onto a blank and honest mind. Our knowledge, he said, is in part characterized by our inherent abilities to know. Our minds break up and categorize what we see in the world, and those categories are part of us, not part of the world. We cannot know something of the world unless we have a pigeon-hole in the mind to put it into. Cause and effect, for example, are not so much things in the world, for Kant, as ways by which our minds categorize and make sense out of some types of things we see.

Kant's view has prompted a number of variations. There have been many significant theories, for example, within the sociology of knowledge based on the notion that after we are born, we all acquire sociological spectacles. That is, what we know is determined to a significant degree by the social contexts within which we live, work and come to know things. George Herbert Mead (1934), whose influence can be seen in Berger and Luckmann (1966) and others, suggested that we are basically social creatures and that our "selves" are created in large part through our social actions within particular social contexts, and that our notions of society are constituted in a sort of "generalized other" self. Most recently, Goffman (1977, p.21) has suggested that "When the individual in our Western society recognizes a particular event, he tends, whatever else he does, to imply in this response (and in effect employ) one or more frameworks or schemata of interpretation of a kind that can be called

made up of many different sorts of things. Different elements can interact subtly. We are often, in fact, unaware of specific aspects of the cultural contexts we belong to.

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primary.... ...a primary framework is one that is seen as rendering what would otherwise be a meaningless aspect of the scene into something that is meaningful." The significant point here is that the meaning of things in the world, particularly the social world, does not lie simply in a solid and unambiguous reality, but is substantially of our making as social beings.

John Dewey (1910) suggests that we bring to judgments habitual forms of thinking. These he says can be beneficial, as in something mastered, or detrimental, as in prejudices. Kurt Lewin (1943) argued that we act within a social "field" and that such fields can be described formally (to a degree), demonstrating patterns and constraints on our action. Barnard (1968), in discussing executive behavior, referred to what he called the "total situation" which the executive must grasp in dealing with specific situations. Buckle and Buckle (1977) have argued that within courts of law a social structure is created within which processes of negotiation such as plea bargaining are carried out. Similarly, Kuhn (1977) has argued that scientific communities operate within a "disciplinary matrix" (what he formerly subsumed under the more general term, "paradigm) which is created by and guides the norms of scientific work within that community.

In a broader perspective, C.P. Snow (1971) argued that the intellectual world has unwittingly divided itself into "two cultures", one scientific, the other "literary", which are growing in different directions and are finding it increasingly difficult to talk to one another. Bensman and Lilienfeld(1973), meanwhile, contend that the specific techniques of an occupation contribute, like socio-economic class, to the development of a particular consciousness or world view.

Geertz (1973), agreeing with Max Weber, argues (as noted above) that "man is an animal suspended in webs of significance he himself has spun". He believes human culture to be those webs and has based his interpretive analysis of "cultural systems" upon this notion. Elkana (1971) has applied Geertz's notion of "cultural system" to the analysis of science in different cultures. Sir Geoffrey Vickers (1968 and 1973) has argued that our membership in various human institutions derives, in part, from shared expectations of what those institutions can and ought to provide, that what we find meaningful in our world is constituted in our "appreciation" of it, and that people have the power and duty to make judgments of value regarding these things.

All this can make it difficult to get a sense of a cultural context. Though difficult, it is not impossible. The soup is thick, not impenetrable.

The analysis I propose of cultural contexts is a bit artificial, as analyses of such things tend to be. In taking "stop-action" photos of things in motion, we inevitably lose some sense of the reality of inertia. Keeping this in mind, however, we can find them useful.

Though we may never get a full grasp of a cultural context, I think we can take "core samples" of it. Each core sample constitutes what I will call a "conceptual perspective". It is by examining the "conceptual perspectives" of a cultural context that we can gain a sense of the cultural context and of how it informs the judgments people make within it.

There are four conceptual perspectives which I will consider in this study (no doubt there are others). They are: epistemology, mythology, ethics, and aesthetics. What I am suggesting is that every cultural context has an epistemology, a mythology, an ethical system, and a system of aesthetics, and that each of these can be viewed as a conceptual perspective within the cultural context. Like the cultural context from which they are drawn, they are both internal and external.

Within the cultural context of a work setting, one can find things which fall into one or more of these perspectives. I will give a simple hypothetical example.

One secretary says to another: "I guess I should tell the boss about this, but he doesn't really understand how these machines work. I mean, if we are supposed to be a fancy ad agency, this copy ought to look good." All four perspectives are here.

1. Epistemological: "...he doesn't really understand how these machines work...." This implies that there is some knowledge or know-how which the secretary has about "these machines" which the boss doesn't. Or, since the boss "doesn't <u>really</u> understand", perhaps he has knowledge, but it is different than the secretary's.

2. Mythological: "...I mean, if we are supposed to be a fancy ad agency...." This hints at myths. Companies and professions are often full of myths. The myths are not lies; they are ways of seeing the company or the work in terms of an archetype, or of bringing a story or the company's past into the reality of a current situation.

3. Ethical: "...I guess I should..." and "...this copy <u>ought</u> to look good...." These comments indicate an ethic about what ought to be done or what should be the case, and in this sense they are ethical statements within the cultural context of the secretary's company.

4. Aesthetic: "...this copy ought to look good...." If the copy ought to "look good", then presumably it could "look bad" or perhaps "not quite good", and these are matters of aesthetics.

Individual comments like these do not acquaint us fully

with any of the conceptual perspectives they hint at, but they can give us a suggestion of their existence and some notion as to where to look further. They can suggest a conceptual perspective since, typically, such comments would not make sense (or the sense the speaker intended) if they were not understood within a conceptual perspective.

A company myth, for example, suggests a company mythology. A mythology is a systematic worldview based on archetypic explanations of nature, people, and events. A myth is a piece of a mythology. It is a story or character which is understood within a particular mythological worldview. Isolated stories and characters can be myth-like, but they are not myths unless they fit into the structure of a mythology. (1)

The same is true of epistemology, æesthetics, and ethics. No piece of knowledge makes sense outside of an epistemology. For example, within the epistemology of medical knowledge held by the American Medical Association, the knowledge upon which the treatment of arthritis with cortisone is based is considered acceptable, while the knowledge underlying its treatment with homeopathic tea is considered nonsense. Within the epistemology of certain Oriental bodies of medical knowledge, the opposite is true. To take a related example, twenty years ago the AMA considered the body of knowledge underlying acupuncture to be

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(1) For a discussion of myths, particularly within organizational contexts, see Yanow (1982).

in the same league with astrology, though the Chinese had engaged in its practice for centuries based on knowledge they considered the very essence of medical orthodoxy. Over the last two decades, the AMA has revised its view. I believe it is safe to say, though, that the legitimacy which the AMA gives to acupuncture is not identical with the Oriental understanding of its legitimacy. In either case, specific knowledge about acupuncture makes sense only within a particular medical epistemology.

Within aesthetics the relationship between a particular aesthetic and an aesthetic system is commonly understood. "Beauty is in the eye of the beholder" is the banner of this understanding. It does not mean "everything is beautiful" (which is foolishness), but that if something is found beautiful, it is found so within an understanding of beauty--that is, within an aesthetic system.

Likewise in ethics. If someone says "this is wrong", there is an appeal implicit within that claim to reasons for why it is wrong--that is, an appeal to an ethical system. If the ethic "thou shall not kill" were viewed in isolation, outside of any ethical system, the rampant exceptions to it would render it one of the most vapid of human maxims. However, its history as a powerful ethic derives from its position within a number of ethical systems.

My argument is, then, in general, that individual ethics, bits of knowledge, aesthetics, and myths can only be understood as part of a corresponding conceptual perspective.

However, conceptual perspectives are not simply empty boxes into which these things are tossed; each has a structure, an organizing scheme. In being a piece of a mythology, a myth stands in a particular relationship to the other myths of that mythology. Put the other way, an organized structure of myths is a mythology. Likewise with the other perspectives. The knowledge of acupuncture, for example, is contained within both Western and Eastern medical epistemologies; it has a place in each, but in different configurations with the other bits of knowledge in its respective epistemology (only some of which are common to both).

I wish to call the organizing scheme of a conceptual perspective its "architecture". An architecture is a systematic organization of the elements of a conceptual perspective. Each architecture follows several principles of organization: the elements of a conceptual perspective stand in relationship to each other in more than one way. I wish to suggest three organizing principles applicable to the architecture of each of the four conceptual perspectives. They are: preference, applicability, and legitimacy. The relationship of one element to one or more other elements of a conceptual perspective can be characterized by one or more of these organizing principles.

"Preference" indicates that one element is to be preferred over one or more other elements. For example, in the case of the auto mechanic, within the architecture of his epistemology, the know-how of tuning an engine by ear is

preferred over the know-how of tuning it by the specifications.

"Applicability" indicates whether or not an element is applicable in a given situation. For example, the AMA considers acupuncture to be applicable to the treatment of certain things and not to others, given its understanding of the body of knowledge upon which acupuncture rests. The pattern for the applicability of acupuncture is clearly different in Eastern medicine.

"Legitimacy" indicates whether or not (or perhaps to what degree) an element is "legitimate" or acceptable within a particular conceptual perspective. Within the epistemology of Western science, the knowledge of what Newton called "that force, whatever it is, by which the planets are continually drawn aside from the rectilinear motions" is viewed as quite legitimate, while the knowledge of that force (whatever it is) which astrologers' claim as the basis of their practice is seen as quite the opposite.

Further, these principles of organization can, and usually do, act together. For example, a general ethic that sees telling the truth as "preferred" to lying might be seen as not "applicable" to a situation where telling the truth could bring harm to someone. Similarly, within the epistemology of Western medicine, acupuncture might be seen as a "legitimate" way to treat headaches, but not one to be "preferred" to the use of certain drugs, unless the use of those drugs is not "acceptable" to certain sorts of patients.

Within a conceptual perspective there is an issue of "consistency". That is, whether or not all the elements of the conceptual perspective are "consistent" with one another. For example, within an ethical system there could be two ethical imperatives, each legitimate and applicable to a situation at hand but which are counter to each other, without any indication that one is to be "preferred" over the other. Similarly, within an epistemology, there could be two counterposing pieces of know-how without any indication as to whether one or the other is more "applicable" to a task at hand.

Such issues of "consistency" and "inconsistency" can be a source of trouble. Within a cultural context, they can result in a dilemma and prevent or impede the effectiveness of action. In the context of work this can result in organizational or professional problems.

I wish to argue that parallel to the architectures of conceptual perspectives, there is a "meta-architecture" of cultural contexts. A cultural context is not simply an empty box into which the stuff of conceptual perspectives can be tossed; it has a structure, an organizing scheme. In belonging to a cultural context, the elements of each conceptual perspective stand in a particular relationship to the elements of the other conceptual perspectives. It is this organization of things within a cultural context that is its "meta-architecture".

As with the architectures of the conceptual

perspectives, I propose three organizing principles for the meta-architecture: "displacement", "combination", and "actualization". These principles of organization can operate individually or in combination on all elements within a cultural context, both within a single conceptual perspective or across perspectives.

"Displacement" is the organizing principle whereby one element displaces another. In the example of the secretary, there was the ethic reflected in her comment "I should tell the boss about this", but her feeling that she knew better how to produce the good looking copy a fancy ad agency should put out displaced the ethic. Her feeling contained elements of epistemology (know-how in running the machines), myth (fancy ad agency), and aesthetics (copy that looks good), which together displaced the ethic.

"Combination" is when two or more elements combine in dealing with a specific situation. This is seen above in the secretary's case. Another simple example would be an ethical imperative combining with the epistemological know-how necessary to carry out the imperative.

"Actualization" is a relationship of elements that breaks a stalemate or a dilemma. For a example, it is possible that the secretary would not have know what to do if she had not thought of the company as a "fancy ad agency". Without the myth of being a fancy agency, the aesthetics of the copy might not have been important enough for the secretary to judge whether she should run the machine or tell

the boss about it.

Finally, parallel to "consistency" within a single architecture, I argue that there is an issue of "compatibility" among the various elements within the cultural context as a whole. For example, in order to act on an ethical imperative, we must have accompanying know-how. If we do not, then the ethical system and the epistemology are not compatible. As with inconsistency within the architecture of a single conceptual perspective, incompatibility among the different architectures can be a source of ineffective professional action or organizational problems.

This scheme of cultural context, conceptual perspectives, architectures, meta-architecture, and organizing principles provides a systematic conceptual framework for understanding the contexts of work which are the subject of this study. It is, in effect, a method of institutional analysis fit for examining the professions, crafts, and organizations as institutions of work.

ORIENTING LINK

It is within a cultural context that people make judgments in their work. The cultural context informs and gives meaning to their judgments. But it in itself is insufficient to inform the making of specific judgments themselves.

In order to make a judgment within a cultural context, the specific thing being judged has to be connected to the cultural context; it needs to be understood in terms of it; it must be seen as part of it. This is done through what I call an "orienting link". An orienting link connects the specific thing a person is judging to the cultural context held in that person's mind.

Orienting links are images. An image is drawn from one (or perhaps more) of the conceptual perspectives of a cultural context. For example, a flute-maker's image of proper feel can be seen as drawn from an aesthetic system--that is, the feel is a particular aesthetic that is evoked as an image. One function which an image can have is to act as an orienting link. (It does not always do so, however: you may call an image to mind while lying on the beach or taking a shower.) An image acts as an orienting link when you are in the process of judging something and the image enables you to see what you are judging in terms of a cultural context.

The auto mechanic from the earlier example judges the sound of an engine within a cultural context of auto mechanics. Within it there is an architecture of knowledge and know-how, one of ethics in terms of how things "ought" to be designed or how they should be fixed, one of aesthetics regarding how mechanical parts should look and how they should feel when interacting with one another, and one of myths about how an ideal engine would work or what would be

perfect performance for a particular car. When the mechanic makes a judgment about a specific thing, he makes it within this context. But the context needs to be linked to the specific thing being judged. This is done through an image acting as an orienting link. When he is tuning an engine by ear, the mechanic links the sound of the engine to the cultural context through an image he has in his mind of how the engine should sound. The meaning and usefulness of the image is derived from its belonging to the entire cultural context, and as an orienting link it enables the mechanic to bring the sound of the particular engine into that context and judge it with respect to that context. (1)

I have used the word "orienting" deliberately. I want it to evoke the visceral sense of "being lost" and of "getting one's bearings". You can have a map and a compass and recognize features about you and even have a specific goal spotted, and still feel disoriented. It is not until you are able to link those things to an image in your mind of where you are that you can feel oriented. This is akin to

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(1) Like the idea of "cultural context", the idea of "orienting link" is not a lone species. However, I believe the specific meaning I intend by it is new.

Kuhn (1977) discusses the nature of what he calls "exemplars" within a disciplinary matrix. He sees them as mental constructs which can be understood as something of an archetypic problem formation or solution within a particular scientific community. Similarly, Holton (1973) develops a theory of the role of "thema" in science and argues that an inclination to see a problem or formulate a solution in a certain way is a "quasi-aesthetic judgment" which is "a form of thematic commitment with deep psychological roots. It is frequently the basis for choices made in actual scientific work..." (p. 26).

the sense of making a judgment.

The auto mechanic says: "You get used to hearing cars run one way, and when you hear them running differently, you know something's wrong. In your mind you might think it's one thing or another, but then you listen closely, and you know what it is." Being used to hearing cars run one way indicates being in a cultural context. Hearing that something is "wrong" before you are able to identify what it is suggests a sense of being lost or disoriented. When the automechanic listens closely and then knows specifically what is wrong and what to do about it, he has become "oriented", he can place the sound of the engine within his cultural context and judge it with respect to the things of that context.

The image which the woodworker expressed in terms of a sense of style functioned for him as an orienting link in the mitering of boards. "There really isn't one right way to join two boards together... If you are making a miter, for example, the way you do it is different if you are making a screen door or a piece of fine furniture...even when you're cutting them to the same size using the same tools... If you were mitering a series of boards to panel a wall, and you cut each board in a way appropriate for furniture, then put them together, the wall would undulate all over the place... When you cut each board, you have to keep in the back of your mind the situation..., set the conditions around what you are making, what it is going to be and do--then the way you use

the technique comes out of that. This accounts for a lot of bad carpentry: people do good work but in a style that's just wrong for what they're making... You have to fit the technique to the scale and style you're working in."

The technique is drawn from the epistemology of joinery, while the woodworker's sense of style links it to the task at hand and enables him to make judgments about how to employ his know-how. Without the link (i.e., when the style is wrong) "the wall would undulate all over the place". The word "undulate" evokes very nicely the sense of being disoriented, just as "fit the technique to...the style" suggests the orienting link.

FLUTES RECAPTURED

There is a cultural context to the Powell workshop, as there are for Haynes and Brannen Brothers. Each is part of the larger context of the craft, its tradition and its history. Each of the four "conceptual perspectives" is reflected in the story of the making of fine flutes.

Aesthetics. There is a powerful aesthetic system in Powell. The whole notion of the feel of the flute and of "feeling right and looking right" is fundamentally aesthetic. A piece of work which "looks right and feels right" is often called "beautiful". Conversely, I have heard Powell craftsmen refer to work not done well or a particularly stubborn problem as "ugly" or "an ugly mess". That a piece

of work can "feel right" or "feel wrong" or "feel almost right" indicates that there is a structure or an architecture to the aesthetics. Different aesthetic judgments are understood in relation to other aesthetic judgments. The aesthetic system is used constantly in carrying out daily work: in his actual physical work on the flute, a craftsman is guided in part by the aesthetic system.

Mythology. Legends are a real part of the flute world. They color the way flutists and flute-makers see and understand the instruments they play and make. The sense that the flute is a bit magical or at least mysteriously special is part of why my friend did not want to see her flute being oiled, and part of why many flutists don't care to know anything about the mechanism which is responsible for the feel they value so much. Likewise, a craftsman is apt to get a pixie twinkle in his eye when he says, "Well, you just know when it feels right". That there is a bit of mystery to what the craftsmen know how to do, that they cannot tell you literally what goes into the making of flutes (due to the central importance of tacit knowledge), is a legend which even the craftsmen tell themselves. And this touches their perception of their work. Myths are reflected, for example, in what the young craftsmen told me about Powell being "a special place with a special atmosphere", that it was a sort of "Old World workshop", that they were "always proud to tell people" they worked at Powell, and that they didn't feel like "just another worker in just another company".

On the front of the Powell brochure there is a logo, drawn very precisely, and the motto "uncompromising craftsmanship in silver, gold and platinum." This is not an advertising slogan. Powell does not advertise. It is a piece of mythology. It is symbolic. It is a coat of arms announcing Powell's essence, its self-image. "Uncompromising craftsmanship" evokes excellence and the "Old World workshop" image. "Silver, gold and platinum" are precious metals, ideal symbols of the flute's specialness and quality. The same ideas are reflected in things the craftsmen have said: "The Powell flute is the best there is" and "The name has always stood for the best." Significantly, this carries over to some very specific things in the craftsmen's work. The craftsman who makes head joints referred to the flute as a "gem", while a craftsman who works on the mechanism called it a "fine machine". Like the motto, both phrases appeal to the legendary image. They also have an intimate connection to each craftsman's work. The first craftsman polishes the embouchure hole as one would polish a "gem"; the other adjusts keys as one would work on a "fine machine". The craftsmen judge details of their work with respect to these legendary images. As pieces of the Powell mythology, they have a real impact on how work is actually done and on the final style and quality of the Powell flute.

Not all pieces of the mythology are equally powerful. They do not all have the same real impact on how work is done; indeed, some have little direct impact at all. Evoking

"gems" and "fine machines" has a strong influence on very fine details of work. The impact of the epithet, "the best damned flute in the world", is not nearly as direct or as powerful. It might move the craftsman to give care to his work, but it would not guide specific subtleties as "gem" does. The legend of Mrs. Powell's spoons is certainly a real piece of the Powell mythology: no one would want to be without it, but it is much more a piece of the general Powell image than it is a specific guide to the details of making the flute.

Epistemology. The ability of the craftsmen to make Powell flutes depends, of course, on what they know. Much of this was discussed earlier in dealing with the issues of explicit and tacit knowledge, "knowing how" and "knowing that", and the displacement of judgments (e.g., where knowing how to judge feel would displace knowing that a spring was set at 4.5 grams tension). These things reveal that there is a Powell epistemology and that the epistemology has an architecture. Within the architecture, different pieces of knowledge are correlated with one another; indication is given as to where some pieces of knowledge apply and others do not; and in cases where two pieces or types of knowledge might apply, a system of preference indicates which one should be used.

Ethics. The most apparent piece of the Powell ethical system is the use of the idea of "right" as applied to work done, particularly in terms of "right feel" and "right look".

There is a right and wrong to work done at Powell, with judgments like "almost right" in between. This is reflected in Dick's comment that a flute "has to look right and feel right" (with the ethical imperative "has to"). In talking about quality control, the craftsmen frequently point out that in order for one craftsman to do his work "right", the work done on the flute before it reaches him also has to be done "right" or even "exactly right". (Recall that this does not mean the work has to be done to "exact" physical detail, since there is physical variation from flute to flute.) In comparing Powell and Haynes, Bickford made the comment that Powell's "whole concept of how a flute should be made..., how the parts should be handled and shaped" was different than at Haynes. That is, what "should" be done at Powell is different than what "should" be done at Haynes. They have different ethical systems, though each is closely tied to the work done on the flutes. Within the architecture of Powell's ethical system, these ethical "should's" and "has to's" touch the details of work directly.

In a different place in the architecture there are ethics which apply to Powell more generally. Perhaps the best example is Ed's comment that "the name has always stood for the best, and that's the way we are going to keep it: the best there is, period." Ed would not consider a change in Powell or an expansion if it presented any threat to the

ethical imperative of keeping Powell "the best there is." (1)

Cultural Context. The four conceptual perspectives of Powell combine within Powell's cultural context. The cultural context has a meta-architecture which reflects the organizing principles of displacing, combining, and actualizing. The elements of Powell's cultural context are remarkably compatible. The judgments made in the workshop often reflect elements from different conceptual perspectives as they relate to one another in the meta-architecture. And the standards of style and quality which Powell has maintained reflect the patterns of compatibility within the cultural context.

The organizing principles which are reflected in specific judgments in Powell (or in an analysis of any institution) should not be understood as "rules" for making Powell-type judgments. I have argued that judgments are not "rule driven". The meta-architecture of Powell's cultural context reflects the regularities and patterns of the craftsmen's judgments; it does not dictate them.

"Displacement" is reflected in numerous cases. For example, as I mentioned earlier, there are cases where a judgment that a part looks straight to the eye displaces the

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(1) I am including as ethical judgments those judgments which, following Vickers (1965), can be seen as "instrumental" judgments. This is justified here since in making an instrumental judgment as to how something "ought to be done", the "ought" carries an ethical sense meaningful within a cultural context. By this, however, I do not wish to undermine Vickers' distinction, which I consider valid and important.

knowledge that the part is physically not straight. That is, in judging such parts, the aesthetic judgment displaces the explicit knowledge. Conversely, in sizing the embouchure hole, the explicit measures taken with calipers displace any judgments of eye. Since a judgment of feel is held by Powell to displace all other ways of judging proper spring tension, once such a judgment is made, the only time it is ever displaced is by another aesthetic judgment of feel.

"Actualization" can be seen in the case of the craftsman who works on the flute mechanism and refers to the flute as a "fine machine". His knowledge of the explicit tolerances which the mechanism must be judged to possess combine with his ability to make aesthetic judgments of the mechanism's feel. But it is through his mythical sense of the flute as a "fine machine" that the elements of the epistemology and aesthetic system are brought to bear--that is, "actualized"--in his judgments of his work.

There are many cases where combinations of elements from all four conceptual perspectives are reflected in judgments made by the craftsmen. For example, the ethic of "how the parts should be shaped" is not solely a matter of judging that a part adheres to precise physical standards. The part should be within certain physical guidelines, but since there is physical variation from flute to flute, the imperative entails aesthetic judgments as well. That is, the craftsmen must judge that the part "looks right and feels right" in combination with their judgments that it meets physical

standards. If the work at hand--say, the final shaping of the embouchure hole--does not look right, then the craftsman must have the knowledge, drawn from the Powell epistemology, of how to make it look right. In other words, the judgment of know-how must combine with the aesthetic judgment of looking right. In doing this, the craftsman may call to mind from the Powell mythology the myth of "gem", which would combine with the other elements in guiding and judging the details of his work on the embouchure hole.

The Cooper innovation reflects a set of judgments of a different sort. The decision to offer the Cooper scale as an option on Powell flutes was a single company decision, but it entailed a number of judgments. The judgments were made within Powell's cultural context and they reflect its meta-architecture, but they were a step removed from the details of daily work. These judgments reflect the Powell cultural context and the various organizing principles as they took form in the decision to go ahead with the Cooper innovation.

One element in Powell's consideration of the Cooper scale was whether or not their mythical reputation for making "the best there is" obligated them to make the Cooper innovation if the Cooper scale turned out to be favored by flutists over Powell's traditional scale . Once they had tested the Cooper scale, its aesthetics were judged to be compatible with Powell's myth of "the best there is". These two in combination then displaced the mythical standing of

Mr. Powell's original scale (which was part of what made Powell flutes a legend).

However, the Cooper scale did not displace the Powell scale entirely. The Cooper scale was given only as an option. Even when well over ninety percent of Powell's orders were for the Cooper option, Ed told me they would continue to offer the Powell scale "until we die". Such was its power as a legend. In this sense the judgment to keep the Powell scale option reflects the Powell scale myth as displacing, in part, the aesthetics of the Cooper scale and the knowledge of its preference among flutists.

The Powell ethic reflected in Ed's comment that Powell had always stood for the best and "that's the way we're going to keep it" proved compatible with the judgments of the aesthetics of the Cooper scale, so that the ethical imperative of "keeping it the best there is" was actually followed by changing the flute through the Cooper innovation. Thus, the ethical judgment "that's the way we're going to keep it" and the mythical judgment of "the best there is" combined with aesthetic judgments of the Cooper scale in displacing the legendary status of the Powell scale in the decision to go ahead with the Cooper innovation.

Orienting Links. The cultural context of Powell is the "thick soup" within which the craftsmen make judgments about their work. Specific tasks are connected to the cultural context by way of orienting links. Various images which the

craftsmen have of the flute or particular aspects of it act as orienting links.

In working on a specific part of the flute, a craftsman may evoke in his mind an image of how that part should look or feel. The image can be very specific to some small detail of that part. The image, acting as an orienting link, guides his work on the part; it enables him to judge how the part he is working on "should be handled and shaped". The craftsman who said he knew that a part was off because he could see in his mind's eye how it should be is an example of this. The hard part of the task was not the technique--he was able to do it technically--but, rather, fitting the part to the image he had in his mind of how it ought to look. He was able to judge when the part "looked right" because the image acted as an orienting link, enabling him to see the part at hand in terms of Powell's cultural context, including the various elements of aesthetics, epistemology, mythology, and ethics which he needed to guide his use of technique in working the part. (Recall how the woodworker used the image of "style" as an orienting link in guiding his technique in mitering boards. Similarly, the interior designer used his image of how he could do something with the plants as an orienting link in beginning his work on the room as a whole.)

Further, being linked to Powell's cultural context assures that the judgments a craftsman makes about a particular part will be compatible with the judgments he makes about other parts. All of his judgments of his work

are made with respect to Powell's cultural context and, thus, his work is within Powell's standards of style and quality.

Similarly, orienting links come into play in assuring that the judgments of one craftsman will be compatible with those of the other craftsmen at Powell. Each piece of work which a craftsman does on the flute is not only judged by him to be consistent with Powell's standard of style and quality, but it is similarly judged by other craftsmen as well. These "hand-to-hand judgments" are most clearly reflected in cases where one craftsman must do his work "right" in order to assure that the next craftsman down the line will be able to do his right. Each must judge the work of the first to be consistent with his sense of Powell style and quality--that is, with his sense of images, orienting links, and Powell's cultural context. If the work is not right, it goes back to the first craftsman to be fixed. If it is "wrong" because the craftsman had an inappropriate image of how it ought to be, he would eventually modify his image so he would be able to do the work in a way acceptable to the other craftsmen. This is how quality is maintained at Powell and how their apprentices are trained.

Though the craftsmen share a spoken vocabulary of images, the images themselves are held in the minds of the individual craftsmen. Each craftsman has his own internal and, in a sense, personal set of images. Likewise, Powell's cultural context is ultimately held in the minds of the craftsmen; it is, in a significant sense, inaccessible to us

and even, in a way, to the craftsmen themselves. But it is reflected in remarkable detail in the things the craftsmen say and do. The sense which each craftsman has of Powell's cultural context and his ability to connect the intimate details of his work to the four conceptual perspectives through images acting as orienting links assure that the different judgments he makes are compatible with one another and that his work is consistent with Powell's standards of style and quality. That the work he does, based on those judgments, is similarly judged by other craftsmen within their sense of Powell's cultural context assures that the judgments of each craftsman are compatible with the judgments of all the craftsmen and that the work of the craftsmen overall is consistent with what the Powell flute should be. Powell's cultural context is a set of "webs of significance" held internally in the minds of the craftsmen but spun externally through their hand-to-hand judgments. All this is reflected in every flute Powell has made and in the constancy of style and quality which the workshop has maintained for over half a century.

Surely in that there is room for a little magic.

Chapter IV

THE HAND OF THE ARTIFICER: IMPLICATIONS FOR PRACTICE AND RESEARCH

In the previous chapter I developed a conceptual framework within which the making of judgments in the Powell workshop was interpreted. The interpretation demonstrated how the Powell craftsmen draw upon specific elements of epistemology, ethics, aesthetics, and mythology, constituted in the Powell cultural context, both in guiding and judging the details of their work and in making company decisions.

The development of the conceptual framework served two other functions. First, it identified some characteristics of judgment which can be generalized beyond the Powell context. Second, it demonstrated through the interpretation of the Powell case the usefulness of the set of ideas associated with the notion of cultural context as a method of institutional analysis.

In this chapter I will summarize these last two aspects of the conceptual framework and draw from it some implications for practice and research.

A SUMMARY OF THE CONCEPTUAL FRAMEWORK

A major argument in the conceptual framework is that judgments are substantially informed and given meaning by the contexts within which they are made. This places an important constraint on the sorts of generalizations which can be made about judgment. Namely, in a very real sense, the extent to which judgments are dependent upon their context is the extent to which we cannot safely make generalizations about them. (1) Understanding how judgment works in a flute factory does not guarantee a full understanding of how it works in economic forecasting or in psychotherapy. Human judgment is not all of a piece, even if it is all human judgment. However, keeping this in mind, the following summary outlines the general characteristics of judgment identified in the conceptual framework.

* Judgment deserves to be considered in its own right. Since we experience judgments as judgments, it is important to be able to discuss, analyze, and understand them as judgments.

* There is a need to view the making of judgments as an activity of human beings--whole human beings. This need rests with the fact that it is as whole human beings that

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(1) This in itself is an important generalization we <u>can</u> make about judgment.

people can and ought to make judgments, and it is as whole human beings that people can be affected by the judgments of others.

* When we judge something, we judge the thing itself. We do not judge by making deductions from general categories or by following rules.

* Judgment entails the activity of fitting to an image. An image is not a fixed template or schematic; it is something called to mind which evokes the "family resemblance" of the thing being judged. It can be expressed as something very specific, such as the flute-maker's "gem", or as something quite general, like the woodworker's "style".

* Making a judgment can modify an image. In this sense, every judgment has a creative potential. Judging a patient with unusual symptoms to have the flu can change a physician's image of what the flu can be. In this sense, images and their related judgments can "evolve". Likewise, the images held by flute-makers have evolved over the history of the craft in an intimate relationship with the changes in flute design.

* Making judgments is inherently non-reductionistic. We can judge wholes without reducing them to parts which may make them up.

* Making judgments always entails at least some knowledge which is tacit. We can make judgments about things which are explicit, even wholly explicit, but the activity of making judgments always entails tacit knowledge.

* Making judgments entails both "knowing-how" and "knowing-that", each of which can have both explicit and tacit elements.

* The use of explicit techniques, such as decision analysis, does not necessarily obviate the need to make judgments. Such techniques deal with "objective measures" which are important only if we judge them to be so, and they produce "outcomes" the value of which can only be set by judgment. They enable us to manipulate probabilities and utilities, but the distinction between a cost and a benefit can only be made by human judgment.

* "Facts", whose truth or falsity is not in question, often need to be judged. Given facts, we often need to make ethical, aesthetic, instrumental, and even factual judgments about them.

* There are judgments which people make in their work which can be taught and learned.

* Professions, crafts, and organizations, as institutions of work, can be analyzed as "cultural contexts".

* A cultural context contains (at least) four "conceptual perspectives": an epistemology, a mythology, an ethical system, and a system of aesthetics.

* The elements of each conceptual perspective are organized into an "architecture". Within an architecture the elements of a conceptual perspective stand in relationship to one another in terms of "preference", "applicability", and "legitimacy". Individual elements can be "consistent" or "inconsistent" with other elements. Inconsistency is a potential source of institutional problems.

* Within the cultural context, elements are organized across cultural perspectives in a "meta-architecture,". Within a meta-architecture, elements stand in relationship among one another in terms of "displacing", "combining", and "actualizing". Elements within a meta-architecture can be "compatible" or "incompatible". Incompatibility is a potential source of institutional problems.

* The relationships among elements within a cultural context reflect the patterns and regularities of the judgments made within that cultural context. Judgments are made with respect to those patterns. The patterns do not, however, dictate judgments, since judgments are not "rule driven".

* In order to judge something within a cultural context, the thing judged has to be connected to the cultural context.

This is done through an "orienting link". Images function as orienting links when they enable someone to judge a specific thing in terms of the cultural context; they allow him to bring the elements of the cultural context to bear on the specific details of the thing he is judging.

* A profession, craft or organization, as an institution of work, can be viewed as a cultural context made up of "webs of significance"--constituted in an epistemology, an ethical system, a mythology, and a system of aesthetics--which are held internally in the minds of its practitioners but are "spun" externally through their interdependent verbal vocabulary of images and their "hand-to-hand" judgments.

IMPLICATIONS FOR PRACTITIONERS

Drawing on the summary above, the following are implications of the conceptual framework of importance to practitioners such as managers, consultants, and teachers who must "think on their feet" in dealing with judgments made by themselves and others. These examples are intended as guidelines, not as absolute rules, since the particulars of making judgments can vary over different contexts.

* Since the making of judgments entails knowledge which is in some part tacit, a manager or consultant should not expect workers or clients to be able to put into words

everything that goes into the judgments they make in their work. A manager who might be excellent at judging the value of a new technology to worker and manufacturing needs might not be able to make explicit much of what is entailed in his judgments. Conversely, a consultant providing such a manager with an information management system, for example, should not assume that his system will provide information which the manager will automatically find meaningful or useful in making judgments in his work. The usefulness of such a system could depend upon its adaptability to the manager's epistemology and its ability to present configurations of information about particular cases which the manager could see in terms of his orienting links. Thus, an understanding of the manager's (or his company's) epistemology and orienting links would be valuable to the consultant. (These points, of course, would not apply equally to all work settings. For example, the greater a company's dependence on explicit techniques and quality control standards, the less likely it is that such judgments would prove a crucial factor.)

* Since making judgments can be based on such things as feel or appearance or having a sense of a situation, in implementing new procedures or technologies one should not automatically expect success based solely on explicit instructions or standards. A "vocabulary" of images and orienting links may need to develop for the procedure or

technology to be utilized effectively. An implementation process (and particularly an evaluation component) should make accommodations for this. Indeed, when possible, the implementation should facilitate the development of such a vocabulary. In cases where the procedure or technology has been implemented elsewhere, images, orienting links, and even stories drawn from those previous cases could help new users "get a feel" for the innovation.

* Similarly, in situations where production procedures or quality control measures are not or can not be made fully explicit, a manager might find it valuable to develop a vocabulary of images for doing the work "right" common to those responsible for maintaining standards.

* Since judgment can be learnable and teachable, in training programs for professions or crafts where making judgments is a criterion for success, instructors should not assume that the ability to make those judgments is simply "a talent" which one either has or doesn't, nor should the instructor assume that he has no responsibility to teach that ability. In such situations, repeated exposure to examples and having a trainee's judgments "re-judged" by an instructor can be valuable methods.

* The notion that organizations and professions have epistemologies, ethical systems, aesthetic systems, and mythologies within which judgments are made is useful both as

a method of analysis (to organizational analysts and planners) and as a method of trouble-shooting (to consultants and managers). This is particularly well seen in the ideas of inconsistency within an architecture and incompatibility among architectures. For example, the dilemmas of counterposing ethical imperatives and of an ethical imperative without accompanying epistemological know-how could easily go unrecognized as such in normal organizational practice. If recognized by a manager or consultant, productive steps could be taken to break the dilemmas.

* Though seemingly a simple point, there is nothing of greater significance that I can say than that the making of judgments deserves to be considered and treated in its own right. There is a tendency in many fields (from medicine to social services to executive management) to assume that the making of judgments is a sort of "unconscious decision calculus". From this it is often assumed that there is an equivalence between judgments and explicit analytic techniques such as decision analysis and cost-benefit analysis. This assumption of equivalence can become the basis for proposals that the making of judgments can be fully modeled through these techniques or even supplanted by them. These techniques are important tools and can be used as valuable aids to judgment; but if they are not equatable with the making of judgments (as I have argued), then substituting them for judgment or designing decision strategies or

organizational decision policies based on the assumption of their equivalence is erroneous and can be misleading.

There is a growing interest, for example, in the application of such analytic techniques to medical diagnosis. The interest ranges from week-end courses to teach physicians how to construct simple decision trees to the design of sophisticated diagnostic computer programs. The design and use of such things can be deeply affected by the assumption that they are equivalent to medical judgment. However, it is not clear that they are best used as aids to medical judgment by attempting to mimic it. Such "simulation" of medical diagnosis may prove to be a perversion both of medical judgment and of the potential value of the techniques. (1) It does not follow that any potential value they may have as aids to diagnosis requires the assumption of their equivalence to it. Further, there are serious questions to be raised (both practical and ethical) as to how the introduction of these techniques (even the use of simple decision trees) might affect the diagnostic process. It is possible, for example, that a physician using decision trees could produce "better" decisions but poorer diagnoses. Since diagnostic judgment is not decision-making, it does not follow that a technique for making decisions would automatically be useful in making such judgments.

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(1) For discussions of modeling and simulation of human processes, see Fodor (1968) and Searle (1980).

DIAGNOSIS: AN EXAMPLE FROM PRACTICE

The ideas of cultural context and orienting link can be useful to consultants and managers in such areas as understanding and evaluating the judgments or judgmental style of individual practitioners.

Following this idea, I conducted a set of interviews of physicians concerning the interpretation of laboratory tests. In all, there were fifteen interviews. Most were with physicians working in a medical clinic serving the students, faculty and staff of a major university. The others were physicians in private practice. Most of the interviews in the medical clinic focused on the interpretation of the results of two specific blood chemistry tests used in treating or diagnosing individual patients.

The example of the physician which appeared at the beginning of Chapter I was drawn from these interviews. The physician received the results of some laboratory tests for a particular patient, including the two blood chemistry tests mentioned above. The results of one test, which measures the level of the enzyme SGOT, was "abnormally high", all else was normal. The physician decided to do nothing about the abnormal result because his "clinical impression" was that "the patient is healthy and that the high level can be safely ignored."

In the interview, the physician reported this to be his "best judgment". He could not give a full "logical

explanation" for it. He could only say that he based his impression in part on the fact that this test often comes out abnormally high, since the level of SGOT in the blood can be influenced by a number of minor things (such as bruises to muscle tissue or the patient having had a few drinks the night before the blood test--not uncommon occurrences among college students).

In fact, among the interviews there were four other instances where physicians similarly ignored elevated SGOT levels following their clinical impressions. The physicians reported that a clinical impression overriding immediate evidence is common in medical practice.

A clinical impression (a common term in medicine) can reflect a number of things. In discussing specific impressions in specific cases, the physicians made reference to several different sorts of factors. Often, they referred to experience which they had had with that patient or that test or the disease in question. A couple of physicians made reference to their own medical specializations. One said, "I'm a hematologist, so I would be more likely to spot this sort of thing, even to see it as a small possibility which needs to be disconfirmed." Several referred to their age and training, as well as that of others. For example, younger physicians tend to make much greater use of laboratory tests; they tend to order more tests than older physicians and are less likely to "ignore" abnormal results. One older physician said he felt his relatively low reliance on

laboratory tests stemmed from the fact that many of them were not available at the time he went to medical school, so he had learned a different style of diagnosis.

I take these things to be elements of the physicians' cultural contexts. Knowledge of patients, tests, diseases, and specializations make up epistemologies. The notion of style in diagnosis hints, I think, at an aesthetic. (Could a diagnosis using fewer laboratory tests, for example, be preferred by some for its aesthetic "elegance"?) I would expect to find an ethical system around such things as when an abnormal level could be "safely" ignored and when it ought to be followed up. Though I did not get much evidence indicating mythologies, I suspect they are there. (I did hear one story about the legendary talents of an elderly diagnostician who could walk into a clinic and make reasonably good guesses as to the illnesses of patients simply by the smell in the room.)

These cultural contexts are the contexts within which the physicians made their interpretations and diagnoses--that is, their medical judgments. Further, I saw the specific cases as linked to the cultural contexts through the physicians' clinical impressions. That is, the clinical impressions functioned as orienting links.

For example, one physician, on first seeing a patient, formed a clinical impression that she had mononucleosis. He ordered a first series of tests including a "mono spot", which is a specific test for mononucleosis. The tests came

back ambiguous. The blood chemistry tests were "consistent" with mononucleosis but did not suggest it by themselves. The mono spot was negative, but the test is known often to indicate negative when the patient in fact has mono. The physician maintained his clinical impression of mono and actually felt a bit "confirmed" by the "consistent" results of the blood tests. Following his impression that the patient had mononucleosis, he suggested things the patient should do to take care of herself and ordered another complete series of tests. The second series, which came back a couple of days later, was much like the first. The physician still held on to his clinical impression of mono and ordered a third series of tests. The results of the blood tests this time (along with the patient's physical signs) indicated improvement in her condition, while the mono spot was still negative. The physician continued to follow his impression of mono and ordered a fourth series of tests. The blood tests in the fourth series (taken about three weeks after the first series) indicated substantial improvement in the patient's condition. The mono spot was negative. At this point the physician felt that one couldn't have "four negative mono spots and say mono", so he concluded that the patient was recovering from a "mono-like illness".

This story demonstrates the strength which a clinical impression can have. The physician, in following sound medical practice, made decisions and interpretations and gave treatment following a clinical impression which was not

immediately suggested by the physical signs and test results alone.

The information on a specific case can be interpreted differently by different physicians. Given a set of physical signs and laboratory test results from a case, different physicians can form different clinical impressions and, thus, make different judgments about what the patient's condition is and how it should be treated. This point was confirmed in the interviews.

A physician's clinical impression, acting as an orienting link, enables the physician to judge details of a specific case in terms of his cultural context. The actual logical decision steps which a physician takes in diagnosing and treating patients can be significantly guided by his clinical impression, and thus those decisions can vary significantly among physicians given their different cultural contexts.

One possible organizational application of these observations is in designing policies for or evaluations of patterns of laboratory usage (a major issue in medical care management due to the rising costs of such services). If a physician has a pattern of high usage of laboratory facilities, this should not be taken as an automatic indication of "over-use". Elements of medical judgment which can affect these patterns, such as a physician's age, specialization, interests, and diagnostic style should be taken into consideration.

IMPLICATIONS FOR RESEARCH

The conceptual framework presented here is intended to have implications for further research and study. It is open to modification and development. Further research could both benefit from its use and contribute to its develoment. The following are examples of ways the framework can be applied and developed.

* The broadest use which could be made of the conceptual framework would be to apply it as a whole to other cases. As a general method of institutional analysis, this would be the most realistic assessment of its strengths and weaknesses. It is my sense that the ideas associated with the notion of cultural context would be quite flexible in application to various contexts--indeed, they were designed to be so. The actual structure or pattern of interrelationships that the elements would take on in the analysis of different cases would vary considerably since they are designed to tap into and reflect the "webs of significance" of specific cases. For example, I would imagine (by way of thought experiment) that there would be an interesting set of such structures revealed in an analysis of the different flute factories mentioned in the chapter on flute craftsmanship. The meta-architectures of Powell, Haynes, and Brannen Brothers, for example, should prove to be remarkably similar, though the specific elements of epistemology, ethics, mythology, and aesthetics would, of course, differ a good deal. For

example, Haynes' myth reflected in "tradition of excellence" differs from Powell's "the best there is", but they would occupy parallel positions within their respective meta-architectures. The Japanese companies, meanwhile, have attempted to produce flutes of the finest quality through very different organizational means. (Though they have not succeeded, they have come very close.) They have broken the manufacture of flutes down into many more "steps" and have used machines to a far greater extent than the three American companies. (1) Consequently, their standards and quality control measures are much more systematized and explicit than those of the American companies. They rely much more on meeting explicit standards than on "hand-to-hand" judgments. This would be reflected quite clearly in an analysis of their cultural contexts. I would expect, for example, that the epistemologies of the Japanese companies would show many more instances of "preference", given explicit knowledge over knowledge of tacit factors such as looks and feel. Similarly, the meta-architectures of the Japanese companies would reflect more instances of "displacement" of aesthetic elements by elements of epistemology (and even ethics and myth) than would be expected in the American companies. Likewise, if a Japanese flute-maker referred to his flute as a "fine machine" or a "gem", I would expect that that image

(1) As a generalization, in comparison to their American counterparts, the Japanese craftsmen need to know less about making flutes and more about operating the machines that make flutes.

would, as an orienting link, tap into a set of elements vastly different from those of the American flute-makers. (1)

* The notion of "fitting to an image" could be tested in various settings where production procedures or standards of product or performance vary in the degree to which they can be or are expressed explicitly. I would expect that images which bear directly on details of work (that is, those functioning as orienting links) would be of lesser influence the greater the orientation toward explicit standards. (There is a rough approximation of this to be found in the comparison of the team production organization of Scandinavian automobile plants as compared with the assembly lines of Detroit.) However, influences on images of worker or company identity would not necessarily follow the same pattern in matters such as company decisions or union actions (and I have no guess as to what the patterns would be).

* A central argument of the conceptual framework is that images and sets of images can change and evolve. They can do so in adapting to new technologies and organizational procedures and in responding to such things as ideological, aesthetic, and market factors. In the latter case, a change in images can bring about technological and organizational changes itself. (Examples of these types of changes are

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(1) An interesting question (which a cultural context analysis could help illuminate) would be: Why have the Japanese failed in several cases to do with flutes what they have succeeded so well in doing with optics and electronics?

reflected in the history of flute craftsmanship.) Two significant research questions are suggested by this. First, can changes in images as a means of adapting to technological and organizational changes be systematically observed across various settings? Second, from an interventionist perspective, can technological and organizational changes be brought about by the introduction of new images? Since the latter happens naturally when, for example, an extrinsic change in aesthetics or ethics finds its way into a profession or organization and precipitates changes, it is plausible that such changes can be brought about deliberately. (1) Naturally, the greater the use of images in a setting, the more likely such changes could be brought about. (2) However, a high use of images would not guarantee such changes. Other aspects of a cultural context would have to be taken into consideration. At Powell, for example, the ethics of constancy which have maintained its standards of style and quality are very strong and would not be easily displaced by the introduction of new images. Indeed, there have been many images of aesthetics in design introduced at Powell which have got nowhere. The elaborate processes of accommodation reflected in the Cooper innovation demonstrate

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(1) I would argue, for example, that extrinsic images which suggest being "scientific" or "exact" are currently finding their way into American medicine and contributing to changes which are not clearly understood nor necessarily desirable.

(2) I do not consider this use of images to be ethically neutral. They could be used to bring about creative improvement or oppressive entrenchment.

much more Powell's adherence to standards than a susceptibility to change.

* The concepts of consistency within an architecture and compatibility across architectures also have implications for research. I have suggested that the existence of inconsistency and incompatibility would be potential sources of institutional problems. A fruitful piece of research would be to test these notions in different contexts. From an interventionist perspective, research could be pursued to develop methods of dealing with such problems.

CONCLUSION

In outline, this study has fulfilled the three objectives set out in the introduction. 1) I have given an interpretation of the Powell workshop focusing on the role of judgments in the maintenance of its standards of style and quality. 2) I have presented a set of characteristics of judgment which can be generalized to cover a range of different cases. 3) I have given a method of institutional analysis suitable for the study of professions, crafts, and organizations as institutions of work, particularly with concern for the role of judgment in those institutions.

I consider the most significant contributions of this study to be the following:

* Providing at least an initial contribution to a conceptual framework which makes it possible to discuss, analyse, and understand the making of judgments as an activity of whole human beings. This includes treating judgments as judgments.

* Presenting an approach to dealing with judgments as judgments. This is based on the conviction that we experience judgments as judgments when we make them, and that the reality of this experience deserves to be considered in its own right.

* Developing a method of institutional analysis which treats professions, crafts, and organizations as cultural contexts and enables practitioners and researchers to tap into the

"webs of significance" of those institutions by interpreting comments and actions in terms of epistemologies, mythologies, ethical systems, and systems of aesthetics.

In the following chapter I will explore speculatively what I see to be some broader implications of this perspective. I will focus on judgment as a way of controlling human technologies and institutions, with particular concern for the ethical issues inherent in the use, abdication, and denial of judgment.

Chapter V

MAKING AND CONTROLLING ARTIFACTS: SOME BROADER SPECULATIONS

In the later poems of W. B. Yeats, the image of artifacts reflects a conditon inherent in the relationship between human beings and their creations. We are capable of producing things which are more consistent, more enduring, and more powerful than ourselves. Our artifacts can out-perform and out-live us.

In "Sailing to Byzantium", Yeats, confronted by human mortality, seeks the "monuments of unaging intellect" symbolized by artifacts.

> ...gather me
> Into the artifice of eternity.
>
> Once out of nature I shall never take
> My bodily form from any natural thing,
> But such a form as Grecian goldsmiths make
> Of hammered gold and gold enameling...

Here, Yeats longs to escape the changing, dying world of nature and man and ascend to the immortal world of eternal forms. And in the poem "Byzantium", man's artifacts seem to assert a superiority over him.

> ...Miracle, bird or golden handiwork,
> More miracle than bird or handiwork,
> Planted on the star-lit golden bough,
> Can like the cocks of Hades crow,
> Or, by the moon embittered, scorn aloud
> In glory of changeless metal

Common bird or petal
And all complexities of mire or blood...

The golden bird is a product of human "handiwork". But in being given "such a form as Grecian goldsmiths make", the artifact becomes more than "bird or handiwork", it becomes a "miracle". As a supernatural thing, and in contrast to the moon which is ever changing, it "in glory of changeless metal" scorns the "common bird" and the "complexities of mire or blood" which symbolize the passions and mortality of human life.

But in the last stanza of "Byzantium", Yeats' ascent into the "artifice of eternity" turns back on itself.

...Astraddle on the dolphin's mire and blood,
Spirit after spirit! The smithies break the flood,
The golden smithies of the Emperor!
Marbles of the dancing floor
Break bitter furies of complexity,
Those images that yet
Fresh images beget,
That dolphin-torn, that gong-tormented sea.

The dolphin is a symbol of man's soul; but it, like man, is also a creature of "mire and blood". The smithies create enduring artifacts, but those artifacts also embody the "complexity" of human passion and mortality. The artifice of eternity which seemed at first not to be a "form from any natural thing", now reflects back forms which, like the changing character of the moon or of man, are "images that

yet fresh images beget". This completes the journey for Yeats. The human yearning for the eternal must always be cast in human terms. Our artifacts should always reflect both the longings of our spirit and the complexity of our "mire and blood".

From this perspective, the golden bird of Byzantium has its modern equivalent in our technologies. Both reflect a dichotomy inherent in the relationship between human beings and their creations: we have the ability to create artifacts which can either celebrate or scorn the realities of our humanness.

In this section, I will explore some implications of the relationship between people and artifacts. The artifacts I have in mind are, in the broadest sense of the word, our technologies. That is, both the "gadgets", large and small, simple and complex, that increasingly fill up our world, and the "institutions" (or as they are sometimes called, the "soft technologies") that increasingly fill up our lives and upon which the operation of our "gadgets" depends. My concern here is with the role which judgment can and ought to play in this relationship.

IN GLORY OF CHANGELESS METAL: FLUTES AS ARTIFACTS

I have told the story of Powell to many people. Most find it fascinating. There seems to be something appealing in the idea of flutes of the finest quality being handcrafted

in precious metals to exacting standards that are expressed only as judgments of appearance and feel but which have kept the style and quality of the flute unchanged for half a century. That making a flute worthy of being a legend requires more than good equipment and precise measurement gives the story of Powell a special quality, a sense that, more than "flute or handiwork", it is "a little magic" that makes Powell flutes possible.

In discussing the Powell case with people (particularly around MIT), there often comes a point in the conversation where my long-suffering interlocutor says: "Hey, wait a minute. Couldn't you make one of these flutes totally by machine?" At face value, this seems to be a reasonable question. But, in fact, it entails some troubling assumptions about the relationship between people and their artifacts. I want to examine these assumptions, but first I must answer the question itself.

The first issue in building a machine that would make Powell flutes is whether or not that is even theoretically possible. Which is to say, and as people have asked, is there anything about the Powell flute which makes it theoretically impossible to build one by machine? The answer, as far as I can see, is "no". The Powell flute is a physical object that has physical dimensions and tolerances which, given enough time and effort, one ought to be able to discover and specify in exact and explicit terms. The issue then would be simply to build a machine which, once set up

with those explicit dimensions and tolerances, could melt down sterling silver spoons and turn out completely acceptable Powell flutes. There is nothing that makes this theoretically impossible.

Further, as long as we are within the realm of thought experiment and don't have to ask NSF for support, the problem of discovering a Powell's dimensions and tolerances could also be aided by machine. What we would need would be a general flute-making machine with lots of dials and levers that would allow us to vary every possible aspect of a flute's design. Then we could just dump a bunch of spoons into the machine and keep moving the dials and levers until the flutes popping out meet our expectations of what a Powell should be. (1) Theoretically, there is nothing that prevents this.

Even with such a machine, there would still be one difference between the flutes coming out of the machine and those coming out of the Powell workshop. Every flute produced by the workshop is in some ways unique; there is variation from flute to flute. The flutes coming out of the machine, however, would all be the same; they would all be "clones" of one single Powell. But the variation among Powells could also be duplicated by machine. All we would need to do is discover how to turn the dials and levers just

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(1) This machine would have the further "advantage" that just as we could discover a setting for making Powells, we could also set it up to make Haynes flutes, the Brannen-Cooper flute or any flute we like.

enough to make some variation among the flutes but not so much that they would stop being Powells. Once we had a scheme for doing this, we could set up a computer to turn the dials for us. At this point the "output" of our machine would be indistinguishable from the "output" of the Powell workshop.

So, the answer to the question is: "Yes, you could make Powells totally by machine." But what does this tell us?

I'm not sure it tells us anything. It seems to me that the question raised by the Powell story is: How can we understand Powell craftsmanship? Knowing how we could make Powells totally by machine does not tell us how the Powell craftsmen make them. The question about the machine in effect ignores the question about the workshop.

Not only does the machine question miss the reality of what the craftsmen do, it inverts the whole Powell question in a rather perverse way. The Powell workshop is not a black box with an input of raw materials and an output of Powell flutes; it is not a contrivance or single purpose machine designed to produce flutes to Powell specifications. Rather, the specifications themselves are a product of the workshop. The Powell question is: "How can the design of the flute be understood in terms of what the craftsmen have put into it?" The question is not: "How can it be understood in terms of its physical dimensions and tolerances?"

When Bohm redesigned the flute so it would play more easily in equal temperament and with a more even tone through

its range, he was in large part responding to the aesthetics of his time. Likewise, when Powell made the Cooper innovation, it was responding to the aesthetics of our time. The machine question misses this point entirely. We could find out how to reset the machine's dials in order to make Powells come out with the Cooper scale, but this would not help us understand how that change was an aspect of the aesthetics of our day. Without that understanding, we can not understand the Cooper innovation.

The machine question entails another, even more troubling issue, which is raised by asking the question itself: Why ask it in the first place? Given the story of Powell, why ask if a Powell flute could be made totally by machine? Why do so many people consider this a reasonable question?

My speculation as to why this question is asked is an unsettling one, but I believe it is true. People look for an explanation of the Powell story in terms of explicit specifications and machine operations because they do not consider an explanation entailing tacit standards and judgments of feel to be an acceptable explanation. Quite simply, the question implies that if we want an acceptable understanding Powell, we need to ask the machine question.

The implications of the question go even further. The reason why judgments and tacit standards are not considered an appropriate basis for understanding Powell is reflected in an assumption upon which the machine question appears to

rest. The assumption is that judgments and tacit standards are not what is really going on at Powell; that they are, at best, a provocative but sloppy and mystical way of looking at the case; that the reality to be explained and understood, particularly by social science, must be an explicit and mechanical one.

My argument has, of course, been quite the opposite. What is unsettling to me about the perspective of the machine question is that it implies that the reality of Powell worth explaining is one without a human dimension. Indeed, as a way of understanding Powell, the machine question definitionally removes any human element.

What is of interest in the Powell story as I see it, and what I have argued deserves analysis and understanding in its own right, is the element of human judgment in the relationship between the craftsmen and the flutes they make. Given this, the Powell flute needs to be understood as a human product, as an artifact which reflects the human realities which have gone into its design and manufacture. One must be able to see in the flute the image of its maker. The machine question denies this reality; it scorns the humanness of a human artifact.

The implications of the machine question and its denial of humanness go far beyond the subject of flutes.

NEW OCCASIONS TEACH NEW DUTIES

We live in a world increasingly of our own making. The physical things around us are more and more the products of human design. And the invisible but very real institutional structures of our world grow constantly more powerful, more pervasive, and more interdependent.

We go through the events of our daily lives in an almost unbroken chain of expectations which are met not by nature but by human artifacts. Many of these expectations have become so much a part of our lives that we are seldom consciously aware of them. Every time we turn a light switch, we are acting on an implicit expectation that the elaborate technological and institutional structure of the electrical system is still functioning. We expect newspapers to be printed and delivered to our door. We expect all sorts of goods and services to be available and regulatory agencies to guarantee their quality and fairness. And so on.

This man-made world differs from the world of nature in many ways, but none more important than the way its events are governed. All events of the natural world are dependent upon the laws of nature. (1) These events are, in this sense, inevitable. We cannot, for example, defy the law of gravitation. We can exert no control over the laws of

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(1) By "laws of nature" I do not mean the laws of natural science. The latter are human conventions which aim to reflect the behavior of nature. The former are embodied in that behavior.

nature.

Within the man-made world there is no corresponding set of laws. All events of the human world are ultimately dependent upon human behavior: they are a consequence of human action and failure to act. There is nothing in the human world which is inherently inevitable nor inherently beyond our control.

By this I do not mean that there are not regularities or trends or even "inertial" forces in human events. There are. The point I want to make clear is that these events are not inherently the inevitable consequences of inexorable laws over which we have no control. In fact, in this sense, what distinguishes the man-made world from the natural world is that it is subject to our control. And since we can control it, we are ethically obligated to do so.

When we create technologies and institutions, we also create a practical and ethical need to control them. The need is practical because, unlike things of the natural world, such artifacts are not governed by inherent laws: if their behavior is to be governed at all, it must be done by people. The need is ethical because, by definition, technologies and institutions affect human lives: they provide goods and services, and they extend or deny rights and protections.

We commonly give our technological and institutional artifacts a degree of autonomy. In effect, we relinquish immediate control over a range of their behavior. This is

part of what makes them powerful and useful. But in doing so, we should not attempt to abdicate ethical responsibility for the consequences of what an artifact might do "autonomously". In relinquishing immediate control of an artifact, it becomes "dehumanized"; the human element is temporarily withdrawn. But in abdicating ethical responsibility for it, the human element is denied, and the artifact becomes inhumane.

A clock, for example, is commonly thought of as a highly autonomous device because once you wind it up or plug it in, it goes on by itself without our exerting control over its every bit of behavior. However, if I connected a clock to a bomb, it would be myself and not the clock who would be held responsible for any explosion, and rightly so. If we can be held ethically responsible for the "autonomous" behavior of our artifacts, we need to maintain the ability to re-assert control over their behavior. This entails maintaining mechanisms which guarantee our ability to do so.

To relinquish immediate control over an artifact without also establishing mechanisms for re-asserting human control is unethical for two reasons. First, it alienates people from control over events for which they can and ought to be held ethically responsible. Second, creating in the man-made world an inhumane artifact can prompt people to deal with that artifact in ways which are themselves inhumane.

Since human artifacts are man-made, since they affect human lives, and since they are ostensibly designed and

created to serve human ends, it is my argument that the elements of their design and the mechanisms by which they are controlled should be fashioned and understood in human terms and evaluated by human criteria. This is not always the case. Examples to the contrary are found in many areas.

Judgment as a way of making evaluations and choices is often called into question because of the possibility of biases or prejudices. A common suggestion in such cases is that a lottery or coin toss be substituted for judgment. There is a common assumption that, since judgment is inherently open to prejudice because it is essentially human, a lottery or coin toss would be inherently fair because it eliminates the human element. This is not true. The fairness of a method depends upon the circumstances of the case. In fact, a lottery or coin toss can be unfair and unethical precisely because it eliminates the human element.

There are common examples of how a judgment or a coin toss can be considered either fair or unfair. Judgment can be considered an unfair way to decide who goes first in a game or contest or who is listed first on a ballot, while a coin toss can be seen as fair. Judgment, on the other hand, is seen as a fair way to determine guilt or innocence, but a coin toss is not. (1)

Lotteries do not automatically assure fairness. But

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(1) There is a case of a judge who determined the length of a jail sentence by tossing a coin. Formal charges were filed against him--quite appropriately, I believe. (New York Times, 11 March 1982)

beyond that, they can remove the human element from a situation in a way that can be unethical. For example, imagine the case of a citizens' committee appointed by the mayor in a city with a population that is half white and half black. Year after year the committee is appointed with 90% whites. A complaint is lodged stating that the committee should reflect the racial make-up of the city. To assure fairness in dealing with the racial issue, the suggestion is made that the committee should be selected from the general population by lottery. On the surface this sounds fine. But there are two problems in it. First, it is statistically possible that the lottery could produce a committee that is 100% white. (1)

Second, the lottery, unlike the judgment of the mayor, is not open to the possibility of appeal. There is nothing inherent in judgment which makes it systematically impossible to appeal particular judgments. But appealing a lottery is nonsense. In this respect, methods like lotteries, by removing the human element, can be unethical in that they can make it difficult or impossible for ethical wrongs to be addressed. Further, the use of a lottery in such a situation can serve to deny or hide the problem. (The lottery does not do away with the mayor's prejudices.) Relying on the making of judgments can carry with it the problem of dealing with

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(1) My conclusion from this is that the use of such methods should be considered unfair in all situations where any statistically possible outcome of their use would, itself, be considered unfair.

our prejudices and biases. But if there is a principle to be followed, it is that it is better to confront our prejudices than to deny them systematically, particularly at the cost of also denying our humanness. In such cases we can be humanly and ethically obligated to judge.

Many authors have treated judgment, in itself, in non-human terms and have evaluated its use and its inherent nature by non-human criteria. Hammond et al. (1975) comment that "Human judgment is a cognitive activity of last resort." They suggest that people need to use judgment only at the default of an explicit and experimental activity or technique. However, such techniques, as I have argued, do not do away with the need to make judgments. In fact, employing such techniques can increase the need to make judgments since we must judge the appropriateness of their application and the value of their results. Further, to consider human judgment to be a "last resort" is, in effect, to consider humanness a last resort, which is unethical since it diminishes the role judgment can and ought to play in understanding and controlling the man-made world.

Lord (1964) argues that the "trouble with human judgment is that it is sometimes wrong." He goes on to consider how analytic techniques can deal with and compensate for the fallability of judgment. The view of the world I must imagine in order to make sense of this statement terrifies me. Human judgment is not a technique which aims at analytic infallibility. It is a way of asserting our human values

over our human creations. To speak of human judgment as "sometimes wrong" is nonsense, not because judgment is perfect, but because it is a human attribute which cannot be evaluated in terms of right and wrong. Clearly, particular human judgments can be wrong. But it does not follow from this that there is something inadequate about human judgment itself. Human judgment is part of who we are as human beings. To evaluate that part of ourselves by the criteria of analytic infallibility is intellectually perverse, and to the extent that it diminishes the use and understanding of the humanness of judgment, it is inhumane.

Hogarth (1980) argues "that intuitive judgmental processes are no longer adequate to deal with the modern world and that it is incumbent upon decision makers to examine their judgmental processes." He then offers several techniques, based on information processing and statistics, which are intended to help meet the demands of the modern world. Hogarth's argument implies that man has created a world which is beyond his inherent abilities to control. I would agree. We have fashioned many artifacts which appear to scorn our efforts to control them. But Hogarth's prescription for dealing with this situation is unacceptable to me for two reasons. First, he suggests that, in lieu of judgment, the human world should be controlled by methods which by definition exclude the human element. I consider this to be inhumane. Why should we fashion or sustain a man-made world by any measures other than those which are

inherently human? Human characteristics such as our "intuitive judgmental processes" should be the criteria by which the "modern world" is designed, evaluated, and controlled. Second, Hogarth uses those same dehumanized criteria to evaluate an aspect of our humanness--namely, judgment. In a practical sense, to suggest that judgment be modified by the use of analytic methods presents a problem: since judgment and analytic methods cannot be evaluated by the same criteria, there is no way to establish whether or not modified judgment is superior to non-modified judgment. It may be better at controlling Hogarth's "modern world", but I have argued that such a world is itself unacceptable. Ultimately, my objection to Hogarth's prescription is an ethical one: to view an inherent aspect of human beings as "not adequate" by dehumanized criteria is immoral.

DIAGNOSIS: AN EXAMPLE AND SOME GUIDELINES

Many questions raised by the issue of the ethical dimension of the relationship between people and artifacts, particularly in the context of judgment, are reflected in the case of computer-aided diagnosis. For example: Should a physician ever defer to the diagnosis of a computer? Are there cases when a physician should not use a computer as a diagnostic aid? When should a physician follow his "better judgment" if it is contrary to a computer diagnosis?

The questions also touch on the issue of malpractice.

For example: If a physician gives treatment based on a computer diagnosis, can he be held responsible if the diagnosis is wrong? If a physician follows his own diagnosis when it is counter to a computer diagnosis which later proves to have been right, can the physician be sued for malpractice? And if he can, can he claim his practice was sound because he was following his "better judgment", even if it lead to a false diagnosis?

As I have argued, I consider medical diagnosis to be an example of human judgment, and as such, it should not be displaced by something that is not human. Thus, I would argue that diagnostic aids should be used only as aids to human judgment and not substitutes for it. (1) If we view diagnostic judgment as a human activity, then the idea of deferring to a computer diagnosis becomes unthinkable. A diagnosis should always be viewed as the responsibility of the physician. Thus, a physician following his better diagnostic judgment can never be faulted for nor protected from fault solely by results of a computer diagnosis.

If such things as computer diagnostic procedures are to be used, and if physicians are to be held ethically responsible for medical practice based on their use, I would argue that at minimum the following three points must be guaranteed.

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(1) As I mentioned earlier, even as aids there is reason to be very cautious about their use, since they could adversely alter the character of diagnosis itself.

First, a diagnostic aid should never be a "logical black box". This means that if a physician is going to use a diagnostic program, the medical logic and reasoning designed into that program must be known and understood by the physician. The logic of such artifacts must be "public".

Second, the physician must be able to intervene in the operation of the diagnostic program when it is applied to specific cases. He must, for example, be able to ask the diagnostic program to explain its "reasoning" on specific points. (And the program must be able to do this.)

Third, the physician must have a known, systematic, and ready set of criteria for recognizing when he should intervene in the program, depart from its recommendations or consider its use inappropriate to a particular case.

If any part of these three points cannot be met (and, again, I consider them a minimum), the diagnostic aid should not be used. To do so would be unethical. These guidelines reflect the basic elements of what I have argued are ethically required in the relationship between people and artifacts. Specifically, they provide mechanisms which allow people to assert control over the behavior of artifacts, they define the use of artifacts in human terms, and they judge that use by human criteria.

ARTIFACTS RECAPTURED

We live in a world increasingly of our own making. As this world of technological and institutional artifacts grows, so does our need to control it. This need carries with it a deep and inescapable ethical dimension.

I have argued that the man-made world should be designed, controlled and evaluated by human criteria, that it should reflect the image of its maker. To create artifacts by any other criteria is to build a world which is, to that extent, inhumane. And to understand or evaluate human behavior and characteristics by such criteria is immoral. The world of human artifacts should celebrate and not scorn our humanness.

I have taken the perspective that judgment, as an inherent part of who we are as whole human beings, is one way by which we can maintain the human dimension in the design and control of our man-made world. It is a way of guarding our need to act as human beings and to be held accountable for our actions in ethical terms.

This view of the ethical aspects of judgment follows from the approach to the making of judgments developed in the earlier sections of this study. It is, in effect, an ethical component of the conceptual framework presented earlier. It offers a coherent approach to ethical issues entailed in judgment, while treating the making of judgments as an activity of human beings acting as whole human beings. As an

approach to the ethics of judgment, it is consistent with the arguments entailed in the conceptual framework and is contributory to current questions of concern in professional ethics. I do not believe that such an ethical perspective could be built on the basis of any of the other approaches to judgment surveyed in this study.

Judgment is part of who we are. It remains in part mysterious because we are ourselves in part mysterious. Yet, judgment is real in our experience of it. We must fashion our artifacts and our expectations of each other to reflect this reality. To do otherwise is to deny our humanness.

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