

special uses of language as in its constant ways of arranging data and its most ordinary everyday analysis of phenomena that we need to recognize the influence it has on other activities, cultural and personal.

THE NAME OF THE SITUATION AS AFFECTING BEHAVIOR

I came in touch with an aspect of this problem before I had studied under Dr. Sapir, and in a field usually considered remote from linguistics. It was in the course of my professional work for a fire insurance company, in which I undertook the task of analyzing many hundreds of reports of circumstances surrounding the start of fires, and in some cases, of explosions. My analysis was directed toward purely physical conditions, such as defective wiring, presence or lack of air spaces between metal flues and woodwork, etc., and the results were presented in these terms. Indeed it was undertaken with no thought that any other significances would or could be revealed. But in due course it became evident that not only a physical situation *qua* physics, but the meaning of that situation to people, was sometimes a factor, through the behavior of the people, in the start of the fire. And this factor of meaning was clearest when it was a LINGUISTIC MEANING, residing in the name or the linguistic description commonly applied to the situation. Thus, around a storage of what are called "gasoline drums," behavior will tend to a certain type, that is, great care will be exercised; while around a storage of what are called "empty gasoline drums," it will tend to be different—careless, with little repression of smoking or of tossing cigarette stubs about. Yet the "empty" drums are perhaps the more dangerous, since they contain explosive vapor. Physically the situation is hazardous, but the linguistic analysis according to regular analogy must employ the word 'empty,' which inevitably suggests lack of hazard. The word 'empty' is used in two linguistic patterns: (1) as a virtual synonym for 'null and void, negative, inert,' (2) applied in analysis of physical situations without regard to, e.g., vapor, liquid vestiges, or stray rubbish, in the container. The situation is named in one pattern (2) and the name is then "acted out" or "lived up to" in another (1), this being a general formula for the linguistic conditioning of behavior into hazardous forms.

In a wood distillation plant the metal stills were insulated with a composition prepared from limestone and called at the plant "spun lime-

THE RELATION OF HABITUAL THOUGHT AND BEHAVIOR TO LANGUAGE*

Human beings do not live in the objective world alone, nor alone in the world of social activity as ordinarily understood, but are very much at the mercy of the particular language which has become the medium of expression for their society. It is quite an illusion to imagine that one adjusts to reality essentially without the use of language and that language is merely an incidental means of solving specific problems of communication or reflection. The fact of the matter is that the "real world" is to a large extent unconsciously built up on the language habits of the group. . . . We see and hear and otherwise experience very largely as we do because the language habits of our community predispose certain choices of interpretation.

—Edward Sapir

There will probably be general assent to the proposition that an accepted pattern of using words is often prior to certain lines of thinking and forms of behavior, but he who assents often sees in such a statement nothing more than a platitudinous recognition of the hypnotic power of philosophical and learned terminology on the one hand or of catchwords, slogans, and rallying cries on the other. To see only thus far is to miss the point of one of the important interconnections which Sapir saw between language, culture, and psychology, and succinctly expressed in the introductory quotation. It is not so much in these

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stone." No attempt was made to protect this covering from excessive heat or the contact of flame. After a period of use, the fire below one of the stills spread to the "limestone," which to everyone's great surprise burned vigorously. Exposure to acetic acid fumes from the stills had converted part of the limestone (calcium carbonate) to calcium acetate. This when heated in a fire decomposes, forming inflammable acetone. Behavior that tolerated fire close to the covering was induced by use of the name "limestone," which because it ends in "-stone" implies non-combustibility.

A huge iron kettle of boiling varnish was observed to be overheated, nearing the temperature at which it would ignite. The operator moved it off the fire and ran it on its wheels to a distance, but did not cover it. In a minute or so the varnish ignited. Here the linguistic influence is more complex; it is due to the metaphorical objectifying (of which more later) of "cause" as contact or the spatial juxtaposition of "things"—to analyzing the situation as 'on' versus 'off' the fire. In reality, the stage when the external fire was the main factor had passed; the overheating was now an internal process of convection in the varnish from the intensely heated kettle, and still continued when 'off' the fire.

An electric glow heater on the wall was little used, and for one workman had the meaning of a convenient coathanger. At night a watchman entered and snapped a switch, which action he verbalized as 'turning on the light.' No light appeared, and this result he verbalized as 'light is burned out.' He could not see the glow of the heater because of the old coat hung on it. Soon the heater ignited the coat, which set fire to the building.

A tannery discharged waste water containing animal matter into an outdoor settling basin partly roofed with wood and partly open. This situation is one that ordinarily would be verbalized as 'pool of water.' A workman had occasion to light a blowtorch near by, and threw his match into the water. But the decomposing waste matter was evolving gas under the wood cover, so that the setup was the reverse of 'watery.' An instant flare of flame ignited the woodwork, and the fire quickly spread into the adjoining building.

A drying room for hides was arranged with a blower at one end to make a current of air along the room and thence outdoors through a vent at the other end. Fire started at a hot bearing on the blower, which blew the flames directly into the hides and fanned them along

the room, destroying the entire stock. This hazardous setup followed naturally from the term 'blower' with its linguistic equivalence to 'that which blows,' implying that its function necessarily is to 'blow.' Also its function is verbalized as 'blowing air for drying,' overlooking that it can blow other things, e.g., flames and sparks. In reality, a blower simply makes a current of air and can exhaust as well as blow. It should have been installed at the vent end to DRAW the air over the hides, then through the hazard (its own casing and bearings), and thence outdoors.

Beside a coal-fired melting pot for lead reclaiming was dumped a pile of "scrap lead"—a misleading verbalization, for it consisted of the lead sheets of old radio condensers, which still had paraffin paper between them. Soon the paraffin blazed up and fired the roof, half of which was burned off.

Such examples, which could be greatly multiplied, will suffice to show how the cue to a certain line of behavior is often given by the analogies of the linguistic formula in which the situation is spoken of, and by which to some degree it is analyzed, classified, and allotted its place in that world which is "to a large extent unconsciously built up on the language habits of the group." And we always assume that the linguistic analysis made by our group reflects reality better than it does.

GRAMMATICAL PATTERNS AS INTERPRETATIONS OF EXPERIENCE

The linguistic material in the above examples is limited to single words, phrases, and patterns of limited range. One cannot study the behavioral compulsiveness of such material without suspecting a much more far-reaching compulsion from large-scale patterning of grammatical categories, such as plurality, gender and similar classifications (animate, inanimate, etc.), tenses, voices, and other verb forms, classifications of the type of "parts of speech," and the matter of whether a given experience is denoted by a unit morpheme, an inflected word, or a syntactical combination. A category such as number (singular vs. plural) is an attempted interpretation of a whole large order of experience, virtually of the world or of nature; it attempts to say how experience is to be segmented, what experience is to be called "one" and what "several." But the difficulty of appraising such a far-reaching influence is great be-

cause of its background character, because of the difficulty of standing aside from our own language, which is a habit and a cultural *non est disputandum*, and scrutinizing it objectively. And if we take a very dissimilar language, this language becomes a part of nature, and we even do to it what we have already done to nature. We tend to think in our own language in order to examine the exotic language. Or we find the task of unraveling the purely morphological intricacies so gigantic that it seems to absorb all else. Yet the problem, though difficult, is feasible; and the best approach is through an exotic language, for in its study we are at long last pushed willy-nilly out of our ruts. Then we find that the exotic language is a mirror held up to our own.

In my study of the Hopi language, what I now see as an opportunity to work on this problem was first thrust upon me before I was clearly aware of the problem. The seemingly endless task of describing the morphology did finally end. Yet it was evident, especially in the light of Sapir's lectures on Navaho, that the description of the LANGUAGE was far from complete. I knew for example the morphological formation of plurals, but not how to use plurals. It was evident that the category of plural in Hopi was not the same thing as in English, French, or German. Certain things that were plural in these languages were singular in Hopi. The phase of investigation which now began consumed nearly two more years.

The work began to assume the character of a comparison between Hopi and western European languages. It also became evident that even the grammar of Hopi bore a relation to Hopi culture, and the grammar of European tongues to our own "Western" or "European" culture. And it appeared that the interrelation brought in those large subsummations of experience by language, such as our own terms 'time,' 'space,' 'substance,' and 'matter.' Since, with respect to the traits compared, there is little difference between English, French, German, or other European languages with the POSSIBLE (but doubtful) exception of Balto-Slavic and non-Indo-European, I have lumped these languages into one group called SAE, or "Standard Average European."

That portion of the whole investigation here to be reported may be summed up in two questions: (1) Are our own concepts of 'time,' 'space,' and 'matter' given in substantially the same form by experience to all men, or are they in part conditioned by the structure of particular languages? (2) Are there traceable affinities between (a) cultural and behavioral norms and (b) large-scale linguistic patterns? (I should be the

last to pretend that there is anything so definite as "a correlation" between culture and language, and especially between ethnological rubrics such as 'agricultural, hunting,' etc., and linguistic ones like 'inflected,' 'synthetic,' or 'isolating.'¹ When I began the study, the problem was by no means so clearly formulated, and I had little notion that the answers would turn out as they did.

PLURALITY AND NUMERATION IN SAE AND HOPI

In our language, that is SAE, plurality and cardinal numbers are applied in two ways: to real plurals and imaginary plurals. Or more exactly if less tersely: perceptible spatial aggregates and metaphorical aggregates. We say 'ten men' and also 'ten days.' Ten men either are or could be objectively perceived as ten, ten in one group perception²—ten men on a street corner, for instance. But 'ten days' cannot be objectively experienced. We experience only one day, today; the other nine (or even all ten) are something conjured up from memory or imagination. If 'ten days' be regarded as a group it must be as an "imaginary," mentally constructed group. Whence comes this mental pattern? Just as in the case of the fire-causing errors, from the fact that our language confuses the two different situations, has but one pattern for both. When we speak of 'ten steps forward, ten strokes on a bell,' or any similarly described cyclic sequence, "times" of any sort, we are doing the same thing as with 'days.' CYCLICITY brings the response of imaginary plurals. But a likeness of cyclicity to aggregates is not unmistakably given by experience prior to language, or it would be found in all languages, and it is not.

OUR AWARENESS of time and cyclicity does contain something immediate and subjective—the basic sense of "becoming later and later." But, in the habitual thought of us SAE people, this is covered under something quite different, which though mental should not be called subjective. I call it OBJECTIFIED, or imaginary, because it is patterned on

¹ We have plenty of evidence that this is not the case. Consider only the Hopi and the Ute, with languages that on the overt morphological and lexical level are as similar as, say, English and German. The idea of "correlation" between language and culture, in the generally accepted sense of correlation, is certainly a mistaken one.

² As we say, 'ten at the SAME TIME,' showing that in our language and thought we restate the fact of group perception in terms of a concept 'time,' the large linguistic component of which will appear in the course of this paper.

the OUTER world. It is this that reflects our linguistic usage. Our tongue makes no distinction between numbers counted on discrete entities and numbers that are simply "counting itself." Habitual thought then assumes that in the latter the numbers are just as much counted on "something" as in the former. This is objectification. Concepts of time lose contact with the subjective experience of "becoming later" and are objectified as counted QUANTITIES, especially as lengths, made up of units as a length can be visibly marked off into inches. A 'length of time' is envisioned as a row of similar units, like a row of bottles.

In Hopi there is a different linguistic situation. Plurals and cardinals are used only for entities that form or can form an objective group. There are no imaginary plurals, but instead ordinals used with singulars. Such an expression as 'ten days' is not used. The equivalent statement is an operational one that reaches one day by a suitable count. 'They stayed ten days' becomes 'they stayed until the eleventh day' or 'they left after the tenth day.' 'Ten days is greater than nine days' becomes 'the tenth day is later than the ninth.' Our "length of time" is not regarded as a length but as a relation between two events in lateness. Instead of our linguistically promoted objectification of that datum of consciousness we call 'time,' the Hopi language has not laid down any pattern that would cloak the subjective "becoming later" that is the essence of time.

NOUNS OF PHYSICAL QUANTITY IN SAE AND HOPI

We have two kinds of nouns denoting physical things: individual nouns, and mass nouns, e.g., 'water, milk, wood, granite, sand, flour, meat.' Individual nouns denote bodies with definite outlines: 'a tree, a stick, a man, a hill.' Mass nouns denote homogeneous continua without implied boundaries. The distinction is marked by linguistic form: e.g., mass nouns lack plurals,³ in English drop articles, and in French take the partitive article *du, de la, des*. The distinction is more wide-

³ It is no exception to this rule of lacking a plural that a mass noun may sometimes coincide in lexeme with an individual noun that of course has a plural; e.g., 'stone' (no pl.) with 'a stone' (pl. 'stones'). The plural form denoting varieties, e.g., 'wines' is of course a different sort of thing from the true plural; it is a curious outgrowth from the SAE mass nouns, leading to still another sort of imaginary aggregates, which will have to be omitted from this paper.

spread in language than in the observable appearance of things. Rather few natural occurrences present themselves as unbounded extents; 'air' of course, and often 'water, rain, snow, sand, rock, dirt, grass.' We do not encounter 'butter, meat, cloth, iron, glass,' or most "materials" in such kind of manifestation, but in bodies small or large with definite outlines. The distinction is somewhat forced upon our description of events by an unavoidable pattern in language. It is so inconvenient in a great many cases that we need some way of individualizing the mass noun by further linguistic devices. This is partly done by names of body-types: 'stick of wood, piece of cloth, pane of glass, cake of soap'; also, and even more, by introducing names of containers though their contents be the real issue: 'glass of water, cup of coffee, dish of food, bag of flour, bottle of beer.' These very common container formulas, in which 'of' has an obvious, visually perceptible meaning ("contents"), influence our feeling about the less obvious type-body formulas: 'stick of wood, lump of dough,' etc. The formulas are very similar: individual noun plus a similar relator (English 'of'). In the obvious case this relator denotes contents. In the inobvious one it "suggests" contents. Hence the 'lumps, chunks, blocks, pieces,' etc., seem to contain something, a "stuff," "substance," or "matter" that answers to the 'water,' 'coffee,' or 'flour' in the container formulas. So with SAE people the philosophic "substance" and "matter" are also the naïve idea; they are instantly acceptable, "common sense." It is so through linguistic habit. Our language patterns often require us to name a physical thing by a binomial that splits the reference into a formless item plus a form.

Hopi is again different. It has a formally distinguished class of nouns. But this class contains no formal subclass of mass nouns. All nouns have an individual sense and both singular and plural forms. Nouns translating most nearly our mass nouns still refer to vague bodies or vaguely bounded extents. They imply indefiniteness, but not lack, of outline and size. In specific statements, 'water' means one certain mass or quantity of water, not what we call "the substance water." Generality of statement is conveyed through the verb or predicator, not the noun. Since nouns are individual already, they are not individualized by either type-bodies or names of containers, if there is no special need to emphasize shape or container. The noun itself implies a suitable type-body or container. One says, not 'a glass of water' but *kə-yi* 'a

water,' not 'a pool of water' but *pa·ha*,⁴ not 'a dish of cornflour' but *ɲəmni* 'a (quantity of) cornflour,' not 'a piece of meat' but *sik^{wi}* 'a meat.' The language has neither need for nor analogies on which to build the concept of existence as a duality of formless item and form. It deals with formlessness through other symbols than nouns.

PHASES OF CYCLES IN SAE AND HOPI

Such terms as 'summer, winter, September, morning, noon, sunset' are with us nouns, and have little formal linguistic difference from other nouns. They can be subjects or objects, and we say 'at sunset' or 'in winter' just as we say 'at a corner' or 'in an orchard.'⁵ They are pluralized and numerated like nouns of physical objects, as we have seen. Our thought about the referents of such words hence becomes objectified. Without objectification, it would be a subjective experience of real time, i.e. of the consciousness of "becoming later and later"—simply a cyclic phase similar to an earlier phase in that ever-later-becoming duration. Only by imagination can such a cyclic phase be set beside another and another in the manner of a spatial (i.e. visually perceived) configuration. But such is the power of linguistic analogy that we do so objectify cyclic phasing. We do it even by saying 'a phase' and 'phases' instead of, e.g., 'phasing.' And the pattern of individual and mass nouns, with the resulting binomial formula of formless item plus form, is so general that it is implicit for all nouns, and hence our very generalized formless items like 'substance, matter,' by which we can fill out the binomial for an enormously wide range of nouns. But even these are not quite generalized enough to take in our phase nouns. So for the phase nouns we have made a formless item, 'time.' We have made it by using 'a time,' i.e. an occasion or a phase, in the pattern of a mass noun, just as from 'a summer' we make 'summer' in the pattern of a mass noun. Thus with our binomial formula we can say and think 'a moment of time, a second

⁴ Hopi has two words for water quantities; *kɔ·yi* and *pa·ha*. The difference is something like that between 'stone' and 'rock' in English, *pa·ha* implying greater size and "wildness"; flowing water, whether or not outdoors or in nature, is *pa·ha*; so is 'moisture.' But, unlike 'stone' and 'rock,' the difference is essential, not pertaining to a connotative margin, and the two can hardly ever be interchanged.

⁵ To be sure, there are a few minor differences from other nouns, in English for instance in the use of the articles.

of time, a year of time.' Let me again point out that the pattern is simply that of 'a bottle of milk' or 'a piece of cheese.' Thus we are assisted to imagine that 'a summer' actually contains or consists of such-and-such a quantity of 'time.'

In Hopi however all phase terms, like 'summer, morning,' etc., are not nouns but a kind of adverb, to use the nearest SAE analogy. They are a formal part of speech by themselves, distinct from nouns, verbs, and even other Hopi "adverbs." Such a word is not a case form or a locative pattern, like 'des Abends' or 'in the morning.' It contains no morpheme like one of 'in the house' or 'at the tree.'⁶ It means 'when it is morning' or 'while morning-phase is occurring.' These "temporals" are not used as subjects or objects, or at all like nouns. One does not say 'it's a hot summer' or 'summer is hot'; summer is not hot, summer is only WHEN conditions are hot, WHEN heat occurs. One does not say 'THIS summer,' but 'summer now' or 'summer recently.' There is no objectification, as a region, an extent, a quantity, of the subjective duration-feeling. Nothing is suggested about time except the perpetual "getting later" of it. And so there is no basis here for a formless item answering to our 'time.'

TEMPORAL FORMS OF VERBS IN SAE AND HOPI

The three-tense system of SAE verbs colors all our thinking about time. This system is amalgamated with that larger scheme of objectification of the subjective experience of duration already noted in other patterns—in the binomial formula applicable to nouns in general, in temporal nouns, in plurality and numeration. This objectification enables us in imagination to "stand time units in a row." Imagination of time as like a row harmonizes with a system of THREE tenses; whereas a system of TWO, an earlier and a later, would seem to correspond better to the feeling of duration as it is experienced. For if we inspect consciousness we find no past, present, future, but a unity embracing complexity. EVERYTHING is in consciousness, and everything in conscious-

⁶ 'Year' and certain combinations of 'year' with name of season, rarely season names alone, can occur with a locative morpheme 'at,' but this is exceptional. It appears like historical detritus of an earlier different patterning, or the effect of English analogy, or both.

ness is, and is together. There is in it a sensuous and a nonsensuous. We may call the sensuous—what we are seeing, hearing, touching—the ‘present’ while in the nonsensuous the vast image-world of memory is being labeled ‘the past’ and another realm of belief, intuition, and uncertainty ‘the future’; yet sensation, memory, foresight, all are in consciousness together—one is not “yet to be” nor another “once but no more.” Where real time comes in is that all this in consciousness is “getting later,” changing certain relations in an irreversible manner. In this “latering” or “durating” there seems to me to be a paramount contrast between the newest, latest instant at the focus of attention and the rest—the earlier. Languages by the score get along well with two tenselike forms answering to this paramount relation of “later” to “earlier.” We can of course CONSTRUCT AND CONTEMPLATE IN THOUGHT a system of past, present, future, in the objectified configuration of points on a line. This is what our general objectification tendency leads us to do and our tense system confirms.

In English the present tense seems the one least in harmony with the paramount temporal relation. It is as if pressed into various and not wholly congruous duties. One duty is to stand as objectified middle term between objectified past and objectified future, in narration, discussion, argument, logic, philosophy. Another is to denote inclusion in the sensuous field: ‘I SEE him.’ Another is for nomic, i.e. customarily or generally valid, statements: ‘We SEE with our eyes.’ These varied uses introduce confusions of thought, of which for the most part we are unaware.

Hopi, as we might expect, is different here too. Verbs have no “tenses” like ours, but have validity-forms (“assertions”), aspects, and clause-linkage forms (modes), that yield even greater precision of speech. The validity-forms denote that the speaker (not the subject) reports the situation (answering to our past and present) or that he expects it (answering to our future)⁷ or that he makes a nomic statement (answering

⁷ The expective and reportive assertions contrast according to the “paramount relation.” The expective expresses anticipation existing EARLIER than objective fact, and coinciding with objective fact LATER than the status quo of the speaker, this status quo, including all the subsummation of the past therein, being expressed by the reportive. Our notion “future” seems to represent at once the earlier (anticipation) and the later (afterwards, what will be), as Hopi shows. This paradox may hint of how elusive the mystery of real time is, and how artificially it is expressed by a linear relation of past-present-future.

to our nomic present). The aspects denote different degrees of duration and different kinds of tendency “during duration.” As yet we have noted nothing to indicate whether an event is sooner or later than another when both are REPORTED. But need for this does not arise until we have two verbs: i.e. two clauses. In that case the “modes” denote relations between the clauses, including relations of later to earlier and of simultaneity. Then there are many detached words that express similar relations, supplementing the modes and aspects. The duties of our three-tense system and its tripartite linear objectified “time” are distributed among various verb categories, all different from our tenses; and there is no more basis for an objectified time in Hopi verbs than in other Hopi patterns; although this does not in the least hinder the verb forms and other patterns from being closely adjusted to the pertinent realities of actual situations.

DURATION, INTENSITY, AND TENDENCY IN SAE AND HOPI

To fit discourse to manifold actual situations, all languages need to express durations, intensities, and tendencies. It is characteristic of SAE and perhaps of many other language types to express them metaphorically. The metaphors are those of spatial extension, i.e. of size, number (plurality), position, shape, and motion. We express duration by ‘long, short, great, much, quick, slow,’ etc.; intensity by ‘large, great, much, heavy, light, high, low, sharp, faint,’ etc.; tendency by ‘more, increase, grow, turn, get, approach, go, come, rise, fall, stop, smooth, even, rapid, slow’; and so on through an almost inexhaustible list of metaphors that we hardly recognize as such, since they are virtually the only linguistic media available. The nonmetaphorical terms in this field, like ‘early, late, soon, lasting, intense, very, tending,’ are a mere handful, quite inadequate to the needs.

It is clear how this condition “fits in.” It is part of our whole scheme of OBJECTIFYING—imaginatively spatializing qualities and potentials that are quite nonspatial (so far as any spatially perceptive senses can tell us). Noun-meaning (with us) proceeds from physical bodies to referents of far other sort. Since physical bodies and their outlines in PERCEIVED SPACE are denoted by size and shape terms and reckoned by cardinal numbers and plurals, these patterns of denotation and reckoning extend

to the symbols of nonspatial meanings, and so suggest an IMAGINARY SPACE. Physical shapes 'move, stop, rise, sink, approach,' etc., in perceived space; why not these other referents in their imaginary space? This has gone so far that we can hardly refer to the simplest nonspatial situation without constant resort to physical metaphors. I "grasp" the "thread" of another's arguments, but if its "level" is "over my head" my attention may "wander" and "lose touch" with the "drift" of it, so that when he "comes" to his "point" we differ "widely," our "views" being indeed so "far apart" that the "things" he says "appear" "much" too arbitrary, or even "a lot" of nonsense!

The absence of such metaphor from Hopi speech is striking. Use of space terms when there is no space involved is NOT THERE—as if on it had been laid the taboo teetotal! The reason is clear when we know that Hopi has abundant conjugational and lexical means of expressing duration, intensity, and tendency directly as such, and that major grammatical patterns do not, as with us, provide analogies for an imaginary space. The many verb "aspects" express duration and tendency of manifestations, while some of the "voices" express intensity, tendency, and duration of causes or forces producing manifestations. Then a special part of speech, the "tensors," a huge class of words, denotes only intensity, tendency, duration, and sequence. The function of the tensors is to express intensities, "strengths," and how they continue or vary, their rate of change; so that the broad concept of intensity, when considered as necessarily always varying and/or continuing, includes also tendency and duration. Tensors convey distinctions of degree, rate, constancy, repetition, increase and decrease of intensity, immediate sequence, interruption or sequence after an interval, etc., also QUALITIES of strengths, such as we should express metaphorically as smooth, even, hard, rough. A striking feature is their lack of resemblance to the terms of real space and movement that to us "mean the same." There is not even more than a trace of apparent derivation from space terms.⁸ So, while Hopi

⁸ One such trace is that the tensor 'long in duration,' while quite different from the adjective 'long' of space, seems to contain the same root as the adjective 'large' of space. Another is that 'somewhere' of space used with certain tensors means 'at some indefinite time.' Possibly however this is not the case and it is only the tensor that gives the time element, so that 'somewhere' still refers to space and that under these conditions indefinite space means simply general applicability, regardless of either time or space. Another trace is that in the temporal (cycle word) 'afternoon' the element meaning 'after' is derived from the verb 'to separate.' There are other such traces, but they are few and exceptional, and obviously not like our own spatial metaphorizing.

in its nouns seems highly concrete, here in the tensors it becomes abstract almost beyond our power to follow.

HABITUAL THOUGHT IN SAE AND HOPI

The comparison now to be made between the habitual thought worlds of SAE and Hopi speakers is of course incomplete. It is possible only to touch upon certain dominant contrasts that appear to stem from the linguistic differences already noted. By "habitual thought" and "thought world" I mean more than simply language, i.e. than the linguistic patterns themselves. I include all the analogical and suggestive value of the patterns (e.g., our "imaginary space" and its distant implications), and all the give-and-take between language and the culture as a whole, wherein is a vast amount that is not linguistic but yet shows the shaping influence of language. In brief, this "thought world" is the microcosm that each man carries about within himself, by which he measures and understands what he can of the macrocosm.

The SAE microcosm has analyzed reality largely in terms of what it calls "things" (bodies and quasibodies) plus modes of extensional but formless existence that it calls "substances" or "matter." It tends to see existence through a binomial formula that expresses any existent as a spatial form plus a spatial formless continuum related to the form, as contents is related to the outlines of its container. Nonspatial existents are imaginatively spatialized and charged with similar implications of form and continuum.

The Hopi microcosm seems to have analyzed reality largely in terms of EVENTS (or better "eventing"), referred to in two ways, objective and subjective. Objectively, and only if perceptible physical experience, events are expressed mainly as outlines, colors, movements, and other perceptive reports. Subjectively, for both the physical and nonphysical, events are considered the expression of invisible intensity factors, on which depend their stability and persistence, or their fugitiveness and proclivities. It implies that existents do not "become later and later" all in the same way; but some do so by growing like plants, some by diffusing and vanishing, some by a procession of metamorphoses, some by enduring in one shape till affected by violent forces. In the nature of each existent able to manifest as a definite whole is the power of its own mode of duration: its growth, decline, stability, cyclicity, or crea-

tiveness. Everything is thus already "prepared" for the way it now manifests by earlier phases, and what it will be later, partly has been, and partly is in act of being so "prepared." An emphasis and importance rests on this preparing or being prepared aspect of the world that may to the Hopi correspond to that "quality of reality" that 'matter' or 'stuff' has for us.

HABITUAL BEHAVIOR FEATURES OF HOPI CULTURE

Our behavior, and that of Hopi, can be seen to be coordinated in many ways to the linguistically conditioned microcosm. As in my fire casebook, people act about situations in ways which are like the ways they talk about them. A characteristic of Hopi behavior is the emphasis on preparation. This includes announcing and getting ready for events well beforehand, elaborate precautions to insure persistence of desired conditions, and stress on good will as the preparer of right results. Consider the analogies of the day-counting pattern alone. Time is mainly reckoned "by day" (*tal*k, *-tala*) or "by night" (*tok*), which words are not nouns but tensors, the first formed on a root "light, day," the second on a root "sleep." The count is by ORDINALS. This is not the pattern of counting a number of different men or things, even though they appear successively, for, even then, they COULD gather into an assemblage. It is the pattern of counting successive reappearances of the SAME man or thing, incapable of forming an assemblage. The analogy is not to behave about day-cyclicity as to several men ("several days"), which is what we tend to do, but to behave as to the successive visits of the SAME MAN. One does not alter several men by working upon just one, but one can prepare and so alter the later visits of the same man by working to affect the visit he is making now. This is the way the Hopi deal with the future—by working within a present situation which is expected to carry impresses, both obvious and occult, forward into the future event of interest. One might say that Hopi society understands our proverb 'Well begun is half done,' but not our 'Tomorrow is another day.' This may explain much in Hopi character.

This Hopi preparing behavior may be roughly divided into announcing, outer preparing, inner preparing, covert participation, and persistence. Announcing, or preparative publicity, is an important function

in the hands of a special official, the Crier Chief. Outer preparing is preparation involving much visible activity, not all necessarily directly useful within our understanding. It includes ordinary practicing, rehearsing, getting ready, introductory formalities, preparing of special food, etc. (all of these to a degree that may seem overelaborate to us), intensive sustained muscular activity like running, racing, dancing, which is thought to increase the intensity of development of events (such as growth of crops), mimetic and other magic, preparations based on esoteric theory involving perhaps occult instruments like prayer sticks, prayer feathers, and prayer meal, and finally the great cyclic ceremonies and dances, which have the significance of preparing rain and crops. From one of the verbs meaning "prepare" is derived the noun for "harvest" or "crop": *na'twani* 'the prepared' or the 'in preparation.'⁹

Inner preparing is use of prayer and meditation, and at lesser intensity good wishes and good will, to further desired results. Hopi attitudes stress the power of desire and thought. With their "microcosm" it is utterly natural that they should. Desire and thought are the earliest, and therefore the most important, most critical and crucial, stage of preparing. Moreover, to the Hopi, one's desires and thoughts influence not only his own actions, but all nature as well. This too is wholly natural. Consciousness itself is aware of work, of the feel of effort and energy, in desire and thinking. Experience more basic than language tells us that, if energy is expended, effects are produced. WE tend to believe that our bodies can stop up this energy, prevent it from affecting other things until we will our BODIES to overt action. But this may be so only because we have our own linguistic basis for a theory that formless items like "matter" are things in themselves, malleable only by similar things, by more matter, and hence insulated from the powers of life and thought. It is no more unnatural to think that thought contacts everything and pervades the universe than to think, as we all do, that light kindled outdoors does this. And it is not unnatural to suppose that thought, like any other force, leaves everywhere traces of effect. Now, when we think of a certain actual rosebush, we do not suppose that our thought goes to that actual bush, and engages with it, like a searchlight turned upon it. What then do we suppose our conscious-

⁹ The Hopi verbs of preparing naturally do not correspond neatly to our "prepare"; so that *na'twani* could also be rendered 'the practiced upon, the tried for,' and other wise.

ness is dealing with when we are thinking of that rosebush? Probably we think it is dealing with a "mental image" which is not the rosebush but a mental surrogate of it. But why should it be NATURAL to think that our thought deals with a surrogate and not with the real rosebush? Quite possibly because we are dimly aware that we carry about with us a whole imaginary space, full of mental surrogates. To us, mental surrogates are old familiar fare. Along with the images of imaginary space, which we perhaps secretly know to be only imaginary, we tuck the thought-of actually existing rosebush, which may be quite another story, perhaps just because we have that very convenient "place" for it. The Hopi thought-world has no imaginary space. The corollary to this is that it may not locate thought dealing with real space anywhere but in real space, nor insulate real space from the effects of thought. A Hopi would naturally suppose that his thought (or he himself) traffics with the actual rosebush—or more likely, corn plant—that he is thinking about. The thought then should leave some trace of itself with the plant in the field. If it is a good thought, one about health and growth, it is good for the plant; if a bad thought, the reverse.

The Hopi emphasize the intensity-factor of thought. Thought to be most effective should be vivid in consciousness, definite, steady, sustained, charged with strongly felt good intentions. They render the idea in English as 'concentrating, holding it in your heart, putting your mind on it, earnestly hoping.' Thought power is the force behind ceremonies, prayer sticks, ritual smoking, etc. The prayer pipe is regarded as an aid to "concentrating" (so said my informant). Its name, *na'twanpi*, means 'instrument of preparing.'

Covert participation is mental collaboration from people who do not take part in the actual affair, be it a job of work, hunt, race, or ceremony, but direct their thought and good will toward the affair's success. Announcements often seek to enlist the support of such mental helpers as well as of overt participants, and contain exhortations to the people to aid with their active good will.¹⁹ A similarity to our concepts of a sympathetic audience or the cheering section at a football game should

¹⁹ See, e.g., Ernest Beaglehole, *Notes on Hopi economic life* (Yale University Publications in Anthropology, no. 15, 1937), especially the reference to the announcement of a rabbit hunt, and on p. 30, description of the activities in connection with the cleaning of Toreva Spring—announcing, various preparing activities, and finally, preparing the continuity of the good results already obtained and the continued flow of the spring.

not obscure the fact that it is primarily the power of directed thought, and not merely sympathy or encouragement, that is expected of covert participants. In fact these latter get in their deadliest work before, not during, the game! A corollary to the power of thought is the power of wrong thought for evil; hence one purpose of covert participation is to obtain the mass force of many good wishers to offset the harmful thought of ill wishers. Such attitudes greatly favor cooperation and community spirit. Not that the Hopi community is not full of rivalries and colliding interests. Against the tendency to social disintegration in such a small, isolated group, the theory of "preparing" by the power of thought, logically leading to the great power of the combined, intensified, and harmonized thought of the whole community, must help vastly toward the rather remarkable degree of cooperation that, in spite of much private bickering, the Hopi village displays in all the important cultural activities.

Hopi "preparing" activities again show a result of their linguistic thought background in an emphasis on persistence and constant insistent repetition. A sense of the cumulative value of innumerable small momenta is dulled by an objectified, spatialized view of time like ours, enhanced by a way of thinking close to the subjective awareness of duration, of the ceaseless "latering" of events. To us, for whom time is a motion on a space, unvarying repetition seems to scatter its force along a row of units of that space, and be wasted. To the Hopi, for whom time is not a motion but a "getting later" of everything that has ever been done, unvarying repetition is not wasted but accumulated. It is storing up an invisible change that holds over into later events.¹¹ As we have seen, it is as if the return of the day were felt as the return of the same person, a little older but with all the impresses of yesterday, not as "another day," i.e. like an entirely different person. This principle

¹¹ This notion of storing up power, which seems implied by much Hopi behavior, has an analog in physics: acceleration. It might be said that the linguistic background of Hopi thought equips it to recognize naturally that force manifests not as motion or velocity, but as cumulation or acceleration. Our linguistic background tends to hinder in us this same recognition, for having legitimately conceived force to be that which produces change, we then think of change by our linguistic metaphorical analog, motion, instead of by a pure motionless changingness concept, i.e. accumulation or acceleration. Hence it comes to our naive feeling as a shock to find from physical experiments that it is not possible to define force by motion, that motion and speed, as also "being at rest," are wholly relative, and that force can be measured only by acceleration.

joined with that of thought-power and with traits of general Pueblo culture is expressed in the theory of the Hopi ceremonial dance for furthering rain and crops, as well as in its short, piston-like tread, repeated thousands of times, hour after hour.

SOME IMPRESSES OF LINGUISTIC HABIT IN WESTERN CIVILIZATION

It is harder to do justice in few words to the linguistically conditioned features of our own culture than in the case of the Hopi, because of both vast scope and difficulty of objectivity—because of our deeply ingrained familiarity with the attitudes to be analyzed. I wish merely to sketch certain characteristics adjusted to our linguistic binomialism of form plus formless item or “substance,” to our metaphoricalness, our imaginary space, and our objectified time. These, as we have seen, are linguistic.

From the form-plus-substance dichotomy the philosophical views most traditionally characteristic of the “Western world” have derived huge support. Here belong materialism, psychophysical parallelism, physics—at least in its traditional Newtonian form—and dualistic views of the universe in general. Indeed here belongs almost everything that is “hard, practical common sense.” Monistic, holistic, and relativistic views of reality appeal to philosophers and some scientists, but they are badly handicapped in appealing to the “common sense” of the Western average man—not because nature herself refutes them (if she did, philosophers could have discovered this much), but because they must be talked about in what amounts to a new language. “Common sense,” as its name shows, and “practicality” as its name does not show, are largely matters of talking so that one is readily understood. It is sometimes stated that Newtonian space, time, and matter are sensed by everyone intuitively, whereupon relativity is cited as showing how mathematical analysis can prove intuition wrong. This, besides being unfair to intuition, is an attempt to answer offhand question (1) put at the outset of this paper, to answer which this research was undertaken. Presentation of the findings now nears its end, and I think the answer is clear. The offhand answer, laying the blame upon intuition for our slowness in discovering mysteries of the Cosmos, such as relativity, is

the wrong one. The right answer is: Newtonian space, time, and matter are no intuitions. They are receipts from culture and language. That is where Newton got them.

Our objectified view of time is, however, favorable to historicity and to everything connected with the keeping of records, while the Hopi view is unfavorable thereto. The latter is too subtle, complex, and ever-developing, supplying no ready-made answer to the question of when “one” event ends and “another” begins. When it is implicit that everything that ever happened still is, but is in a necessarily different form from what memory or record reports, there is less incentive to study the past. As for the present, the incentive would be not to record it but to treat it as “preparing.” But our objectified time puts before imagination something like a ribbon or scroll marked off into equal blank spaces, suggesting that each be filled with an entry. Writing has no doubt helped toward our linguistic treatment of time, even as the linguistic treatment has guided the uses of writing. Through this give-and-take between language and the whole culture we get, for instance:

1. Records, diaries, bookkeeping, accounting, mathematics stimulated by accounting.
2. Interest in exact sequence, dating, calendars, chronology, clocks, time wages, time graphs, time as used in physics.
3. Annals, histories, the historical attitude, interest in the past, archaeology, attitudes of introjection toward past periods, e.g., classicism, romanticism.

Just as we conceive our objectified time as extending in the future in the same way that it extends in the past, so we set down our estimates of the future in the same shape as our records of the past, producing programs, schedules, budgets. The formal equality of the spacelike units by which we measure and conceive time leads us to consider the “formless item” or “substance” of time to be homogeneous and in ratio to the number of units. Hence our prorata allocation of value to time, lending itself to the building up of a commercial structure based on time-prorata values: time wages (time work constantly supersedes piece work), rent, credit, interest, depreciation charges, and insurance premiums. No doubt this vast system, once built, would continue to run under any sort of linguistic treatment of time: but that it should have been built at all, reaching the magnitude and particular form it

has in the Western world, is a fact decidedly in consonance with the patterns of the SAE languages. Whether such a civilization as ours would be possible with widely different linguistic handling of time is a large question—in our civilization, our linguistic patterns and the fitting of our behavior to the temporal order are what they are, and they are in accord. We are of course stimulated to use calendars, clocks, and watches, and to try to measure time ever more precisely; this aids science, and science in turn, following these well-worn cultural grooves, gives back to culture an ever-growing store of applications, habits, and values, with which culture again directs science. But what lies outside this spiral? Science is beginning to find that there is something in the Cosmos that is not in accord with the concepts we have formed in mounting the spiral. It is trying to frame a *NEW LANGUAGE* by which to adjust itself to a wider universe.

It is clear how the emphasis on "saving time" which goes with all the above and is very obvious objectification of time, leads to a high valuation of "speed," which shows itself a great deal in our behavior.

Still another behavioral effect is that the character of monotony and regularity possessed by our image of time as an evenly scaled limitless tape measure persuades us to behave as if that monotony were more true of events than it really is. That is, it helps to routinize us. We tend to select and favor whatever bears out this view, to "play up to" the routine aspects of existence. One phase of this is behavior evincing a false sense of security or an assumption that all will always go smoothly, and a lack in foreseeing and protecting ourselves against hazards. Our technique of harnessing energy does well in routine performance, and it is along routine lines that we chiefly strive to improve it—we are, for example, relatively uninterested in stopping the energy from causing accidents, fires, and explosions, which it is doing constantly and on a wide scale. Such indifference to the unexpectedness of life would be disastrous to a society as small, isolated, and precariously poised as the Hopi society is, or rather once was.

Thus our linguistically determined thought world not only collaborates with our cultural idols and ideals, but engages even our unconscious personal reactions in its patterns and gives them certain typical characters. One such character, as we have seen, is *CARELESSNESS*, as in reckless driving or throwing cigarette stubs into waste paper. Another of different sort is *GESTURING* when we talk. Very many of the gestures

made by English-speaking people at least, and probably by all SAE speakers, serve to illustrate, by a movement in space, not a real spatial reference but one of the nonspatial references that our language handles by metaphors of imaginary space. That is, we are more apt to make a grasping gesture when we speak of grasping an elusive idea than when we speak of grasping a doorknob. The gesture seeks to make a metaphorical and hence somewhat unclear reference more clear. But, if a language refers to nonspatials without implying a spatial analogy, the reference is not made any clearer by gesture. The Hopi gesture very little, perhaps not at all in the sense we understand as gesture.

It would seem as if kinesthesia, or the sensing of muscular movement, though arising before language, should be made more highly conscious by linguistic use of imaginary space and metaphorical images of motion. Kinesthesia is marked in two facets of European culture: art and sport. European sculpture, an art in which Europe excels, is strongly kinesthetic, conveying great sense of the body's motions; European painting likewise. The dance in our culture expresses delight in motion rather than symbolism or ceremonial, and our music is greatly influenced by our dance forms. Our sports are strongly imbued with this element of the "poetry of motion." Hopi races and games seem to emphasize rather the virtues of endurance and sustained intensity. Hopi dancing is highly symbolic and is performed with great intensity and earnestness, but has not much movement or swing.

Synesthesia, or suggestion by certain sense receptions of characters belonging to another sense, as of light and color by sounds and vice versa, should be made more conscious by a linguistic metaphorical system that refers to nonspatial experiences by terms for spatial ones, though undoubtedly it arises from a deeper source. Probably in the first instance metaphor arises from synesthesia and not the reverse; yet metaphor need not become firmly rooted in linguistic pattern, as Hopi shows. Nonspatial experience has one well-organized sense, *HEARING*—for smell and taste are but little organized. Nonspatial consciousness is a realm chiefly of thought, feeling, and *SOUND*. Spatial consciousness is a realm of light, color, sight, and touch, and presents shapes and dimensions. Our metaphorical system, by naming nonspatial experiences after spatial ones, imputes to sounds, smells, tastes, emotions, and thoughts qualities like the colors, luminosities, shapes, angles, textures, and motions of spatial experience. And to some extent the reverse transference occurs;

for, after much talking about tones as high, low, sharp, dull, heavy, brilliant, slow, the talker finds it easy to think of some factors in spatial experience as like factors of tone. Thus we speak of "tones" of color, a gray "monotone," a "loud" necktie, a "taste" in dress: all spatial metaphor in reverse. Now European art is distinctive in the way it seeks deliberately to play with synesthesia. Music tries to suggest scenes, color, movement, geometric design; painting and sculpture are often consciously guided by the analogies of music's rhythm; colors are conjoined with feeling for the analogy to concords and discords. The European theater and opera seek a synthesis of many arts. It may be that in this way our metaphorical language that is in some sense a confusion of thought is producing, through art, a result of far-reaching value—a deeper esthetic sense leading toward a more direct apprehension of underlying unity behind the phenomena so variously reported by our sense channels.

HISTORICAL IMPLICATIONS

How does such a network of language, culture, and behavior come about historically? Which was first: the language patterns or the cultural norms? In main they have grown up together, constantly influencing each other. But in this partnership the nature of the language is the factor that limits free plasticity and rigidifies channels of development in the more autocratic way. This is so because a language is a system, not just an assemblage of norms. Large systematic outlines can change to something really new only very slowly, while many other cultural innovations are made with comparative quickness. Language thus represents the mass mind; it is affected by inventions and innovations, but affected little and slowly, whereas to inventors and innovators it legislates with the decree immediate.

The growth of the SAE language-culture complex dates from ancient times. Much of its metaphorical reference to the nonspatial by the spatial was already fixed in the ancient tongues, and more especially in Latin. It is indeed a marked trait of Latin. If we compare, say Hebrew, we find that, while Hebrew has some allusion to not-space as space, Latin has more. Latin terms for nonspatials, like *educō*, *religio*, *principia*, *comprehendo*, are usually metaphorized physical references: lead

out, tying back, etc. This is not true of all languages—it is quite untrue of Hopi. The fact that in Latin the direction of development happened to be from spatial to nonspatial (partly because of secondary stimulation to abstract thinking when the intellectually crude Romans encountered Greek culture) and that later tongues were strongly stimulated to mimic Latin, seems a likely reason for a belief, which still lingers on among linguists, that this is the natural direction of semantic change in all languages, and for the persistent notion in Western learned circles (in strong contrast to Eastern ones) that objective experience is prior to subjective. Philosophies make out a weighty case for the reverse, and certainly the direction of development is sometimes the reverse. Thus the Hopi word for "heart" can be shown to be a late formation within Hopi from a root meaning think or remember. Or consider what has happened to the word "radio" in such a sentence as "he bought a new radio," as compared to its prior meaning "science of wireless telephony."

In the Middle Ages the patterns already formed in Latin began to interweave with the increased mechanical invention, industry, trade, and scholastic and scientific thought. The need for measurement in industry and trade, the stores and bulks of "stuffs" in various containers, the type-bodies in which various goods were handled, standardizing of measure and weight units, invention of clocks and measurement of "time," keeping of records, accounts, chronicles, histories, growth of mathematics and the partnership of mathematics and science, all cooperated to bring our thought and language world into its present form.

In Hopi history, could we read it, we should find a different type of language and a different set of cultural and environmental influences working together. A peaceful agricultural society isolated by geographic features and nomad enemies in a land of scanty rainfall, arid agriculture that could be made successful only by the utmost perseverance (hence the value of persistence and repetition), necessity for collaboration (hence emphasis on the psychology of teamwork and on mental factors in general), corn and rain as primary criteria of value, need of extensive PREPARATIONS and precautions to assure crops in the poor soil and precarious climate, keen realization of dependence upon nature favoring prayer and a religious attitude toward the forces of nature, especially prayer and religion directed toward the ever-needed blessing, rain—these things interacted with Hopi linguistic patterns to mold them, to be

molded again by them, and so little by little to shape the Hopi world-outlook.

To sum up the matter, our first question asked in the beginning (p. 138) is answered thus: Concepts of "time" and "matter" are not given in substantially the same form by experience to all men but depend upon the nature of the language or languages through the use of which they have been developed. They do not depend so much upon ANY ONE SYSTEM (e.g., tense, or nouns) within the grammar as upon the ways of analyzing and reporting experience which have become fixed in the language as integrated "fashions of speaking" and which cut across the typical grammatical classifications, so that such a "fashion" may include lexical, morphological, syntactic, and otherwise systemically diverse means coordinated in a certain frame of consistency. Our own "time" differs markedly from Hopi "duration." It is conceived as like a space of strictly limited dimensions, or sometimes as like a motion upon such a space, and employed as an intellectual tool accordingly. Hopi "duration" seems to be inconceivable in terms of space or motion, being the mode in which life differs from form, and consciousness *in toto* from the spatial elements of consciousness. Certain ideas born of our own time-concept, such as that of absolute simultaneity, would be either very difficult to express or impossible and devoid of meaning under the Hopi conception, and would be replaced by operational concepts. Our "matter" is the physical subtype of "substance" or "stuff," which is conceived as the formless extensional item that must be joined with form before there can be real existence. In Hopi there seems to be nothing corresponding to it; there are no formless extensional items; existence may or may not have form, but what it also has, with or without form, is intensity and duration, these being nonextensional and at bottom the same.

But what about our concept of "space," which was also included in our first question? There is no such striking difference between Hopi and SAE about space as about time, and probably the apprehension of space is given in substantially the same form by experience irrespective of language. The experiments of the Gestalt psychologists with visual perception appear to establish this as a fact. But the CONCEPT OF SPACE will vary somewhat with language, because, as an intellectual tool,¹² it

is so closely linked with the concomitant employment of other intellectual tools, of the order of "time" and "matter," which are linguistically conditioned. We see things with our eyes in the same space forms as the Hopi, but our idea of space has also the property of acting as a surrogate of nonspatial relationships like time, intensity, tendency, and as a void to be filled with imagined formless items, one of which may even be called 'space.' Space as sensed by the Hopi would not be connected mentally with such surrogates, but would be comparatively "pure," unmixed with extraneous notions.

As for our second question (p. 138): There are connections but not correlations or diagnostic correspondences between cultural norms and linguistic patterns. Although it would be impossible to infer the existence of Crier Chiefs from the lack of tenses in Hopi, or vice versa, there is a relation between a language and the rest of the culture of the society which uses it. There are cases where the "fashions of speaking" are closely integrated with the whole general culture, whether or not this be universally true, and there are connections within this integration, between the kind of linguistic analyses employed and various behavioral reactions and also the shapes taken by various cultural developments. Thus the importance of Crier Chiefs does have a connection, not with tenselessness itself, but with a system of thought in which categories different from our tenses are natural. These connections are to be found not so much by focusing attention on the typical rubrics of linguistic, ethnographic, or sociological description as by examining the culture and the language (always and only when the two have been together historically for a considerable time) as a whole in which concatenations that run across these departmental lines may be expected to exist, and, if they do exist, eventually to be discoverable by study.

¹² Here belong "Newtonian" and "Euclidean" space, etc.