I must admit at the outset that by including this 1952 book in my list of the 20 studies that revolutionized child psychology, I embrace a certain amount of chronological dishonesty. Now it’s not like I robbed the campus bookstore or anything. But keep in mind that the whole premise of my book is to showcase revolutionary child psychology research that has taken place since 1950. Although *The Origins of Intelligence in Children* (hereafter called simply *Origins*) really was published in its English version in 1952, the book was originally published in its French version in 1936. In fact, the data presented in *Origins* were originally collected in the 1920s! So why include it among my post-1950 list? Well, there are at least three reasons; feel free to choose whichever one you like best. First, this is my book, and I can handle it any way I want to, so there. Second, I’m an American elitist and as far as I’m concerned, science really isn’t science until it’s translated into English (just kidding). Or third, *Origins* was quite simply the most frequently nominated study in my empirical survey. In fact, it was nominated by almost all of the scholars who nominated Piaget at all, so obviously members of the child psychology research community view the book as really important.

Okay, so why do they view this book as so important? I think that much of the popularity of *Origins* was because it was here that Piaget summarized his most significant theoretical points about early intellectual development. And he coupled
his theoretical claims with real-life observations that helped create and support them. Unlike other epistemologists of the time, many of whom were armchair philosophers, Piaget, eminent scientist that he was, was very aware of the need to present scientific data in support of his beliefs. I think the book's popularity also came from the fact that it was the first of a trilogy of Piaget's books that exploded on the American scene right at a time when American developmental psychologists were trying to escape from the twin asphyxiating grasps of Freudian psychosexual theory and Watson's/Skinner's behaviorism. For many scholars Piaget's general biological approach, which was largely captured in this initial work, was truly a breath of fresh air!

INTRODUCTION

Because I was able to use much of the preceding chapter to describe the forces driving Piaget's theory, along with many of the central principles of the theory, I have, in essence, already given you the introduction to this study. And so I have much greater latitude in dealing with Piaget's findings. But let's review very briefly the main points of the previous chapter in a rough logical order. (1) Piaget was an evolutionary biologist. (2) Therefore, he believed that all organisms must adapt to survive. (3) Adaptation takes place at the species level phylogenetically. (4) Adaptation also takes place at the individual level ontogenetically. (5) Intelligence happens in biological organisms. (6) Therefore, intelligence is a biological process. (7) Therefore, intelligence adapts. (8) Because intelligence adapts ontogenetically, we should be able to observe it in the development of children. (9) The ontogenetic adaptation of intelligence in children might give a good approximation of the phylogenetic adaptation of intelligence that took place in the species since at least 300,000 years ago.

So Piaget's grand theoretical framework was pretty much laid out. But the busy work of finding evidence to support his notions had only just begun. All he had to do was collect the data. In Origins, Piaget set out on the task of determining the starting point of it all. And one of the very first questions Piaget had to contend with was "When does intelligence begin?" Or, to say it in a more biologically oriented way, "When do intelligent adaptations begin?"

METHOD

Participants

The participants that Piaget observed for this book were two girls and one boy, all siblings. For Origins they were essentially observed several times a day, almost every day, from birth to about 2 years of age. Jacqueline was born in 1925, Lucienne was born in 1927, and Laurent was born in 1931. So from Jacqueline's birth through the time Laurent reached 2, Piaget made detailed recordings of at least one kid pretty much constantly for 3,000 days! Although this would be a Herculean effort for anybody, Piaget's efforts were reduced somewhat because the three siblings were his own children. At least the participants in his study lived in the same house! And even Mrs. Piaget helped out on occasion. It's been said that she used to carry a small notebook attached to her necklace so that she could record observations of her children as needed.
Procedure

Because Piaget was a pioneer in the scientific investigation of children's development, and because he was dealing with very, very young babies, there really weren't many existing methodologies at his disposal that he could use to measure babies' thinking abilities. Compounded with this problem was the fact that 1-week-old babies are notoriously difficult to carry on a conversation with. This means that almost every method Piaget used to measure the thinking abilities of babies was his own creation. Have you ever heard the saying "Necessity is the mother of invention"? Well, Piaget invented dozens of methods to test out his various hypotheses, many of which are still used to this day. Unfortunately, I don't have the space to describe every type of observational technique Piaget developed, but I can at least share with you a couple of examples. Neither task was particularly sophisticated—no computers were involved, no high technology was employed. But nobody ever said doing experiments with babies had to be fancy. As the great philosopher and baseball coach Yogi Berra once said, "You can observe a lot just by watchin' ."

Means-Ends Task. In the typical means-ends task, babies are observed to see whether they can perform one action in order to do a second action. The second action is usually the more desirable action. When one act is necessary to do a second act, we call it means-ends sequencing. Means-ends sequencing is essential for our existence, and we do it all the time. For example, you engage in means-ends sequencing every time you remove the cap in order to take a swig of Pepsi-Cola. And about 30 minutes after drinking the Pepsi, you engage in means-ends sequencing when you push open the door to enter the restroom. Means-ends sequencing is essential to adult intellectual functioning because it's what allows us to make plans about the future. But from a developmental point of view, one might wonder when means-ends sequencing first happens. Hence, on several different occasions at several different ages, Piaget employed various forms of means-ends tasks with his kids.

For example, when Jacqueline was just over 12 months of age, Piaget placed a series of objects on a shawl, just outside of her reach. Although she couldn't reach the objects, the shawl was close enough to grab. Each time an object was placed before her, Jacqueline first tried to reach the object directly. But she quickly realized that a better way to get the objects was simply to pull on the shawl. In this way, bringing the shawl near was the means toward obtaining the end of getting the objects. The means-ends task is not overwhelmingly popular these days as a measure of intellectual competence, but for many years it was used as the standard measure of intellectual performance. In fact, many researchers believed performance on the means-ends task was a good indicator of infant IQ, although it should be said that performance on the task was never strongly correlated with "real" assessments of IQ in later childhood.

Object Permanence Task. The object permanence task is actually just an extension of the means-ends task, but it's used more specifically to discover how well children understand that an object continues to exist even when they can't see it. You may have heard of object permanence in your high school or introductory psychology class. The basic idea comes from the notion that as adults, we function under the assumption that things continue to exist even when we no longer sense their presence. We assume
that our bed will still be there when we get back home after a 12-hour shift of hard labor. We assume that the turkey we put into the oven at 6:00 a.m. on Thanksgiving Day will still be there when we go to take it out at 1:00 p.m. In fact, it’s hard to imagine what the world would be like if we didn’t know that objects continue to exist when we don’t see them. Just as with our ability to use certain means to reach certain ends, our adult understanding of the permanence of objects is extremely adaptive. But again, we are left wondering when babies first show that they understand the permanence of objects.

In another display of ingenuity, Piaget again demonstrated that you don’t need a high-tech procedure to measure object permanence. Basically, what he did was cover up an interesting toy with a cloth until it was no longer available to the baby’s senses. The key question was whether the baby would remove the cloth in order to retrieve the toy. If so, the baby was assumed to have some form of understanding of the permanence of the object. If not, it was more likely a case of “out of sight, out of mind.”

RESULTS

Piaget’s results in Origins were not neatly summarized into a single, concise “Results” section, as would typically be found in professional journal articles. Instead, they were pretty much scattered throughout the book in various sections and subsections, brought into play as Piaget needed them to make some theoretical point about intelligent adaptation. It took him some 419 pages to tell the story of all his data. What I will attempt to do in my much shorter redescription of his results is to profile his major findings in the same order he presented them.

Remember that in Origins, Piaget was investigating intellectual development in babies from birth to about 2 years of age. So his results are pretty much presented in chronological order, starting with the intellectual adaptations of newborns and ending with the intellectual adaptations of 2-year-olds. He breaks this 2-year time frame into six different substages. (Remember that he calls the first major stage of development the sensorimotor period. But in this book, he breaks down this bigger period into even smaller chunks of developmental time, which we can call substages.) In describing each of these substages, Piaget focused on one or more of the major developmental breakthroughs demonstrated by his children during this time frame. Let me say one more time that in my opinion the interesting feature of this developmental story is not that children achieve and eventually graduate from these stages, but that their intellectual functioning represents adaptation through natural selection as in all other aspects of biology.

In the pages that follow, I will run through the six substages that Piaget delineated. In doing so, I would like to give you a flavor of Piaget’s writing style, so I will reproduce excerpts from the observations he made of his own children. This is something you don’t get in a typical introductory child psychology text. But I think it will give you a better sense of the way that Piaget thought about things. Throughout these excerpts, you will see references to the children’s ages during certain observations that look something like this: 1;4 (14). This is Piaget’s shorthand for noting that the child was 1 year, 4 months, and 14 days old. Obviously, Piaget was quite a stickler for detail. And many times he would make observations of exactly the same behaviors on several days in a row.
The First Substage: The Use of Reflexes. In some ways, the believability of Piaget’s entire theory came down to how well he could account for children’s thinking in the very first days of life. You see, it’s one thing to say that adult thinking can be traced to its roots in childhood thinking; but this just takes a difficult problem at one level (adulthood) and moves it to another level (childhood). And as much as one might wish to keep moving the problem to earlier and earlier periods in human development, for example from late childhood to early childhood, then from early childhood to toddlerhood and so on, eventually one has to pay the piper. At some point, we have to account for the very first thinking. But this is like a chicken-and-egg problem. As the old conundrum goes, you can’t have a chicken without an egg, but it takes a chicken to lay the first egg. Similarly, you can’t have thinking without the first thought, but you can’t have the first thought without also thinking. So Piaget carried quite an intellectual burden in trying to explain the very first thinking. Let’s see how he dealt with it.

If you remember from the previous chapter, Piaget’s problem really amounted to explaining where children get their first schemas. Schemas are the knowledge structures that underlie all thinking, and so what he had to do was account for the very first ones. Undoubtedly, one important breakthrough took place when Piaget realized that early schemas didn’t need to look much like adult ones at all. In fact, the earliest schemas could look quite different from later ones. The key similarities between the first schemas and later schemas were to be found not in their structures, but in their function, in what they allowed the baby to do. Remember, thinking is a biological process that helps the organism adapt to the world. All Piaget had to do was figure out what babies brought with them into the world that would allow them to adapt to it. Piaget’s solution to the problem was simple: REFLEXES!

Although all reflexes are essentially “hardwired” in the brain, they aren’t impervious to environmental experience. In fact, many reflexes require the environment for their very existence. One of Piaget’s favorite reflexes to talk about was the sucking reflex. In one of his earliest diary entries, he wrote: “Observation 1.—From birth sucking-like movements may be observed: impulsive movement and protrusion of the lips accompanied by displacements of the tongue, while the arms engage in unruly and more or less rhythmical gestures and the head moves laterally, etc. Observation 3.—The third day Laurent makes new progress in his adjustment to the breast. All he needs in order to grope with open mouth toward final success is to have touched the breast or the surrounding teguments with his lips. But he hunts on the wrong side as well as on the right side, that is to say, the side where contact has been made.”

Already you can see that Piaget emphasizes “progress” in the adaptations of reflexes to the environment; in this case, of sucking. The sucking schema doesn’t stay the same for long; it adapts to the environment right from the start. Within a few weeks, children begin coordinating the sucking schema with environmental input from other senses. For example, in later substages vision takes on a key role in babies’ abilities to fire up the sucking reflex. Consider the following observation: “Observation 27.—Jacqueline, at 0:4 (27) and the days following, opens her mouth as soon as she is shown the bottle. She only began mixed feeding at 0:4 (12). At 0:7 (13) I note that she opens her mouth differently according to whether she is offered a bottle or
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a spoon. Lucienne at 0;3 (12) stops crying when she sees her mother unfastening her
dress for the meal. Laurent too, between 0;3 (15) and 0;4 reacts to visual signals.
When, after being dressed as usual just before the meal, he is put in my arms in posi-
tion for nursing, he looks at me and then searches all around, looks at me again,
etc.—but he does not attempt to nurse. When I place him in his mother’s arms with-
out his touching the breast, he looks at her and immediately opens his mouth wide,
cries, moves about, in short reacts in a completely different way. It is therefore sight
and no longer only the position which henceforth is the signal.” So the point is that
over time, and with experience, the sucking reflex ceases to be a slave to tactile stim-
umulation, and becomes much more responsive to visual stimulation. This clearly illus-
trates developmental maturity of the sucking schema.

As an aside, I’d like to bring to your attention the incredible detail in Piaget’s
diary records. Could you imagine sitting around staring at the mouth movements of
your children just to see if the mouth takes on a slightly different shape before suck-
ing a bottle versus a spoon? I wonder if Piaget’s respect for this level of detail can be
traced back to his childhood when he sat around all day staring at mollusk shells!

The Second Substage: The First Acquired Adaptations and the Primary Circular
Reactions. The first substage was very short-lived in Piaget’s mind—about a month—
because babies’ reflexes so quickly start adapting to the surrounding environment.
Once a reflex changes as a result of coming into contact with the environment, in
even the tiniest way, then the reflex is no longer exactly the same as it was. In other
words, we can say the reflex has accommodated. In watching his kids, Piaget noticed
that sometimes, beginning in about the second month, they would exercise their
schemas apparently just for the enjoyment of the exercise. These kinds of behaviors
indicated that the actions were no longer purely reflexive, because there was noth-
ing around that stimulated them. Instead, it was as if the activity was self-generated.
Sucking, for example, could often be seen even in the absence of any reflex-causing
trigger—that is, without anything actually touching the lips. In Observation 14, Piaget
wrote: “During the second half of the second month, that is to say, after having
learned to suck his thumb, Laurent continues to play with his tongue and to suck,
but intermittently. On the other hand, his skill increases. Thus, at 0;1 (20) I notice
he grimaces while placing his tongue between gums and lips and in bulging his lips,
as well as making a clapping sound when quickly closing his mouth after these exer-
cises.” Here you can see how Laurent seems to be content simply to play with his
mouth and tongue muscles. Nothing in the environment caused the muscles to go
into action, Laurent just seemed interested in activating them himself.

At about this time, Piaget also noticed that his children would often try to activ-
ate their own reflex schemas by stimulating them with other parts of their own body.
At first, they usually did so accidentally. For example, as their arms flailed about ran-
domly, their hands would sometimes smack into their face and accidentally make
contact with the lips. Their fingers would then slip into their mouths and they would
suck them. Of course, in this case, sucking was initially being activated reflexively as
the fingers rushed in uninvited. But if the fingers fell back out, the babies would
seem to try to “coordinate” the sucking reflex with the movements of the arm as if
trying to repeat the chance occurrence. “Observation 20.—At 0;1 (5) and 0;1 (6)
Laurent tries to catch his thumb as soon as he awakes but is unsuccessful while lying
on his back. His hand taps his face without finding his mouth. When he is vertical, however . . . he quickly finds his lips.” Clearly, you can see that the sucking schema is no longer a reflexive island, passively responding to environmental stimulation, but is being coordinated with other activities of the child’s own body. And the fact that the children frequently reinstated the initial chance encounter showed that there was a certain amount of circularity involved. That is to say, an action happened by accident, the baby seemed to find it interesting, so he tried to make it happen again. For this reason, Piaget called this kind of coordination between existing schemas and body activity a “circular reaction.” But because the next substage also involved these kinds of circular activities, Piaget wanted to make a distinction between the kinds of circular reactions that involved only the child’s own body and those that involved other objects. Therefore, the kinds of circular reactions that take place on the child’s own body, Piaget called “primary”; and so putting all these terms together, we get Piaget’s term primary circular reaction. The primary circular reactions are most common from about the 1st month to the 4th month. But afterward, their frequency dies down and kids start showing secondary circular reactions.

The Third Substage: The Secondary Circular Reactions and the Procedures Destined to Make Interesting Sights Last. As his children moved past about the 4th month, Piaget observed that they not only tried to reenact interesting experiences that took place on their own body, but they often tried to incorporate outside things into their schemas as well. If you think about it, there’s little difference in how you can apply your basic schemas either to your own body or to other things. Does your sucking reflex really care whether it’s activated by your own fingers or a set of car keys? So we would say that the sucking schema is functionally invariant; that is, it works the same no matter whether the baby is sucking on his fingers or a Barbie Doll. But by and large, as Piaget found, babies’ efforts to incorporate external objects into existing schemas tended to occur later in time. This is why Piaget created the third substage, which is pretty much the same as the second except that external objects are now the focus of the schemas.

Although I’ve been focusing on the sucking schema as a primary means that babies learn about the world around them, this schema was only one among many that Piaget talked about. Another major player among infants’ first knowledge schemas involved vision; or as we called it in the previous chapter, the orienting reflex. As an example of how babies coordinated their orienting reflex with outside objects, Piaget noted that his children would often perform some action, again usually accidentally at first, and the action would have some effect on the surrounding environment that the kids observed. They would then try to re-create the interesting event. Take, for example, Observation 94: “At 0;3 (5) Lucienne shakes her bassinet by moving her legs violently (bending and unbending them, etc.), which makes the cloth dolls swing from the hood. Lucienne looks at them, smiling, and recommences at once. These movements are simply the concomitants of joy. When she experiences great pleasure Lucienne externalizes it in a total reaction of leg movements.” So here you see that a random body movement causes some external object to move about, which Lucienne sees (meaning that she incorporates it into her visual orienting schema), and she tries to make it happen again. This is a circular reaction of a secondary sort, but involving vision. A similar kind of reaction can be seen with Lucienne’s hearing schema: “Observation 102.—... At 0;4 (15) Lucienne grasps the
handle of a rattle in the shape of a celluloid ball. The movements of the hand in grasping the rattle result in shaking it and producing a sudden and violent noise. Lucienne at once moves her whole body, and especially her feet, to make the noise last. She has a demented expression of mingled fear and pleasure, but she continues.

In all of these examples, Piaget's goal is to provide evidence that schemas are present at birth in the form of reflexes, and that they slowly but surely get incorporated into grander and grander patterns of behavior that will give babies a fuller and better understanding of the world. Development isn't all-or-none. It takes place gradually—as later schemas build on earlier ones—with each passing experience the child has. But incorporating body actions and environmental experience into preexisting schemas is only the beginning. The really serious sensorimotor intelligent adaptations start emerging in the fourth substage. Up through substage 3, babies do something accidentally, and they try to make it happen again. Remember, these are the circular reactions we've been talking about. But in substage 4, babies start showing that they can do things on purpose. Here, they start demonstrating intention! And it is here that we start seeing the integration of some schemas into the service of other schemas. For the first time, babies show a capability for means-ends action.

**The Fourth Substage: The Coordination of the Secondary Schemas and Their Application to New Situations.** In substage 4, which Piaget thought began at about 8 or 9 months of age, babies take a major intellectual leap forward. All along they’ve been developing individual, isolated schemas that have been informed by environmental feedback. They have schemas for seeing things, hearing things, sucking things, grabbing things, shaking things, pulling things, and hitting things. But before now, babies haven’t coordinated two or more schemas in order to carry out some planned action. Before now, babies pretty much just reacted to things. But in substage 4, instead of only being mostly reactive, babies start being proactive. They start acting on the world, intentionally, in order to accomplish something.

Consider the following: "Observation 124.—At 0:8 (8) Jacqueline tries to grasp her celluloid duck but I also grasp it at the same time she does. Then she firmly holds the toy in her right hand and pushes my hand away with her left. I repeat the experiment by grasping only the end of the duck’s tail; she again pushes my hand away. At 0:8 (17) after taking a first spoonful of medicine, she pushes away her mother’s hand which extends to her a second one. At 0:9 (20) she tries to place her duck against the wicker of the bassinet but she is bothered by the string in her right hand and moves it to the far side of the left arm (the arm holding the duck), and consequently where the string no longer is an obstacle." What Piaget is describing here is that Jacqueline can use one schema, something like a pushing-away schema, in order to help her enact another schema, something like a pulling-toward schema. This is intellectual adaptation of the best kind—getting what you want! It also demonstrates a serious intellectual advantage over earlier behaviors. Previously, babies only attempted to reproduce actions that had happened by accident—the so-called primary and secondary circular reactions. Now, however, babies manage to use old schemas in new ways. Old schemas aren’t activated for their own sake, they are activated for the sake of making other schemas possible. When babies move an obstacle out of the way to get an interesting thing, such as a celluloid duck, they aren’t merely trying to repro-
duce an interesting effect they've already observed. Rather, they're dealing innovatively with a problem they're just now encountering for the first time!

We also see in this substage evidence of the emergence of object exploration for the sake of "understanding" the object. When confronted with some new object, babies in this stage will attempt to incorporate the object as much as possible into as many of the existing schemas as possible. It's as if they're saying to themselves, "Hmm. Can I suck it? Can I grab it? Can I shake it? Can I hit it?" "Observation 138.—Lucienne, at 0;8 (10) ... examines a new doll which I hang from the hood of her bassinet. She looks at it for a long time, touches it, then feels it by touching its feet, clothes, head, etc. She then ventures to grasp it, which makes the hood sway. She then pulls the doll while watching the effects of this movement. Then she returns to the doll, holds it in one hand while striking it with the other, sucks it and shakes it while holding it above her and finally shakes it by moving its legs." So it appears that babies not only can sequence one schema in the service of another, as we saw in the means-ends behaviors above, but babies can also chain together a whole series of schemas, maybe five or six in a row, to better understand a new thing.

*The Fifth Substage: The Tertiary Circular Reaction and the Discovery of New Means Through Active Experiments.* The progress of intelligence through the first four substages has more or less involved the application of familiar schemas to new situations. In substage 2, reflexive schemas are applied to accidental encounters with one's own body and are reproduced to make them last. In substage 3, the same schemas are applied to accidental encounters with outside objects, but they are still reproduced to make them last. In substage 4, familiar schemas are intercoordinated to achieve some new ends. But in substage 5, there is a new push to use old knowledge to achieve novel results, at an even higher level. This time, existing schemas are used in the pursuit of novelty itself. This *tertiary circular reaction* is a pattern of behavior that Piaget observed frequently in his own kids when they were between 12 and 18 months of age.

The circular reactions of substage 5 have much the same flavor of the circular reactions of substages 2 and 3 in that they're repeated over and over. But in those more primitive substages, the circular reactions pretty much just reproduced the *same* interesting effect each time. Substage 5 circular reactions, on the other hand, are aimed at producing a different interesting effect each time. Here an old schema is applied—dropping, for instance—but the schema is not reproduced just to get the same effect that has just occurred. Rather the goal is to produce a series of novel effects. True, the same *general* schema is enacted over and over, but the specific details vary. Consider Laurent's behavior: "Observation 141.—At 0;10 (11) Laurent is lying on his back but nevertheless resumes his experiments of the day before. He grasps in succession a celluloid swan, a box, etc., stretches out his arm and lets them fall. He distinctly varies the position of the fall. Sometimes he stretches out his arm vertically, sometimes he holds it obliquely, in front of or behind his eyes, etc. When the object falls in a new position (for example on his pillow), he lets it fall two or three times more on the same place, as though to study the spatial relation; then he modifies the situation."

It seems as if the goal is not just to learn about the object, as it was in substage 4, but to learn about how the object interacts with the world, to learn about *relationships* between objects. And a good way to find out how the object interacts
with a variety of aspects of the world is to vary the ways in which the object is given the opportunity to interact with various aspects of the world. In this substage, the baby is a little scientist! He drops an object from a variety of locales, noting the different behaviors of the object each time it is dropped. Not only is he learning about the behavior of the object with respect to the world, he is learning about the world with respect to the object. In so doing, the baby is learning about gravity (when an object falls), friction (when an object slides down another object), solidity (when one object collides into another object), bounciness (when one object bounces off another), mass (when a big object comes into contact with a smaller object), and so on.

In substage 5, the baby’s little mind makes a huge leap. If you think about it, she’s learning about many of the same topics that are covered in a high school physics class. However, there is at least one major difference between the intellectual abilities of 15-month-olds and those of 15-year-olds. The babies’ understanding of objects in the world is limited to what they can do with them in the immediate present. They can’t, for example, think about what might happen in advance of it happening. They also can’t imagine it happening in the absence of any real objects. It’s not until substage 6 that these kinds of abilities start to emerge.

**The Sixth Substage: The Invention of New Means Through Mental Combinations.**
The biggest innovation that takes place in this substage, which Piaget located sometime around the 18th month, is the internalization of schemas that previously had to be enacted physically. In other words, schemas go mental. This achievement provides some serious adaptive advantages over previous behaviors. For one thing, babies don’t have to actually perform an action in order to know something about the world. Instead, they can more or less anticipate what will happen by imagining it. Piaget called this “pre-vision.” Through pre-vision, babies can figure out how to solve some kinds of problems without the consequences of trial and error. One of my favorite examples of this kind of thinking comes from Lucienne Piaget in Observation 180. Piaget writes, “Here begins the experiment which we want to emphasize. I put the chain back into the box and reduce the opening to 3 mm. It is understood that Lucienne is not aware of the functioning of the opening and closing of the matchbox and has not seen me prepare the experiment. She only possesses the two preceding schemata: turning the box over in order to empty it of its contents, and sliding her finger into the slit to make the chain come out. It is of course this last procedure that she tries first: she puts her finger inside and gropes to reach the chain, but fails completely. A pause follows during which Lucienne manifests a very curious reaction bearing witness not only to the fact that she tries to think out the situation and to represent to herself through mental combination the operations to be performed, but also to the role played by imitation in the genesis of the representation. Lucienne mimics the widening of the slit. She looks at the slit with great attention: then, several times in succession, she opens and shuts her mouth, at first slightly, then wider and wider! Apparently Lucienne understands the existence of a cavity subjacent to the slit and wishes to enlarge the cavity.”

This observation clearly illustrates the transition from thinking on the outside to thinking on the inside that I don’t think Piaget could’ve captured the moment better with a Polaroid snapshot. Let’s recap. First, Lucienne had a problem that she
needed to adapt. She needed to get a small chain out of a partially opened matchbox. To solve this problem, she first tried out a couple of good ol’ schemas that worked for her in the past: her “turning-over” and “finger-poking” schemas. But this time, the schemas failed her. The chain was still stuck inside the matchbox. So Lucienne bumped up her intellectual efforts a couple of notches and represented the problem in a different way—using her imagination. Once she removed the problem from its physical form and represented it mentally, she was able to invent a solution that wasn’t previously possible. She pretended her mouth was the slit of the matchbox. By bringing this mental image into play, Lucienne was able to manipulate the image in a new way. Specifically, she was able to pretend she was opening and closing the matchbox by opening and closing her mouth. And once she was able to do this, she made the connection that to get the chain out of the matchbox all she had to do was open the matchbox wider than it already was. Voilà, success!

To summarize: By the end of the sensorimotor period, intelligence is no longer bound to actions on the world in conjunction with the sensory feedback they produce. The most adaptive schemas at this point are those that are capable of being represented mentally—freed from the here and now. Because schemas can be invoked mentally without needing real-world objects to act upon, children in the sixth substage have some serious intellectual advantages over children in the more primitive substages. For one thing, they don’t have to actually do things in order to gain knowledge; instead, they can gain knowledge just by imagining things. Does it make for an adaptive advantage to be able to use your imagination? Heavens yes! Consider, for example, how long it would take you to learn about weight differences if you still had to physically lift a watermelon and an orange in order to know which was heavier. A second advantage of having your schemas go mental is that they allow you to invent solutions to problems that wouldn’t have occurred otherwise. This is where Piaget’s phrase “invention of new means through mental combinations” comes into play. Mentally, schemas can be combined with each other in ways that could never happen in reality. For example, imagine flying a Volvo 740 to Lake Erie to go fishing for whales and sharks. Of course, none of this could happen in reality, but they can happen very easily in mentality! Obviously, once schemas go mental there’s a whole new range of possibilities for intellectual adaptation to the world. Piaget believed that once schemas became mentally represented, they were able to assimilate one another not only rapidly, but spontaneously—almost automatically.

SUMMARY

Piaget’s single goal in *Origins* was to present data that showed that intelligent adaptation as a result of experience takes place, and that it takes place in a manner consistent with the basic tenets of evolutionary theory. In achieving this goal, Piaget developed a framework for describing how babies’ intelligences adapted, and the framework applied equally well throughout infancy; from the earliest, most primitive reflexive “thoughts” of newborns to the most advanced mental combinations of 2-year-olds. The keys to his theory were the “functionally invariant” roles played by the adaptive processes of assimilation and accommodation. By “functionally invariant” adaptive processes, I mean that although the specific items that were assimilated and accommodated to might change over time, the processes themselves worked the same
way no matter what the items were or how old the child was. It doesn’t matter if you’re assimilating a car key to your sucking schema or a matchbox opening to your mouth-opening schema, assimilation is assimilation is assimilation.

CONCLUSIONS

As I mentioned previously, Piaget gets so much space in this book because he was so important to the field of psychology. Piaget laid his cards down for everyone to see, and by doing so, he set the standard that everyone else would have to live up to. And, as a matter of fact, the 1960s and 1970s represented a Piagetian golden age. Everybody was testing this or that hypothesis generated by Piagetian theory. And the old master himself was still alive and kicking and doing as much as he could to further our understanding of children’s cognitive development.

But as you might imagine, when you’re the leader of a major revolution of any sort, it doesn’t take long before other people start having second thoughts about the leadership you’re providing. And so it was that a number of anti-Piagetian movements started to rise and gain momentum. The behaviorists, who, throughout the 1950s and 1960s, remained strong vocal opponents of the notion of internal mental development Piaget so clearly articulated, took potshots whenever possible. And Chomsky (see Chapter 8), who was as anti-behaviorist as Piaget, was also as anti-Piaget as were the behaviorists. Chomsky believed Piaget gave too much weight to children’s own efforts at constructing their own mental world. As we will see in Chapter 8, Chomsky was a firm believer in the innateness of grammar; so from his point of view, there was simply no room for the Piagetian idea that children were the authors of their own mental development.

In the two decades since Piaget’s death in 1980, his theory remains the target of attack of many psychologists. For example, as we see in Chapter 6, Renee Baillargeon took a huge bite out of Piaget’s suggestion that object permanence doesn’t fully develop until 18–24 months of age. But the result of these attacks has often been only to show that Piaget might have been wrong about when a particular cognitive ability emerged, not about whether it existed. In the end, it’s a tribute to Piaget’s vision, ingenuity, and comprehensiveness that his theory remains on center stage in contemporary child psychology theory. While it may be true that his theory no longer commands the attention of the entire field as it once did, his ideas remain so central to modern child psychology as to be almost invisible.

Questions for Discussion

1. What might be some limitations of basing an entire theory of cognitive development on observations of only 3 children?
2. What might be some strengths of basing an entire theory of cognitive development on observations of only 3 children?
3. Compare and contrast the concept of development with the concept of differentiation, as they apply to basic reflexive schemas.
4. Why is the concept of functional invariance important for a developmental theory?