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Greek Temple and Greek Brain

We all know that when we look at a building with our eyes, we are also seeing it with our heads. This is why when we look at a Greek temple, we cannot do so without seeing it in terms of our preexisting knowledge of its conventional attributes. These include its underlying schemata, as represented by its proportions and measurements; its embedded history, as represented by the wooden origins of the Doric order; its construction out of a collection of elements, such as base, column, and capital, or echinus, dentil, and torus; and even the analogies with which it is associated, such as that between the column and the human form. Confronted with a Greek temple, we see it in terms of numbers and origins, names and correspondences. Most of these have entered our heads from books, typically in the form of words.

This situation is not surprising. We are used to believing that most—and certainly the best—knowledge is formulated and transferred in verbal form, and we are used to thinking of our heads as large libraries full of information stored in booklike repositories. Of course, we all realize that our heads are also filled with visual information, but this we also imagine typically as illustrative material accompanying the booklike compendia of information. This is why even visual knowledge is organized verbally. When we think of buildings, we think of names, places, and dates, to which are attached ground plans, facades, and interiors, to which are attached in turn such labels as capital, volute, cyma recta, and so on. We represent such knowledge verbally for good reasons. The founders of our mental tradition, the ancient Greeks, used the term for *word, logos,* for thought too. Since the ancient Greeks, we are accordingly all predisposed to believe that we think best when we think in words. Numbers, of course, and diagrams are also allowed, but these are only respectable because, like words, they constitute a mutually agreed recordable schematization of experience. Words, numbers, and diagrams are what we have in our heads. We think in these

terms, and when we think about a Greek artifact, such as a temple, it is also in these terms. We are even proud of doing so, because we believe that we are then most in tune with the most famous Greek artifact, the Greek mind. This pride is appropriate, but only when *thinking* of a Greek temple is concerned. Where we go wrong is in *looking* at Greek temples in the same terms. When we look, we would be wise to try to look not with a Greek mind but with a Greek brain.

To think of looking in terms not of the mind but of the brain has several advantages. The most obvious is the prima facie one: that it brings us closer to the specifics of real experience. When we talk of the mind, we are necessarily talking in terms of the conventions of a long tradition. When we talk of the brain today, we are able to talk in terms not just of conventions and assumptions, but of the functioning of neural mechanisms. It is in these terms that this chapter will operate. The basis of its argument is that any study of the human mind and its activities that is undertaken now should move beyond the conventional language used to describe mental activities to take account of what has recently become known about the detailed workings of the brain. If we take advantage of that knowledge, it should be possible to develop new hypotheses that are more precise and more testable than any obtained earlier.

The knowledge I am referring to is that obtained by neurologists, neurobiologists, and neuropsychologists using techniques of experiment and observation available only recently. Among the most important of these techniques are those involving the implanting of electrodes into the neural networks of animals and the scanning of the human brain to observe the differential absorption of oxygen. These techniques have allowed the identification of the functions of particular neurons and groups of neurons and an understanding of the laws governing their growth and decline. Techniques such as these have made it possible to establish, for example, that the brain is only about 50 percent formed at birth, its subsequent development being fundamentally shaped by postnatal experience. Although the genes already determine much of the brain's structure, especially that of the stem, that of the cortex will be determined largely by subsequent interaction with the environment. The use of particular motor or sensory organs will stimulate the growth and interconnection of particular neural networks in particular ways. Often there is a latent propensity that must await precise activation after birth. An obvious example is the propensity to learn what is desirable and undesirable. The brain has lower areas such as the parietal lobes and amygdala that are solely concerned with helping us to have a positive response to some things and a negative response to others.[1] What these things are has to be determined by other upper and outer areas concerned with cognition. Some responses, such as the taste for sweet things or attraction to the opposite sex, are largely genetically prescribed, but others are not, such as the determination of which humans or other large animals might be

friendly or dangerous, which plants might be nutritious and which poisonous, which raw materials useful and which not, and even which tool shapes are more effective and which less.

Equally familiar is the way we acquire speech. The tendency to babble is genetic, but the languages we learn will be determined by early experience. That we learn languages most easily when we are young is a clear indication that such learning is made possible by associated neural development. Just as significant, though much less obvious, is the fact that in other fields, such as looking, our brains are predisposed at birth to develop neural structures in a process of often passive interaction with our environment.[2] This means that such apparently inconsequentially variable aspects of our environment as climate, landscape, flora, and fauna will critically influence the formation of our brains. Depending on whether we live in a desert or a snowfield, a tropical jungle or a temperate city, on a small stream or the sea, our neural networks will be different to some extent. In the case of the visual cortex, the neurons that deal with the analysis of such separate elements as color or line, or with the convergences of feature recognition and categorization, will be stimulated in total different ways and consequently will grow and connect in totally different patterns, with the result that our basic sensory discriminations and the knowledge on which they are based will be equally differentiated. At the same time this passive process is powerfully influenced by much better understood factors such as language, social habit, and training. Finally, while many of these tendencies lead to members of the same group having similarly formed brains, others, such as the brain's tendency to be affected by intimate emotional relations, ensure that each person's neural development is also profoundly influenced by experiences that are specific to the individual.

The fundamental point that emerges from all this is that some aspects of our brain are shared with all other humans; some are shared with all who live in a similar place at a particular time, or by all who share an instrument of social formation such as a language, religion, or family; and some are unique to ourselves. This is true of both the structure of the brain and the information it contains, since the latter is directly influenced by the former. This is why, if we are going to understand what goes on inside our heads, we have to know what goes on inside our brains, and if we are to understand the role of the brain in the control of behavior, we have both to understand our genetically determined drives and to familiarize ourselves with each individual's or group's social and natural environment. Understanding such differences enables us to understand why the temples in our brains are different from those in the brains of ancient Greeks.

What then were they like, the temples in the brains of those who built them? I argued some time ago that if they were like anything, they were like phalanxes, that is, rectangular formations of armed warriors, and I am now prepared to refine this hypothesis by drawing

on the new knowledge of the brain's role in perception.[3] It follows from what has been argued above that if we are to understand what the Greeks saw in temples, we have to ask what they saw in general, that is, what they perceived and how it engaged them. Before proposing answers to these questions, we should remind ourselves of the ground rules we need to observe and of their consequences.

We have to start by rebuilding our assumptions about the Greeks. The first step is to abandon a notion, implicit in the term *Greek* itself, that the principal mental community of the people who built these temples was linguistic. They did share a language, but language was only one of the things they shared. They also shared physical activities, rituals such as the Olympic Games, and other social activities, such as drinking. Most important, they shared the experience of a similar geography—the land, sea, and sky and all that was in them. In particular, associated with their shared experience of geography was a shared experience of raw materials—of stone, clay, metals, and wood—to which the biochemistry of their brain stems ensured that they paid particular attention because they were vital to their survival. The Greeks shared a language, but they also shared an experience of the natural and social environment, of the body and of society, of activities and of materials.

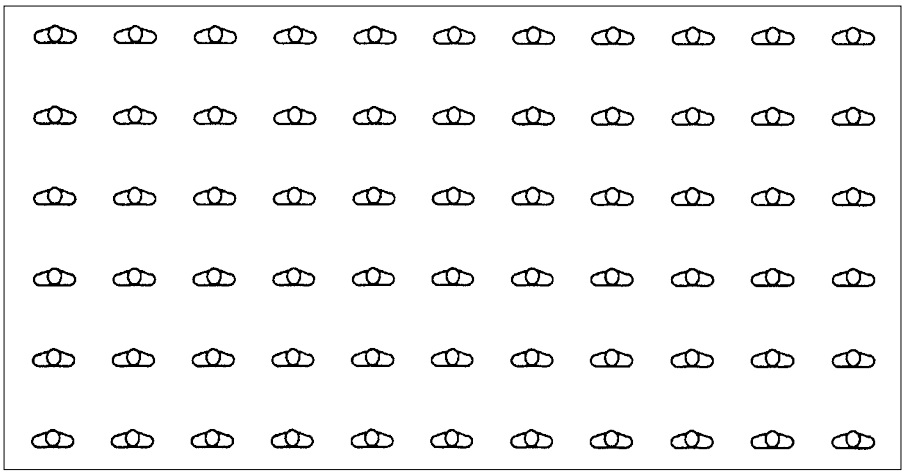
Language had a much less important role in their mental formation than we, who know them best by their books, are apt to think. Much more important would have been other shared experiences. These could be natural: a landscape of fertile river valleys flanked by rocky mountains; a surrounding that was alternately life sustaining when it allowed fishing or trade and life threatening when it brought an enemy fleet or storms; a climate that brought a series of changing temperatures and humidities and alternating waves of sun and rain that could be either beneficial or destructive. They could also be man-made, especially those man-made things that gave them pleasure when they were their own and pain when they were their enemies'. These included such essential elements of the food supply as cornfields, vineyards, and olive groves; such essential elements of the craft system as potters' wheels and pots, forges and metalwork; such essential elements of the trade system as the appurtenances of shipping, ropes, sails, and planks; such essential elements of the defense system as soldiers and ships, especially when arranged in formations as armies and fleets; and such essential elements of city life as walls, streets, agoras, and temples. These were the things that most engaged the Greeks visually, and so it was these that were likely to have an important place in their brains.

It is necessary to say "likely" because we must remember that depending on habitat or activity, each Greek would have his or her own preoccupations. For each tradesman, for example, some things would have a greater importance than others. A farmer, potter, smith, or sailor would each have a greater concern with the forms and materials on which their

livelihood depended. Equally, communities that consisted more of potters or sailors would each share diverse preoccupations. The same would be true of communities living in different natural environments—in the mountains, on a plain, on the coast, or on an island. In each case the preoccupations would actually affect the formation of the brain. Thinking of the Greeks as similar because they shared a language through space and time leads us to forget the extent to which the experiences they had were different depending on place and period. Although the part of the brain concerned with language, and especially grammar, would have a similar formation through time and space, other areas would be much more highly differentiated.

This is not to deny the role of language in the formation of Greek culture, only to redefine it so as to make clear that one of its original and principal functions was precisely to facilitate the sharing of mental experiences that were preexistent and neurally constituted. Thus, the myth about the Greeks descending from a race born from the stones thrown over their shoulders by Deucalion and Pyrrha was invented and accepted only because of the prominence of stone in the Greek landscape, which is such that those who lived there acquired a natural empathy with it. Other myths result from the correspondence between critical experiences in different fields. Thus, the myth that the Thebans descended from men who grew from sown dragons' teeth was possible only because the Greeks were used to giving particular attention to three similar phenomena that were particularly life saving or life threatening: the sight of men lined up in rows for warfare and military training, the sight of rows of corn grown from rows of seed, and the sight of the most deadly threat in the animal world of the Greeks, the rows of teeth in a snake's mouth. It was the brain's genetically driven predisposition to pay attention to things that secured or threatened its survival and its tendency to form neural networks specializing in phenomena in this area that led to the development of a tendency to see convergences in the appearances of these very different sets of objects. It was a series of linkages between the neurons in the visual cortex and other areas essential for cognition that put them together. All that the inventor of the story did was render the convergence visible. All that his words did for his listeners was to make a shared unconscious mental experience conscious.

While the creators of myths help to shape communal culture, other users of language give more objective and private views of it in operation. Thus, the clearest statement on the linkages between the Greek brain and the Greek eye around 600 B.C., when the Greek stone temple became established as a type, is provided by someone who was a clever psychologist, if not a neuropsychologist, Sappho. In a poem celebrating the simple power of sexual love, she mockingly reminds her contemporaries how distorted their visual interests have become: "Some say the most beautiful thing in the world is an army of horsemen, some say



3.1
Scheme of the phalanx.
(Martha Montgomery)

an army of foot soldiers, some a fleet of warships . . . but I say it is one's beloved."[4] Without understanding the mechanisms that underlie the phenomenon she is observing, she is able to point out how the Greek brain has been so modified by experience that the neural connections between the eye and the base of the brain, which normally function to focus our attention on the object of sexual desire, have become so modified that the object of supreme desire is not a human individual but a formation of cavalry, infantry, or ships. In noting "some say this" and "some say that," she may even suggest a realization that the different abnormal preferences she notes relate directly to the critical experience of particular groups. Those, like the aristocracy, who relied more on horses, might most desire to see cavalry; those, such as the newly important middle classes whose critical role was as hoplites or foot soldiers, infantry; and those, such as traders and sailors, who depended more on ships, the fleet. She is certainly likely to have known that, increasingly, the most important common element of the defense system of all Greek states was the infantry, more particularly the phalanx, whose sexual desirability is shown by its illustration on a vessel such as the Macmillan aryballos, used to contain the perfumed oil with which young men anointed themselves after exercise. This indeed we might have predicted on the basis of the laws of neurology. Since the thing, the sight of which brought most pleasure deep in the center of the brain of most Greeks, was the infantry formation or phalanx (figure 3.1), it was this that becomes an object of almost sexual fixation.

At this point we have to remember exactly what sight involves. The eye does not, of course, see either soldiers or a phalanx. What it does is feed signals to networks of neurons in the brain, each specialized in its own task of feature detection, pattern recognition, or

the response to such separable elements as vertical lines, horizontal lines, color, the face, the body, an emotional expression. These neurons are connected to others involved with classification and other cognitive activities, and these are in constant contact with the base of the brain. If classified as beneficial, they provoke a positive, if as dangerous, a negative, response. It is in the nature of vision that anything that generates signals that are sufficiently similar to those that would be generated by something genuinely dangerous or attractive is likely to generate the same cognitive response in the cortex and chemical reaction in the base of the brain as the real thing. Something that has sufficient visual properties in common with something desired or feared may elicit a similar response. The best examples of this phenomenon are the responses evoked in the human being by highly reduced representations. Dolls, for example, can give almost the same pleasure as babies, and pin-ups can give almost the same pleasure as real members of the desired sex. Indeed any painted and sculpted representation may evoke almost the same positive or negative response as the thing represented. Less known, though frequently exploited, are the responses evoked only subconsciously by a vast number of other objects in the human environment, of which the car as woman and the car as animal are among the most familiar, having long been exploited by designers. More significantly in the present context, the same phenomenon also lies, I would argue, behind the development of the Greek temple.

My core argument is this: that when the Greeks began to build temples to their protective deities, because they looked to them for defensive properties that they believed were secured by the phalanx, they tended to strengthen in them those phalanx-like attributes that were already emergent, because that made them feel good. For the citizens of the valley towns of Greece, to whom the need for military training was increasingly apparent, it would have been easy to see a rectangular house as having a similar configuration to a rectangular phalanx and a post or column a similar configuration to a standing warrior. The more the temple was lengthened and the more it was surrounded by aligned identical supports, the more of a positive phalanx-like reassurance it would have produced. These first temples with their brick walls and wooden posts were built in the eighth and seventh centuries B.C., at the same time that the phalanx was beginning its development. Moreover, in the eighth-century B.C. text of Homer, not only is there a celebration of the phalanx in which the front rank is compared to a fence, with "shield against shield, helmet against helmet and man against man,"[5] but Pirithous and Leonteus are described as "tall oaks" standing before the gates of the Greek camp,[6] and Asius, as he dies, is compared to a felled oak, poplar, or pine.[7] Since the phalanx in question is made up of Greeks, and Greek too are Pirithous, Leonteus, and Asius, there is a clear sense that Greek soldiers could be thought of as vertical tree trunks, making it easy to see how a row of tree trunks or posts could be

3.2
Parthenon, Athens, 447–432 B.C., detail. (Photo: Agora Excavations)

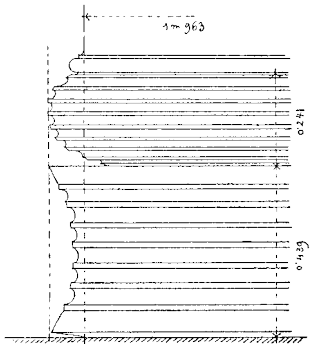
seen as having the reassuring properties of Greek soldiers. When they saw a soldier, they desired to see him as a tree, and when they saw a post, they saw something that embodied those properties. As a result, putting up posts in front of the deity's house gave a feeling of reassurance. Putting up a larger number increased that feeling. Posts all-round produced maximum reassurance.

Homer also compared the members of the phalanx to stones in a wall, and around 600 B.C. the wooden posts become stone columns. This change of material had advantages in terms of durability, but it too is likely to have been encouraged by preexisting neural conditioning. Given the way the Greek experience of their environment led to the formulation of the myths of Deucalion and Pyrra and of the Theban Spartoi in which they identified themselves with stones and regular hard objects such as snakes' teeth, the change from timber post to stone column had obvious advantages, improving as it did the match between what was seen with the eyes and what was desired or imagined in the brain. The new stone

colonnades also evoked even better an imagined phalanx. The demands of stone cutting ensured that the buildings were now in themselves more disciplined in their geometry, the forms more standardized, and the edges of the blocks harder and sharper. For the generations after Sappho, obsessed with phalanxes in the same way that people in other places and periods were obsessed with sex, the tendency to increase their visual pleasure by increasing the correspondence was unconscious but remorseless.

This was especially true of the forms we now call Doric. The alignments became more rigorous, the disciplined uniformity of column and capital more insistent and precise, and the arrises between the flutes acquired more and more the look of the hollow ground blades of spear and sword (figure 3.2). The correspondence even affected the sculptural decoration. Homer compared warriors to lions, and those who noted the water gurgling out of the gutters, even as they looked in the temple for signs that they might protect them, easily imagined roaring. It was a small step for those who were also sculptors to turn the outlets into lions' heads. In the Olympieum at Acragas in Sicily, the assimilation between column and warrior was directly materialized in the alternation of half-columns and naked males. The Olympieum was erected to commemorate a military victory over the Carthaginians in the same way that the Temple of Zeus at Olympia and the Parthenon were erected to commemorate victories over the Persians. It is not surprising if these fifth-century B.C. buildings, which were erected to call to mind military successes, embody even more effectively the qualities on which victory was founded. Sparer, harder forms evoked the aesthetic of the armourer. In the Parthenon this was particularly emphasized by the introduction of marble as a new high-technology building material. Also in the Parthenon, the elaborate geometries of curving stylobates and converging columns recall the refinements of a parade ground performance such as might have been staged to commemorate and keep alive the uniquely disciplined flexibility of the Athenian phalanx, which had almost singlehandedly defeated the Persian masses at Marathon. Paid for out of the defense budget of the Delian League, commissioned by Pericles, the general who was head of the militarized Athenian state, home of the warrior goddess and decorated throughout with martial scenes, the Parthenon was a structure designed to fulfill the deepest dream of citizens preoccupied with military success.

The extent to which the images in the Greek brain now affected Greek vision is illustrated by Euripides in his *Iphigenia in Tauris,* performed below the Parthenon fifteen or twenty years after its completion in 431 B.C. In her nightmare, Iphigenia sees her ancestral house collapsing: "One column alone was left. . . . From its capital streamed golden hair and it took on a human voice' that of her brother Orestes . . . for the columns of a house are sons."[8] Euripides, like Sappho, knew how desire could distort perception. Just how deep



3·3
Temple of Hera at Samos, late sixth century B.C., column base. After Dinsmoor.

were the implications of the tendency to imagine people as columns and columns as people is apparent in the female figures who carry the porch of the Erectheum (421–405 B.C.) (figure 3.6) , a building even closer in date than the Parthenon to *Iphigenia.* It has long been recognized that the flutes of the girls' dresses recall those of the adjoining Ionic columns, and we now know why. The Greeks in a sense actually desired their sons and daughters to be like columns. They were even capable of seeing them as columns when they looked at them. By the late fifth century B.C., an Athenian was likely to see as a column any man or woman on whom he or she depended and could not look at a column without experiencing this vital assimilation. The extent to which this had all become a normative experience is documented by the Vitruvian story that the Doric and Ionic columns were derived from male and female figures. Although the underlying association may relate to a correspondence recognized earlier, the story itself is likely to be the product of a specific mental climate in fifth-century B.C. Athens, when anxieties led people to see the rising generations as columnar supports.

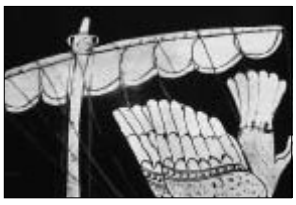
So far I have argued that all Greek temples have properties in common with the phalanx and that this is especially true of Doric forms. What, then, was it in the Greek brain that led to the emergence of the other set of forms, those now known as Ionic? We may remember that Sappho, writing just before Doric and Ionic became established, talked of people finding beauty in either a land army or the fleet, and it happens that the area where Ionic is most popular is one as much united by sea as the Doric area was by the land. Moreoever, Samos, the site of the first great Ionic building, was in the sixth century the greatest naval power in the Aegean. It cannot be claimed that the correspondence between temple and ship is as close as that between temple and phalanx, but there are clear similarities in the general configurations of a ship with its multiple rows of oars and a temple with multiple rows of columns. A subliminal association with a trireme might thus help to explain the otherwise puzzling Ionic preference for temples, which, more clearly than Doric ones, possess clear front and rear facades, the latter often with a central column. The single column at the rear, as in the earliest temple at Samos with its row of posts down the center, gave the temple plan an axis much as the keel and stern did a ship. Moreover, if the assimilation of Doric temple and phalanx explains why there are large steps all around, as if waiting for the columns to move in any direction, the placing of steps at one end on the Ionic suggests that it, like a ship, has only one "business" end. The beak on a Greek war vessel occupied a similar position in the ship's silhouette to the steps on the Ionic temple.

So much for the general configuration. What of the details? The principal element that is absent in Doric and present in Ionic is the base. The origin of the element in the architecture of the Near East is beyond question, but the particular form is totally new. The simple round molding of the torus, like the concave scotia or trochilus flanked by rectan-

3.4
Temple of Artemis, Ephesus, early to mid-sixth century B.C., capital.

gular fillets, are all plain moldings without ornaments. What did the Ionian brain see in such forms to get a positive feeling from them? The answer is probably pulleys and ropes. This is supported by the names of the moldings themselves. *Torus* regularly means knot, and *trochilus* is the Greek word for pulley (from *trechein,* a place for a rope to run in). No Ionic bases are more like pulleys than the earliest ones from Samos circa 560 B.C., with their convex and concave profiles marked by hollows that seem only to await the rope (see figure 3.3). The Samos bases were turned on a lathe, a giant version of the instrument that would have been used also to produce the best pulleys. Even the so-called Attic base with its splayed form running down to a fillet looks like one-half of a pulley or the flanged end of a drum, such as would be used to wind the ropes of rigging and anchor. Most torus moldings were smooth, but one form was decorated with a guilloche, a pattern deriving from the twining of fibers, one that could be a natural allusion to the surface of a rope.

As with the base, there is no doubting the origin of the Ionic capital in oriental leaf forms, and, indeed, in the Aeolic capital we have examples of the oriental form in a Greek context at the end of the seventh century B.C. What then is the basis for the transformation of the downturned leaves into the Ionic bolster, narrowing in the center and broadening at the ends, where tight spirals are seen on the faces (figure 3.4)? Something that possessed many of the same properties was a sail. Strengthened at the edges by a cord, it too when rolled up would be narrow in the center and fatter on the ends, and the ends themselves would present the appearance of a tightly rolled spiral. The round molding on the spiral would recall the cord on the end of the sail, and the similar rounded moldings, which are spaced regularly across the bolster, would recall similar cord reinforcements across the sail



3.5
Detail of ship from the scene of Odysseus passing the Straits of Messina, red figure vase, fifth century B.C. (After Pfuhl)

(figure 3.5). It is interesting that at Ephesus, where the earliest capitals survive from around 560–550 B.C., the moldings on the bolsters correspond exactly with the molding on the lower section of the base, and it is easy to see how a drum with ropes around it and a sail with ropes sewn in might present similar appearances.

The surprising tendency to transform a leaf pattern into something resembling a sail must have been greatly encouraged by the form's position at the top of a vertical element. The column has much in common with a ship's mast, and before the wooden form was turned to stone, the resemblance would have been all the greater. Indeed the sailors of Samos, who would have been more used to masts than to the palm trees from which the oriental capital form derived, might naturally have tended to see the leaves as sails and to give them saillike forms. There is no trace of the sail origin in the terminology describing the Ionic capital, but the Vitruvian *pulvinus,* "cushion," like the "bolster," which is its English translation, indicates that the form presented the appearance of a filled textile, and a rolled sail could be described as just that.

The argument advanced here about the origins of Ionic forms is not supported by any text, nor should one expect it to be. It is, however, either a happy chance or a silent confirmation that the first use by the Athenians of the Ionic form is in the stoa that they erected at Delphi to house and display the ropes and other ornaments taken from the Persian ships after the defeat of the Persians at Salamis in 480. The ropes, which perhaps lay behind the columns, might have related suggestively to the flangelike bases close by, and the lighter tackle is likely to have been stored in tight coils resembling the volutes. Forms, which had previously only been juxtaposed in the brains of the Ionian population, now lay beside each other on the stone platform.

The other main difference between the columnar elements of Doric and Ionic is in the flutes. As I already suggested, the Doric shallow flute and its sharp arris acquired its classic form because it recalled in a satisfying manner the hollow grinding that was necessary to make the sharpest spear or sword blade, the essential offensive instrument of the member of the phalanx. The mental pleasure that explains the popularity of the deeper rounded flutes of Ionic separated from each other by flat bands must have a different origin. The similarity of the flutes of the columns from the earliest temple at Ephesus to the moldings of base and capital suggest that all were felt to come from the same world, and the easiest explanation of the similarity would be that the flute recalls the negative images of ropes. Then, as now, drums may have been deliberately grooved to encourage the alignment of coils, and elsewhere on a ship, rounded grooves would have emerged anywhere where ropes ran repeatedly over wood. The sight of a flute that evoked the negative image of a rope, such

a vital piece of equipment in a maritime community, would always have given the brain pleasure.

In stressing that the Doric order was developed by people for whom the phalanx was the most important element of the war machine and Ionic by people for whom it was the trireme, I do not intend to suggest that these are exclusive cerebral obsessions. The common preoccupation with warfare was of universal and overriding importance, as is suggested by the detailed forms of both building types and the names by which they were identified. Typical is the echinus, the element at the top of the Doric shaft. This word is originally the designation of the hedgehog or sea urchin, and given its shape, it is probably a correspondence to the latter that is suggested. Whichever it is, the common element is that both animals are equipped with a spiny protective mechanism, which would fit well with a desire to see in the building to which it was attached a defensive function. The use of the term *dentils,* or little teeth for the beam ends of Ionic, would carry exactly the same implication. A more modern name for an Ionic detail and one that brings us even closer to the phalanx is the *egg and dart.* The word *dart* refers to a pointed element that by the Roman period does indeed take on the shape of an arrow or spear. This, however, is only the final stage of a series of transformations that go back to a molding that was originally a series of downturned leaves. The process by which the downturned leaves were slowly transformed by generations of sculptors is a perfect example of the way that what people have in their brain affects both what they see and what they make. Already during the sixth century, the pointed shoots have acquired ridges and a curved profile that gives them a threatening sharpness, and the soft leaves have hardened into convex rounded forms with metallic borders and this tendency continues in the fifth.

The most likely explanation for the transformation of innocent vegetation is that people who saw the leaves were in fact, as Sappho tells us, dreaming of phalanxes and saw in the pattern something like the series of shields and spears that Homer described. Unconsciously the carvers, who were also trained as soldiers in the phalanx, modified the leaves so that they looked enough like a row of spears and shields that they gave them the same pleasure. In some places, there was also a tendency to make the sharp elements look more like lions' claws, and this should not disturb us. Because when the Greeks looked at warriors, they desired them to be lions, there was no conflict between making the same element look both more like a row of spears and a row of claws. Both tendencies worked simultaneously to create the form we see on buildings like the Siphnian Treasury at Delphi, and, curiously enough, the molding there finds itself juxtaposed both with one of the best portrayals of a phalanx front with its alternation of spears and shields and with a marvelous

celebration of the destructive power of the lion's claw. Subsequently, as the lion lost its authority and weapons gained in theirs, the molding came to look more like a sequence of spears and shields, until in the Roman period this is what it could become. Even when the shield is not a full shield, the intermediate spike does acquire the barbs of a killing weapon, but there are cases when the shield too is fully represented. An assimilation, which had been subliminal for hundreds of years, at last became explicit. A continuous pressure in the imaginative faculty slowly turned soft leaves into the hard tools of war.

Why, if the assimilation had always been hinted at, was it never fully expressed until the Roman period, and then only once or twice? Probably the answer lies once again in the nature of the neuropsychological response. For a form to have enough elements to lead the feature detectors in the brain to recognize it as shield- and spearlike and so trigger the feel-good response at the brain's base was one thing. For it to constitute a representation of those things was something else. An actual row of spears and shields would have been frightening rather than reassuring. The phenomenon is familiar in such banal areas as women's dress. For a girl to wear a blouse with a leopard-skin pattern and to display long nails is effective; for her to have a hat in the shape of a leopard's mask or nails sharpened to become real claws would be counterproductive. The same factors apply to all the other assimilations proposed. Forms that have enough properties in common with desirable phenomena to trigger positive responses are one thing. Forms that look like those phenomena are something else. Columns that actually looked like warriors, or moldings that really looked like sea urchins or teeth, would be off-putting. Only if we analyze visual perception into its neural and chemical elements can we understand how forms are pulled in a particular direction by a desired assimilation but never need to be fully transformed.

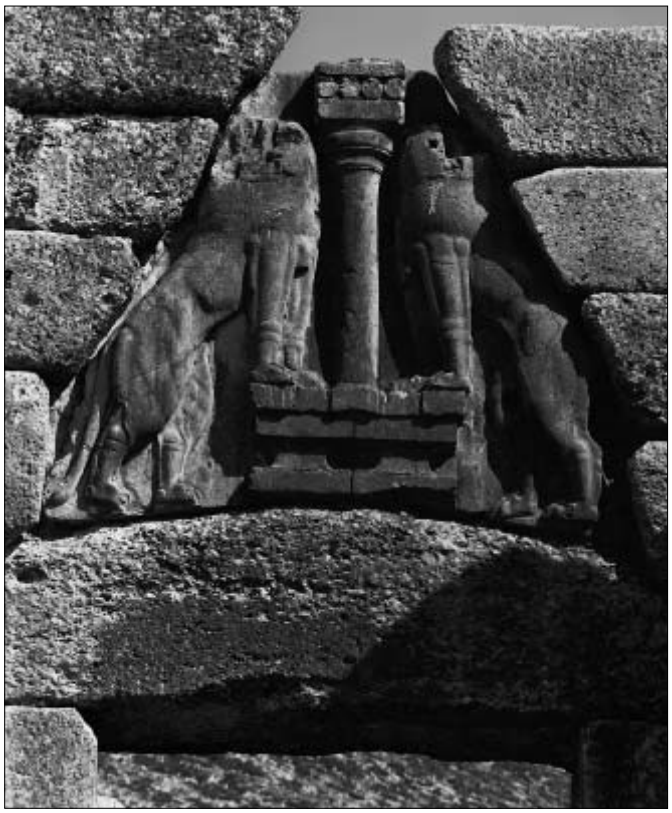
I previously played down the importance of words for the formation of culture, especially of Greek architectural culture, but the importance of words cannot be denied. The texts referred to—the myths, the epics of Homer, the lyrics of Sappho, the drama of Euripides—were not just passive reflectors of neural activity. They also influenced it, and by the time of fifth-century B.C. Athens, especially during the Peloponnesian War, when citizens were often shut up behind walls, words must have taken on a new importance. Like the radio broadcasts of World War II, the plays the Athenians saw, the poems they read, and the myths they told must have filled that part of the brain we call the imagination (and the Greeks called the *phantasia*) with a wealth of vivid imagery. The functioning of this part of the brain was essential to many of the experiences that have already been discussed. Our survival depends on the brain's ability to store images of those things it most desires, whether those desires are genetically formed, as in the case of mates, relatives, and friends,

or environmentally formed, as in the case of phalanx and trireme. However, as is so often the case with the human brain, a facility that exists for one reason can be activated in quite other contexts. Our ancestors discovered long ago that it was possible to activate the visual imagination not by a visual memory but by verbal storytelling, and in fifth-century B.C. Athens, where Homer's plays were performed at the Panathenaia and myths were presented as dramas in front of large sections of the population, people must have shared a large common world of the imagination. This was the world in which the heroes of Greek mythology once again came to life, and buildings such as the ancestral home of Iphigenia, the palace of Mycenae, imaged in Euripides' dream, rose once again in the minds of the play's spectators. Such buildings existed only in the electrochemistry of the brain's neural networks, but there they had much the same power as real structures, which is why Iphigenia's speech must have been so compelling. But perhaps an even better demonstration of their power is a building that is unlike all others in the history of Greek architecture, the Erectheum, which was being built on the Acropolis as Iphigenia spoke her lines (figure 3.6).

Two principal features of this structure are the flat roof and the row of disks on the frieze. The two elements are almost certainly connected, the disks being understood as the vestiges of the ends of round beams laid horizontally to support a flat roof, or rather of the metal ornaments that covered their ends. If we ask where this idea comes from, the best answer is the Lion Gate at Mycenae (figure 3.7). There in the triangular tympanum stands a single column. This carries an architrave with, above it, a row of cylindrical shapes, which must be intended as the representation of beams designed to support a flat roof. It is hard to avoid the conclusion that the designer of the Erechtheum intended the porch to be a reconstruction of just such an architectural system as exists here. The main difference is that while in the one case we have a carved representation of real timber architecture, in the other we have a real stone architecture whose forms allude to its timber origins. Confirmation that the porch of the maidens is a conscious reconstruction of an explicitly flat-roofed architecture is found in another detail of the entablature. Dentils, which are omitted from all the other parts of the building with sloping roofs, are introduced here as if they are the ends of rectangular horizontal beams. Explaining this imitation of Mycenaean style in a classical building gives further insight into the Athenian brain. Many visitors must have visited the ruins of Mycenae, the capital of Homeric Greece. To study the architecture of the Lion Gate, its grandest relic, with a view to reconstructing it must, however, have been exceptional. The reason that the architect of the Erectheum did so is almost certainly because he wanted to build a structure that would recall the great palace of the Bronze Age rulers of Athens. The remains of the foundations of the legendary residence were always visible on

3.6
Porch of the maidens, Erechtheum. (Photo: DAI)

the rock, and they took on a new significance when the Peloponnesian war forced the Athenians to find or invent evidence of ties with their Ionian allies, as Euripides did around 415 B.C. in his *Ion,* which made the founder of the Ionian race a grandson of Erechtheus. The decision to rebuild the temple of Athena Polias using Ionic forms and to give a new prominence to Erechtheus in its dedication had been a move in the same direction a few years before. The Athenians who knew that they had once had a palace on their Acropolis would have loved to be able to show their Ionian allies the home of their common ancestor. Given that their other principal allies were the Argives, whose ancestral royal family lived at Mycenae, it was particularly appropriate to take from that site the model for their reconstruction. Restoring on the Acropolis the carved architecture of the Lion Gate allowed them to materialize their dream of a lost past. It also helped them in identifying their enemies as Dorian invaders, destroyers of a great civilization.



3.7
Lion Gate, Mycenae.
(Photo: Alison Frantz)

The need to evoke Erechtheus's palace would explain why what was originally the reconstruction of a temple of Athena Polias came to be called the Erechtheum, as it is identified by Pausanias. It also explains many of the Erechtheum's unparalleled features. Principal among these is its extraordinary asymmetry and its row of windows framed by engaged columns, both more appropriate in domestic than sacred architecture. But no feature is more remarkable than the porch of the maidens. This is probably the part of the building most closely identified with the palace, since the two symmetrical groups of three maidens to the left and right are best understood as representations of Erechtheus's three daughters. It might be asked where the Athenian architect got the idea of turning princesses into columnar statues. The answer is most likely again the Lion Gate. Mycenae was the ancestral house of Iphigenia, and it is natural to find the inspiration of her dream in a tourist's experience of the lone column above the gateway, which was indeed all that was left of the

palace. A visiting Athenian, who was already predisposed by his neural networks to see men as columns and columns as men and who might have come to Mycenae looking for the spirit of Orestes, would not have found it difficult to see in the isolated column the lone protector of the family's honor. He could equally easily have imagined golden hair streaming from the capital and even a voice as well. Once the assimilation between column and Bronze Age prince had been made, it was no great step to introduce Bronze Age princesses in the reconstruction of the Athenian palace.

The Erechtheum reveals much about the Greek brain. It shows that Iphigenia's dream was an experience that someone really had. It shows that Athenians were able to imagine an invisible building. Perhaps most interesting for the history of architecture, it shows that Athenian architects could look at an ancient monument, recognize it as a representation of a timber structure, and when reconstructing it set out not to copy it but to show by the details of a modern building its dependence on the earlier one's timber forms. It is thus likely that the experience of the Lion Gate inspired the theory of the wooden origins of Greek temple architecture found in Vitruvius. Once they had discovered that the earliest Greek architecture was timber, they looked anew at all their own buildings and saw in them proof of their wooden origins. They could see this only because even as they looked with their eyes at stone buildings, their brains could imagine them as wood.

If this chapter has worked, the temples in the reader's brain will now be different from those that filled them before. Instead of thinking of ratios and measurements, ground plans and elevations, labels and structural origins, you will now imagine phalanxes and triremes, spears and shields, ropes and pulleys, sails and masts. This does not mean that when you look at Greek temples themselves you will also see them in those terms, because while the Greek brain had feature detectors for these objects in the cortex, linked directly to pleasure centers lower down, you do not.

Our neural networks are differently configured because our environment is different, and so is our emotional attachment to objects within it, which is why it is these we have to understand if we are to write the history of modern architecture. After all, similar mechanisms to those described here have necessarily influenced design processes over the past century too. It is thus no accident that the businessmen who commissioned the grids of the Lever and Seagram buildings had neural networks adapted to working with the apparatus of modern commerce, from cash registers to profit graphs. Even more intriguing is the link between the histories of modern and ancient architecture through the general type of the tall American building. Before the term *skyscraper* was applied to a structure on land, it was the name of the topsail of a great sailing ship. For the inhabitants of the port cities of New York and Chicago a hundred years ago, tall ships were more important than tall buildings,

and the pleasure in making tall and tower-like edifices came partly at least from their evocation of the great four- and five-masters. The neural networks of the inhabitants of Manhattan in the late nineteenth century A.D. had surprising convergences with those of the islanders of Samos twenty-five hundred years before.