The Particle Zone

Appendix 1

Notes on the Geometry of Language

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The form of an object is a "diagram of forces."
—D'Arcy Wentworth Thompson

Suppose English were visible from a very great distance. You could stand somewhere outside it, which would already be an impressive grammatical accomplishment, and look back at the whole thing: the immense scattered population of nouns, the busy neighborhoods of verbs, the adjectives accumulating around whatever people have recently decided to have opinions about. Names would keep lighting up along

the outer arms. New objects would acquire words, old words would acquire jobs, compounds would assemble themselves out of available parts. The galaxy would be visibly growing. You could point to a new light and say: there. That wasn't here before.

Near the middle, however, the picture would be harder to resolve. The objects would be smaller, more densely entangled, less willing to tell you what they meant independently of their neighbors. A few would look suspiciously familiar. Wasn't that a word for a direction? Didn't that one used to describe an ordinary action? And what, precisely, are those three doing together? The closer you looked, the less satisfactory the inventory would become. Something would be happening there that counting new words could not adequately describe.

The particle zone is the name for this central activity: the region where linguistic material is compressed and recombined into new grammatical possibilities. At the periphery, language readily produces more members of its open classes. At the center, the relatively closed machinery can acquire new ways of working. The distinction is between extending the population and changing what the population can do together. Both are productive. They are productive in different directions.

An open class has a wonderfully uncomplicated relationship with novelty. Another noun? Certainly. We have millions of objects, several of them invented this morning, and a great many people whose principal occupation is inventing things for which we will subsequently require nouns. The class does not need to reconsider its constitutional arrangements every time a new member arrives. A new word can enter an existing grammatical position and immediately inherit an enormous amount of established behavior. Its novelty is real, but the accommodation of that novelty has already been provided for.

Compounding makes the arrangement even more conspicuous. You put familiar pieces together, and something newly nameable appears. The operation may be ingenious, beautiful, appalling, or all three; calling this the easier kind of productivity is not a judgment on the intelligence of the person doing it. It is a statement about what the operation assumes. The grammatical permissions are already available. What is new is, principally, something made under those permissions.

Try the corresponding maneuver with a preposition. Announce at breakfast that you have invented another one. Decline to explain it by substituting a familiar phrase, since that would rather spoil the demonstra-

tion. Expect everyone to infer which relations it expresses, which constructions admit it, where it belongs, and what happens when it meets the rest of the grammar. You will discover that the language's enthusiasm for entrepreneurship is unevenly distributed. The noun department is expanding. The preposition department would like to know who let you into the building.

Yet a closed class is not a dead class, and a finite inventory is not a finite capacity. A small set of grammatical elements can participate in indefinitely many expressions. That familiar fact is only the beginning of the puzzle. The more consequential question is how such elements acquire new combinatorial powers: how an old piece comes to mark a relation it did not previously mark, how several pieces establish a reusable construction, how the language gets another operation without first getting an obviously new word. A census of the vocabulary may register nothing unusual while the machinery has changed underneath it.

The proposed geometry places these two productive regimes in one picture. Outward, there is room to add distinguishable lexical objects. Inward, the identities of existing objects become increasingly implicated in relations, patterns, expectations, and habits of combination. At the center, a little material may do a great deal of

organizing. The apparent poverty of the inventory conceals the density of the activity. A vocabulary list is a particularly bad instrument for observing it, rather as a list of the ingredients is a bad instrument for observing dinner catching fire.

This is why particles are such useful things to stare at. They make some of that activity visible without requiring the observer to reconstruct a thousand years of linguistic history. The pieces are still recognizable as pieces. You can watch them refuse one combination, tolerate another, lend a faint suggestion to a third, and belong so thoroughly to a fourth that asking what they contribute separately begins to feel like asking which individual has supplied the meaning of a handshake. Their smallness is not the interesting fact. Their manner of participating is.

The center, in this picture, is not a little room containing the rules of English. There is no committee there, and certainly no ninth-grade teacher operating a very small telescope. It is a concentration of transformations: places where familiar material stops merely contributing its own meaning and begins to alter the terms on which other material can mean. The particle zone is the productive middle of the language. Its characteristic

output is not another object for the dictionary. It is another possibility for the grammar.

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Move toward the center and watch what happens to a word's address. Farther out, you can identify it fairly well by asking what it names or describes. Its semantic commitments distinguish it from its neighbors. Bring it into a recurrent construction and some of those commitments become negotiable. A feature that once belonged to the word's ordinary description of the world begins to operate on a much wider range of situations. Keep moving inward, and increasingly you need to know what surrounds the element before you can say what sort of contribution it is making.

Distance from the center is therefore not word length, and it is not importance. A long auxiliary construction may be more central in the relevant sense than a short, vividly descriptive noun. Nor is the center simply the part used most often, although repetition gives linguistic material many opportunities to become familiar in particular surroundings. The radial coordinate, so far as a verbal picture can supply one, concerns the balance between relatively independent descriptive content and construction-dependent grammatical work. It

measures a change in where an element's explanation has to be sought.

That distinction matters because there is a tempting but disastrous way to draw the galaxy: meaningful words outside, meaningless words inside. It gives a satisfyingly dramatic black hole and a thoroughly inadequate account of language. A grammatical element can tell you whether something happened, might happen, must happen, or did not happen. Calling such contributions meaningless because they fail to resemble the meaning of an elephant would be a fairly severe case of taking the elephant as the measure of all things. Grammar does not become inconsequential when it becomes abstract.

What gets compressed is a certain kind of semantic self-sufficiency. An element becomes less able to insist on the full conditions of its former independent use. Some of its descriptive detail recedes; the construction supplies more of the interpretation; distinctions that belonged to its source domain become available elsewhere. It has not necessarily become less informative in the sentence. Its information has changed its manner of residence. You can no longer reliably find all of it by looking in the little box assigned to the individual word.

Generality by itself does not put an item at the center. The noun "thing" can have an extravagantly permissive range of reference while still filling an ordinary lexical position. It does not thereby organize the surrounding expression as an aspect marker does. A vague description and an abstract grammatical operation are different accomplishments. What makes the central material interesting is the transfer of responsibility: less insistence on describing a particular kind of content, greater involvement in determining how content elsewhere is related or construed. The center is a concentration of structural leverage, not simply a shortage of detail.

There are consequently two movements to keep in view. The element can shed conditions that would restrict it to a particular descriptive task, while the constructions in which it participates acquire a wider range of possible applications. Its semantic compression and its functional reach are measured in different respects. There is no contradiction in their moving in opposite directions, but neither is their connection automatic. The intervening work is done by the constructions that recruit the material. An element's diminished insistence becomes productive when an arrangement can make use of the freedom.

This is the sense in which the geometry approaches a singularity. The closer the material comes to thoroughly constructional functioning, the less well the original coordinates describe it. Independent word meanings cease to be sufficient units of explanation. The question "What does each piece mean?" still has a perfectly respectable grammatical form, but the object under examination is no longer obliged to furnish a separate answer for every piece. A perfectly good question has arrived somewhere it does not entirely belong. English allows this to happen quite frequently and does not provide signage.

The singularity is a limiting image, not a claim that language contains an actual point of infinite density. The productive region is the crunching zone around it: material being brought into relations that change its available functions without necessarily erasing its identity. Here the galaxy metaphor becomes useful in a more specific way. The center is not merely an emptiness into which meanings disappear. It is an active region whose transformations can affect the structure of everything farther out.

There cannot be only one coordinate. Two items may be equally dependent on their constructions and differ completely in how tightly they are bound to other

words. Another pair may resemble each other in semantic abstraction while differing in how readily they enter new combinations. Positional mobility, phonological reduction, semantic independence, and productive reach need not advance in formation like a well-disciplined little grammatical army. The galaxy has thickness. Flatten it into a single line from "word" to "grammar" and several of its inhabitants will immediately appear to be in the wrong place.

A particle, then, need not sit halfway along one universal itinerary. It may be close to the center in one respect and comparatively peripheral in another. It can retain an ordinary spatial use while participating elsewhere in constructions that have almost nothing spatial about them. The relevant location belongs to an element in a pattern of use, not immutably to a spelling. A word can have more than one address. This is inconvenient for filing systems but rather convenient for words.

The name "particle zone" consequently identifies a region of activity rather than a newly fortified part of speech. Its inhabitants need not pass a single examination for membership. What matters is their participation in the conversion of inherited material into reusable grammatical relations. Similar work can occur with different degrees of separability, different histories, differ-

ent formal equipment. The shared geometry lies in the relation between material and function, not in a requirement that everything look like an English particle when photographed from the correct angle.

Even "zero-dimensional" has to be read in that spirit. It describes the relaxation of an element's insistence on its own particular semantic coordinates, not an achieved state of absolute nothingness. Absolute nothingness would be an unpromising grammatical resource. You could already obtain as much of it as you needed by not speaking. The interesting condition is compressed determination: less independently specified content, but a surviving structure of tendencies that can be recruited by a construction. A small amount of inherited orientation can guide a surprisingly large range of new uses.

The force of the proposal lies in putting these facts together. Centrality is a mode of involvement, not a synonym for emptiness. Compression concerns the reorganization of semantic responsibility, not the destruction of all information. And the productive zone is a volume of possibilities, not an intermediate drawer into which the grammarian can sweep whatever failed to fit the other drawers. The drawer does not explain why

its contents keep making new things. The geometry is intended to.

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Two small words arrive beside one another. Nothing looks especially momentous. Neither has been invented, both have respectable histories, and the sentence is proceeding at the usual speed. Nevertheless, their meeting permits an interpretation that is not quite the one either would have imposed elsewhere. The listener understands it. The construction is used again. Something about the relation becomes available to be heard on the next occasion. There has been no public announcement, but a little of the work has migrated from the separate pieces into their arrangement.

That migration is what "crunching" is meant to make palpable. The pieces do not simply sit next to one another with their meanings intact, each contributing its allocated spoonful. Their repeated combination can change what counts as a contribution. A feature of one element is selected by the other; an inference initially supplied by the situation becomes increasingly associated with the expression; the whole begins to invite an interpretation that the constituents, consulted separately, would not completely authorize. Under suffi-

cient pressure from use, an arrangement starts acquiring a history of its own.

The pressure is not a mysterious grammatical force added to the explanation after everything else has been explained. It is the ordinary insistence of contexts, repetitions, expectations, analogies, and successful acts of understanding. Speakers need to get something across. Listeners need to decide what was gotten across. A sequence that repeatedly helps them accomplish this can become familiar as a sequence. Familiarity makes it easier to retrieve the pattern without rebuilding every part of the interpretation from the ground up. A local accommodation begins to look like an available way of speaking.

The ingredients need not all come from the lexical outskirts. This is crucial. A picture in which full words fall inward, lose their meanings, and emerge as finished grammatical markers would describe only one route through the system. The central machinery is not merely a destination for retired lexical items. Material that is already grammatical can participate in further recombination. A particle acquires a partner. A familiar arrangement starts doing another kind of work. A pattern that already regulates one relation becomes the

basis of another. The center can work on its own contents.

There is no requirement, either, that the pieces physically fuse. Compression here is not a demand that the printer remove the spaces. The relation may become tighter while the words remain separately pronounceable, movable, even interruptible. Conversely, forms that have fused can retain productive lives. Orthography is entitled to record a decision about spaces; it is not entitled to settle the entire ontology on that basis. The interesting question is where the interpretive work is being done and how that work becomes reusable.

Semantic bleaching, viewed from this angle, is a part of the process rather than a sufficient explanation of it. Losing a specific meaning does not by itself create a useful new function. The emptying has to occur in relation to something that gives the material another job. A word does not become an aspect marker by spending a weekend meaning less. It becomes available for aspectual work through patterns in which its inherited meaning can be generalized, redirected, or partly displaced. What disappears and what becomes possible have to be understood together.

Consider only the spatial insistence of "up." As long as an expression must specify upward movement, an

enormous range of possible uses is excluded. Once a construction can recruit something from that orientation without requiring literal ascent, the element has room to participate in other kinds of organization. But the release is guided. It does not follow that "up" can mean absolutely anything, nor that every listener will understand whichever private completion of the theory the speaker happens to prefer. The inherited associations and the established constructions continue to shape what can plausibly be heard.

This is a particularly economical form of novelty. The expression can be new while much of the listener's means of interpreting it is old. Enough resemblance remains to make a route through the unfamiliar combination. Enough has changed to let the route arrive somewhere else. The zone's productivity depends on this combination of continuity and relaxation. Perfect preservation would leave the new use tied to its original conditions. Perfect erasure would leave the listener with nothing to go on. Neither extreme explains why an unfamiliar arrangement sometimes feels immediately intelligible.

Calling the process compression therefore does not require a literal conservation law for meaning, as though three units of spatial semantics could be

squeezed into two units of completion and a small quantity of heat. Meaning is not a substance being weighed before and after the experiment. The image concerns a change in organization: individually describable material becoming the vehicle of relations that exceed those descriptions. Something that had been a contribution inside the expression begins to shape the interpretation of the expression. The same visible pieces can now support a different distribution of work.

And the result need not yet be a finished rule. It may be a family resemblance that speakers can extend, a preference for one interpretation, a slightly more insistent directive, a construction with an opening into which other words can fit. The grammatical novelty may arrive as a tendency before it arrives as a category. Waiting until it can be given a clean label is rather like waiting for the smoke to develop a postal address before acknowledging that something is burning.

This is the sense in which the particle zone can be called the production engine of the non-open classes. The engine does not solve their relative closure by making them secretly open. It creates new functions, new combinations, and sometimes new members through the resources already caught in their relations. A gram-

mar can become richer without first acquiring a conspicuously larger inventory of grammatical words. Its center produces by reorganizing what the inventory can do.

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Now imagine the newly established pattern reaching another verb. The encounter is possible because the pattern no longer belongs exclusively to the circumstances in which it first became familiar. It carries a little reusable expectation. The next verb supplies different lexical material, and the same expectation organizes that material in a recognizably related way. A local achievement has acquired range. Something produced near the center has begun to travel outward.

That is the radiation. The term does not require words to shoot across the page at the speed of light, although anyone who has tried to follow certain conversations may consider the possibility worth investigating. What spreads is a permission, a bias, a relation, a way of construing material. The central transformation has created something that can be applied beyond the combination that sustained it. It radiates because other expressions can participate in its organization.

The contrast with ordinary compounding is now especially clear. A compound gives the language something else it can name. A reusable grammatical pattern can give it something else it can do with an expanding range of names and descriptions. The innovation is not confined to the item that first displays it. Its consequences can propagate across material that already exists and material that has not yet been invented. A small central change may therefore affect an enormous periphery. The reach belongs to the operation, not to the physical size of its exponent.

The relation between center and edge is consequently reciprocal. The periphery supplies new lexical situations in which grammatical resources can be used. Those uses can stretch, reinforce, or redirect the resources. The center supplies patterns that make new peripheral combinations interpretable. Their successful use gives the patterns additional footholds. There is traffic in both directions, and the output of one round of activity can become material for another. Language does not manufacture its infrastructure once and spend the rest of history decorating it.

A newly conventionalized construction can also become an input to further crunching. What was once an outcome is now a familiar unit, available to enter a

larger arrangement. Its internal relations may become less salient while its relation to something else becomes more important. The scale of the material has changed, but the geometry of the operation can recur. Little structures become ingredients in larger structures that may themselves acquire compact functions. The central engine is capable of feeding on its own products without waiting for fresh deliveries from the noun department.

This also helps distinguish a route of historical change from an active source of present productivity. One can trace how a particular form acquired its current function. That gives a trajectory. One can also ask why a currently available family of forms supports a combination nobody has encountered before. That gives a productive configuration. The particle-zone hypothesis concerns their connection: how configurations generated through use can remain fertile rather than merely harden into a record of what happened. Its object is both the path and the conditions under which traffic continues along it.

An item need not complete its journey for the region to do useful work. It can remain multiply usable, participating in ordinary description here and grammatical modulation there. It can settle into several constructions with different degrees of dependence. The lan-

guage need not choose a final identity for the spelling. A long residence in the zone is not necessarily a delay awaiting repair. The open range of possible affiliations may be precisely what makes the material worth retaining there.

Some outcomes will, of course, become comparatively fixed. A combination may become a lexical item whose interpretation has to be learned as a unit. Another may establish a highly regular grammatical operation. These are different kinds of stabilization. The latter can remain tremendously productive even when its form and function are no longer especially indeterminate. Regular morphology has not ceased working merely because it has become regular. A factory and a machine produced by the factory are both allowed to function. Confusing their kinds of productivity would make the whole economy difficult to describe.

The central engine is therefore not the claim that only half-formed things can be useful. It concerns the production and renewal of operations, including operations that subsequently become stable. The distinction is between the ability to apply a settled pattern and the activity through which patterns acquire, extend, or redistribute their functions. The two can coexist within the same construction. A form may be completely con-

ventional in one respect and still available for creative pressure in another.

The astronomical picture has to remain a circulation rather than a funeral procession. Nothing in it requires all linguistic material to fall permanently inward until English ends as a single unstressed syllable of infinite grammatical authority. Some material becomes lexicalized. Some remains available for new constructions. Some loses old uses while gaining others. Some simply stops being useful. What matters is that the central zone can transform local interactions into resources with a reach beyond their point of formation.

The periphery expands through the availability of positions into which new words can enter. The center renews the repertoire of relations in which those positions participate. One produces new occupants; the other can alter the possibilities of occupancy. This is not an absolute partition of every linguistic innovation. It is a distinction between productive movements that can be intertwined in one expression. From a sufficient distance, the galaxy can look as though it is merely getting larger. Look toward its middle and some of the growth turns out to be a change in how it holds together.

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From close up, the galaxy disappears into its neighborhoods. There is this particle in this construction, that prefix attached to those verbs, a familiar sequence beginning to sound natural in a new setting. None of the inhabitants needs to know where the center is. The center is a property of their relations viewed together. What looks like one active region from a distance may consist locally of many small sites where inherited material is being made to support another function.

This prevents the central metaphor from smuggling in a central controller. The machinery does not have to know what the language needs, and the language does not have to dispatch a particle to address a shortage of aspect. No one is sitting under the galaxy with a clipboard. A use has to work in a particular exchange. Its availability elsewhere depends on what other speakers can recognize, repeat, and extend. The larger organization can arise from those local accommodations without being represented as a plan by anyone making them.

The shape would consequently be uneven. Certain routes between meanings would be well traveled, certain regions densely connected by analogy, certain combinations unexpectedly isolated. Historical affili-

ations would matter. Two elements that look equally abstract might invite very different extensions because they bring different inheritances and belong to different established families. The center is not a universal blender that removes the identity of every ingredient and serves the same grammatical soup. Its productive possibilities retain the marks of what has been drawn into it.

One can imagine the unevenness as curvature. A small change along a familiar constructional route may be easy to understand; an apparently comparable change elsewhere may require the listener to invent an entire interpretation on the spot. Equal movements on the printed page need not be equal movements through grammatical space. Replacing one short particle with another is physically cheap. It may be interpretively enormous. The distance between expressions is determined by the available paths of understanding, not by the number of letters that have changed.

This is also why a region can be real without possessing a neat fence. Speakers can be sensitive to clusters of possibilities, affinities among uses, and differences in the ease of an extension without consulting necessary-and-sufficient membership conditions. A grammatical category can be useful as a description of a dense and

relatively stable region. It becomes misleading when its boundary is assumed to be the thing that produces the region's behavior. Drawing a line around a neighborhood does not explain why people keep meeting there.

The ordinary parts-of-speech picture favors objects that can be assigned addresses once. The galactic picture favors configurations, routes, and concentrations of activity. It can therefore make room for the possibility that some apparent categorical indecision belongs to the grammar itself. An element may work because several affiliations remain accessible, with the construction recruiting one tendency more strongly than another. Forcing an exclusive identity onto it would not clarify the available possibilities. It would remove some of them from the description.

But indeterminacy alone is not the engine. A completely obscure expression is not automatically a promising site of grammatical innovation. The crucial combination is flexibility with recoverability: enough freedom for the material to enter a new relation, enough structure for someone else to understand what has happened. The geometry is constrained by the requirement that a path can be followed. There may be several plausible paths through a construction; there cannot

be no path at all and still be an ordinary success of communication.

Nor is the proposal exhausted by the observation that a small inventory can generate many combinations. The alphabet does that quite happily. The problem is how combinations acquire organized functions that can themselves become available for further use. A huge number of possible strings does not give a language a new way to mark completion or shape a request. The particle zone concerns the transformation of combinatorial possibility into interpretable, repeatable, extensible organization. Its productivity has to be observed at the level of operations, not merely permutations.

That gives the image a substantive commitment. If the zone is genuinely an engine, its character should show up where new grammatical uses become possible: in the relations between residual source meanings, established constructions, and the extensions speakers find intelligible. The most revealing cases would be ones in which the inventory stays put while the range of functional possibilities changes. Counting novel forms would miss them. Looking only at established categories would catch them late. The relevant evidence would lie in how familiar pieces begin to support a pattern that can travel.

Different formal arrangements could exhibit that geometry without becoming the same grammatical category. An independently written particle and a bound marker need not be made identical in order to compare the work their constructions perform. Their positions would be specified along several dimensions, including the kinds of semantic modulation available and the constraints on further extension. A shared region is not a claim of identical coordinates. That is the point of having a space rather than a box.

The image remains a proposal about organization, not a completed mathematical model with distances already measured and an obliging arrow labeled "you are here." Its value would lie in directing attention toward a relation that static inventories obscure: the relation between a class's resistance to new members and its capacity to generate new functions through the interaction of old ones. The apparent closure and the internal activity are not contradictory. The closure concerns admission. The activity concerns what happens among those already inside.

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Someone invents a noun, and the novelty can be pointed out immediately. There is the new form; there is roughly what it names. People can argue about whether it is necessary, ugly, useful, or a sign that civilization has become impossible to continue. The event arrives in a form that is easy to notice. A grammatical innovation made from familiar material can be less conspicuous. You hear the words, understand the expression, and fail to register that the relation among them has shifted. Nothing individually unfamiliar has demanded your attention.

The asymmetry of visibility helps explain why the outer arms so readily stand for linguistic creativity as a whole. Coinages have edges. They can be quoted, collected, mocked, advertised. A new constructional possibility may be distributed across a family of uses before anyone has an economical way to name it. Its novelty is in the participation of the pieces rather than their mere presence. You can be using a changed relation while confidently recognizing every object involved in it.

Near the center, then, successful novelty can look uncannily like familiarity. The listener understands because enough of the inherited organization remains

available. The speaker can try the extension because it does not require the listener to begin from nothing. What makes the change possible also helps it pass without ceremony. An operation begins to acquire range, and the visible vocabulary remains almost offensively ordinary. After all this activity, the language may still appear to be saying "up."

A particle in that region is small in rather the way a hinge is small. Measuring its contribution by how much it describes independently will not tell you what the surrounding structure can do because it is there. The analogy is imperfect—a hinge is manufactured for a settled purpose, while a particle can participate in several evolving arrangements—but it catches the change in scale. A tiny piece can matter through the movements it permits elsewhere. Its productive importance is relational.

The galaxy is sustained by both kinds of work. It needs distinguishable lexical material, things that can be named and acts that can be described. It also needs ways of bringing that material into relations that speakers have reason to express. Its periphery is not frivolous, and its center is not sacred. The distinction is geographical rather than hierarchical. What appears trivial about open-class productivity is only the availability of the

route by which another member enters. The uses to which people put those members are another matter entirely.

The harder-to-see activity lies where the permissions themselves remain susceptible to use. Here a closed inventory need not be a sealed architecture. The same elements can enter altered relations; an altered relation can become familiar; familiarity can support an extension; the extension can establish another resource. These movements need no moment at which the whole language stops and installs a new grammar. They can occur within the very arrangements they are gradually changing.

Seen at that scale, the particle zone is neither a heap of troublesome exceptions nor a waiting room for forms that have not yet acquired proper grammatical identities. It is the active middle: material carrying histories into new relations, relations acquiring repeatability, repeatable patterns reaching outward into more of the language. Compression is the weakening of separate identities under constructional pressure. Radiation is the spread of the possibilities thereby produced. The engine consists in their connection. Farther out, a new word appears. It finds places already available to it and begins entering sentences. Somewhere nearer the

middle, two old pieces have acquired a way of working together that they did not have before. No new light is added to the inventory. But the next thing that arrives can move differently because of it.

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