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When Astronomy, Biology, and Culture Converge: Children's Conceptions About Birthdays

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ABSTRACT. The authors investigated the development of children's understanding of birthdays using structured interviews of 102 Israeli children aged 4 to 9 years. To fully comprehend the concept of birthday, children must grasp the relationship between the social occasion (the birthday party), irreversible biological growth, and the cyclical nature of the calendar. The authors' findings affirmed that a child's early conception is wholly social and self-contained (birthday parties confer a new age) and that young children believe that age can be affected by multiplying or skipping birthdays. The mature conception is socially based, but it is integrated with additional conceptual subsystems: the irreversible and independent unfolding of biological growth and the cyclical aspect of time. This enables the child to go beyond a magical approach to birthday rituals.

Key words: birthday, cognitive development, conceptual development, naive theory

> "Seven years and six months! . . . An uncomfortable sort of age. Now if you'd asked *my* advice, I'd have said 'Leave off at seven'—but it's too late now."
> ". . . One can't help growing older," [said Alice].
> "*One* can't, perhaps," said Humpty Dumpty, "but *two* can. With proper assistance, you might have left off at seven."
>
> Lewis Carroll, *Through the Looking Glass*

IN RECENT YEARS, the domain-specific theory of cognition has become the dominant view among cognitive developmental psychologists. Many investigators have come to ascribe to the newborn human infant a preparedness to develop specific cognitive domains, each characterized by a common domain of application, an ontology, and an evolutionary relevance that accounts for its

development (e.g., Carey & Gelman, 1991; Hirschfeld & Gelman, 1994; Karmiloff-Smith, 1993; Keil, 1990; Rosser, 1994; Spelke, Breinlinger, Macomber, & Jacobson, 1992; Wellman & Gelman, 1992). Beginning with Piaget's groundbreaking studies on "The child's construction of . . ." various domains, countless researchers have investigated how children build conceptual systems in the course of their development. Thus, studies have been conducted on the development of economics, biology, politics, psychology, physics, and so on (e.g., Bar, Zinn, Goldmuntz, & Sneider, 1994; Berti & Bombi, 1988; Connell, 1971; Hatano & Inagaki, 1994; Leiser, 1983; Smith, Carey, & Wiser, 1985; Springer & Keil, 1989; Wellman, 1990). However, each of those studies tended to imply a single *mode of construal* (Keil, 1994), a distinct *intelligence frame* (Gardner, 1983).

For this study, we were interested in investigating the development of concepts that appear to span more than one type of intelligence. We found a case in point in a deceptively simple concept: the birthday. To understand the concept of birthday, one must coordinate several independent systems that do not all belong to the same intelligence frame. A birthday, which young children tend to equate with their birthday party, involves several facets—social, cultural, and biological—which are all interrelated with time (episodic, cyclical, and linear).

Socially, a birthday usually involves a party centered on the person whose birthday is being celebrated. It is also a public occasion, akin to a degree conferral or a wedding, in which the social status of a person changes. A mere 6-year-old child becomes a proud 7-year-old on that special day (*episodic time*). However, a birthday is not celebrated at just any chosen time but on the date of birth, because it is a *cultural* construction of time as *cyclical* (in turn based on astronomical considerations that are not intrinsically relevant). A birthday, with its accompanying change in status, is also a consequence of the *biological* maturation, growth, and senescence that ties humans to *linear time*.

The relations between these facets are complex. Children grow independently of their birthday, and they do so continuously. They age, mature, and increase in size and dexterity. However, because birth dates occur once every year, age is a step function. The birthday party is the discrete moment that marks the special date, so that the child can claim the higher status. Children associate birthday parties with certain activities and items, without which there can be no proper birthday. Without props, guests, or presents, would a *birth day* still be a *birthday*? The emphasis placed on the celebration may even obscure the direction of

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causality for children. (Do you celebrate because you grew up, or did you grow up because you celebrated your birthday?) Indeed, if your birthday is celebrated repeatedly, do you grow up faster? And do you stay the same age if your birthday is skipped? (This notion, one suspects, was the ploy that Humpty Dumpty, the overbearing conventionalist, had in mind.)

For children to understand birthday as a whole concept, they must grasp many aspects simultaneously, as opposed to successively, in which case only some aspects are integrated at any given time (*successive synthesis;* Biggs & Moor, 1993; Das & Varnhargen, 1986). Furthermore, children must comprehend visible as well as invisible characteristics. For instance, a child might understand that after a certain point in time a person is older. But he or she may not be capable of conceptually understanding how one person can be older than another and yet have his or her birthday earlier.

In this study, we expected children to focus on only one aspect of the concept of birthday at any given time, which would be in line with what happens at the preoperational level (e.g., when children cannot integrate length and surface, they concentrate on only one dimension). Because it is the most visible, we expected the social aspect of birthdays to dominate. We postulated that as children grew older, they would gradually (a) encompass more constructions of the birthday concept, (b) attain an improved understanding of the intangible as well as the tangible aspects of a birthday, and (c) acquire an increased ability to integrate the biological and the cultural aspects of this concept. To investigate how children understand these various constructions, we interviewed them about birthdays, their conditions, and their consequences.

Method

Participants

A total of 107 children, ranging in age between 3 and 9 years, were interviewed. We placed them into the following groups: Group 1 (4-year-olds) included 24 children (12 boys and 12 girls) between the ages of 3 years, 6 months and 4 years, 4 months. Group 2 (5-year-olds) included 28 children (13 boys and 15 girls) between the ages of 4 years, 6 months and 5 years, 4 months. Group 3 (7-year-olds) included 27 children (15 boys and 12 girls) aged 6 years, 6 months to 7 years, 4 months. Group 4 (9-year-olds) included 28 children (15 boys and 13 girls) aged 8 years, 6 months to 9 years, 4 months. (Note: We initially conducted this study with children aged 5, 7, and 9 years and added the 4-year-old group when our results indicated that the developmental trend begins earlier than we anticipated.)

Participants were from neighborhoods in Beer Sheva, Israel. Because socioeconomic status (SES) is strongly coordinated with neighborhood, we sought to control this variable by choosing roughly the same number of children in each

age group from each neighborhood. Approximately one third of the children were from a low-SES neighborhood, and the remaining children were from a middle-class neighborhood. The children who participated in this research were randomly chosen from the class roster of their schools or nursery schools and were interviewed after we obtained informed consent from their parents.

Instruments and Procedure

The children were interviewed individually in a quiet room outside of their class. The interviews, lasting about 20 min, were taped, transcribed, and coded by two research assistants. The coding was based on categories that were constructed on the basis of a pilot study. The coding criteria proved to be very easy to apply, and the interrater reliability was very high (95%).

We concentrated on the following five issues:

Issue 1: The spontaneous definition of a birthday party ("What is a birthday?").

Issue 2: The essence of a birthday ("Why do we celebrate a birthday?").

Issue 3: Requirements of a birthday ("What customs are essential?").

Issue 4: Conception of date and year: For this issue, we explored children's understanding of the connection and the differentiation between the way people determine the date of a birthday (according to the month and day of birth) and the way people determine age (only according to the year of birth).

Issue 5: The relationship of a birthday to growth ("Can a birthday affect growth?").

We formulated the questions around very short stories, which were told in a simple language with an expressive, varying tone and mimicry. We repeated parts and concrete details when necessary, and we occasionally checked to see if the children understood. The children were interested in our questions and were very cooperative. The answers for each question were categorized and analyzed by chi-square tests. For clarity, we present the issues, stories (questions), and answer categories together with our results in the next section.

Results

Issue 1: The Spontaneous Definition of a Birthday Party ("What Is a Birthday?")

We hypothesized that the younger the children were, the more they would tend to grasp the concept of a birthday according to its overt social characteristics (e.g., "A birthday is a celebration"). We anticipated that children would gradually begin referring to the *growing up* aspect and that only the older children would understand the meaning of a birthday as an integration of both a celebration and grow-

ing up, as in the following description: A birthday is a celebration of the growing up process that takes place on the date of birth. One's date of birth recurs every year; therefore, celebrating one's birthday every year on that date becomes a fixed ritual that serves to indicate the date of birth and the number of years that have passed since one's birth. In posing the direct question "What is a birthday?" to children, we intended to determine what aspects of birthdays came spontaneously to their minds. We placed the children's answers into three categories:

A celebration. The first category of answers related to only the party and its characteristics. It included the following answers: "A party when presents are given" (Group 1), "It is when they bring a cake with candles" (Group 1), and "A party with sweets and balloons" (Group 2).

A date of birth and/or growing up. The answers in this category referred to only the date of birth or to growing up (or both) and included responses such as "It is when the birthday arrives" (Group 3), and "It is according to his date; that's when you make him his birthday" (Group 3).

A celebration, the birth date, and growing up. The third category of answers addressed the party, the date of birth, and growing older (or only the celebration plus the birth date or plus growing older). It included the response: "Every year you celebrate on the day you were born" (Group 4).[1]

Answers referring to date and growing up were rare (see Table 1), although they increased from youngest to oldest children. The pattern of results quite clearly shifts from young children viewing a birthday as simply a celebration (a special party) to older children understanding that a birthday marks and celebrates something external.

Issue 2: The Essence of a Birthday ("Why Do We Celebrate a Birthday?")

We defined a birthday as "a celebration or party that is, or can be, given in honor of someone every year on the day he or she was born to recognize that specific date and the number of years that have passed since his or her birth." We based the analysis for this issue on responses to the question "Why do we celebrate birthdays?" and to a second question that was asked subsequent to the children's hearing the following story:

> A child's birthday was celebrated when he was 1 year old. Then when he was 2, they celebrated his birthday again; and the year after, when he was 3, they also celebrat-

[1]The examples are translated from Hebrew in which the word for "celebrate" (*la'hagog*) is simple and common. Similar comments apply to many of the translations for which we strove to be accurate rather than idiomatic or cute. The term for birthday can now be written either as two words (birth day) or as a compound.

ed his birthday. But the next year, the year after he was 3, his mother got sick and could not give him a birthday party. So he was very sad because he did not know how old he was. In your opinion, how old is he?

In our analysis, we jointly considered the children's answers to both questions, according to the following categories (some of which we had anticipated in advance and some of which emerged as a result of a preliminary analysis of the children's answers):

A birthday as a means to determine one's age. Responses included, "It is so they would know that you are already moving up an age . . . When you grow up all the time then on the birthday you know that you are already growing and you move up an age" (Group 2); "The birthday party is to know how old you are . . . but your parents can also tell" (Group 4); and "A celebration so that we can know how old we are" (Group 4).

TABLE 1
Children's Responses to Issue Questions by Age and Answer Category

Answer category	Age (years) 4	5	7	9	Total
Issue 1: What is a birthday?					
A celebration	24	25	18	7	74
A day of birth and/or growing up	0	2	2	5	9
A celebration plus the day of birth and/or growing up	0	1	7	16	24
Issue 2: Why do we celebrate a birthday?					
To determine one's age and declare it	1	9	10	10	30
It is a ritual one has to go through	4	2	1	0	7
To increase one's age	19	14	8	2	43
To indicate the day of birth and the growing up process	0	3	8	16	27
Issue 3: What customs are essential?					
Every custom is essential	15	6	0	0	21
Some customs are essential	8	18	18	7	51
Only customs that cause happiness are necessary	0	4	7	9	20
No customs are essential	1	0	2	12	15

(Table continues)

TABLE 1—Continued

Answer category	Age (years) 4	5	7	9	Total
Issue 4: Conception of date and year					
Paradox 1: Is it possible for two people of different ages to have a birthday on the same day?					
It is too paradoxical to understand	5	1	0	0	6
The situation is impossible (It is a paradox)	15	17	13	1	46
The situation is possible (It is not a paradox)	4	10	14	27	55
Paradox 2: Is it possible for an adult to celebrate his or her birthday after a child, even though the adult was born before the child?					
It is too paradoxical to understand	8	1	2	0	11
The situation is impossible (It is a paradox)	14	20	15	3	52
The situation is possible (It is not a paradox)	2	7	10	25	44
Issue 5: Can a birthday affect growth?					
Question 1: Can a birthday increase growing up?					
Yes, it is possible	20	14	9	2	45
No, it is not possible	4	14	18	26	62
Question 2: Can a birthday decrease (reverse) growing up?					
Yes, it is possible	8	8	2	0	18
Yes and no (It helps for age, but not for the body)	1	2	3	1	7
No, it is not possible	15	18	22	27	82

Note. Age 4 (Group 1), $n = 24$. Age 5 (Group 2), $n = 28$. Age 7 (Group 3), $n = 27$. Age 9 (Group 4), $n = 28$. For Issue 1, $\chi^2(6, N = 107) = 42.947$, $p < .0001$. Issue 2, $\chi^2(9, N = 107) = 50.357$, $p < .0001$. Issue 3, $\chi^2(9, N = 107) = 72.322$, $p < .0001$. Issue 4, Paradox 1, $\chi^2(6, N = 107) = 58.128$, $p < .0001$. Issue 4, Paradox 2, $\chi^2(6, N = 107) = 52.686$, $p < .0001$. Issue 5, Question 1, $\chi^2(3, N = 107) = 32.354$, $p < .0001$. Issue 5, Question 2, $\chi^2(6, N = 107) = 20.214$, $p < .005$.

A birthday as a ritual. Responses in this category indicated that some children believed birthdays are celebrated as a ritual that a person must undergo. One response was, "Why do we have a birthday party? Because parents want us to . . . I don't want all that candy because it is bad for my teeth" (Group 2).

A birthday causes growing. Answers in this category suggested that children conceived of a birthday celebration as increasing one's age. In response to the story question ("How old is he?"), two children replied, "He will still only be . . . 3

years old because he didn't have a birthday party" (Group 1); and "If next year he won't have a birthday party? . . . He, he—he won't grow up" (Group 3).

A birthday indicates the day of birth and the growing up process. Responses in this category contained the components of our definition: a celebration or party intended to indicate one's date of birth and the fact that one is older. Responses included, "Every time you grow a little taller, and then you have a birthday party" (Group 3); "It's a kind of party to feel how great it is that you are big" (Group 4); and "To celebrate that we have gone up a year" (Group 4).

Our results indicated that young children (up to age 5 years) generally believe that a birthday causes growing (see Table 1). As they mature, children begin to view a birthday as a celebration of growing up and as a means to determine one's age.

Issue 3: Requirements of a Birthday Party ("What Customs Are Essential?")

In Israel, birthday parties involve a rich ceremonial. A central prop is a decorated cake with lit candles corresponding in number to the child's age, and the key moment of the celebration is when the child blows out the candles. There are various sweets, balloons and party decorations, and a clown or a magician. The child often wears a crown made out of flowers, family members are present, guests bring little presents, and there are special songs and party games. For Issue 3, we were concerned with which (if any) of these elements the children conceived of as being essential for a birth day to count as a birthday. The children were presented with the following scenario:

> Mom, Dad, Haimke, and his brothers and sisters sat around the dinner table and had a conversation. Do you know what about? They were discussing Haimke's birthday. Haimke said that he can hardly wait for his birthday and that he is so happy that in only 2 weeks his birthday will be celebrated. Dad was slightly embarrassed when he said, "Haimke, you know that this year we really don't have that much money. Also, our house is very crowded. So I thought that this year on your birthday we would give up some of the things that we usually do on a birthday." "What?" asked Haimke in alarm. "You won't give me a birthday party?" "Yes! We will give you a birthday party, but we will have to give up some things in order to save money," said Mother. "Let's think, for example, if we give up the magician, is that so terrible?" Haimke thought for a moment, and then an argument started between him and his brothers. Some said, "It doesn't matter, it will still be considered a birthday." Some said, "No magician? That's no birthday." They argued and argued but could not decide whether or not it is considered a birthday without a magician.
>
> What do you think? And how about no crown of flowers? And no sparklers? And no presents? And no candy? And no cake? And no candles? And no friends or guests? And no balloons? In the end, Dad suggested that Haimke decide what the most important things are, without which the "birthday" will not be considered a "birthday." And those things will not be omitted. Now *you* help Haimke decide: Do you think that there are things that must be present on Haimke's birthday in order for him to consider it a birthday, and therefore he must not give them up? What are they?

Every custom is essential. Answers in this category were clear cut, all-or-nothing, with the children viewing each part of the ritual as equally important (an absence of any custom meant no birthday). To the interviewer's questions "And no balloons?" and ". . . no crown of flowers?" two children answered: "It doesn't count" (Group 1).

Some customs are essential. Answers reflected the belief that some customs are essential but others can be given up if there is no other choice. These answers expressed the view that without certain customs, a birth day cannot be considered a birthday. Responses included (the interviewer's questions are in brackets), "A cake is very important." ["Why?"] "Because it is. And presents also. Also candy." ["A magician?"] "Not important, you can have a clown instead." ["And if you have to give up the clown as well as the magician?"] "It doesn't matter; it's still a birthday. But without a cake, it's only half a birthday" (Group 1).

Only the customs that cause happiness are necessary. Responses referred to the pleasure and joy that some customs generate (if a birthday is in essence a joyful celebration, leaving out some of the customs that make it fun diminishes its most important aspect). Sample response: "Candy is not necessary. Balloons aren't either. [Decorations?] No. It's like balloons. [Candles and cake?] It depends—because the child has to be happy and choose the cake and put out the candles; and the people, more friends, and at least parents and brothers and sisters, they have to be there. Otherwise it is a sad birthday, and you can't have that" (Group 4).

No customs are essential. The view that no component or custom is necessary for a birth day to be considered a birthday was expressed in answers such as "Nothing is necessary. Even without anything it still is a birthday" (Group 4).

Our findings for Issue 3 indicated that as children grow older, their views shift from an insistence that each and every custom is essential to the position that no customs are actually required.

Issue 4: Conception of Date and Year

Birthdays are celebrated according to the date (month and day) of birth, whereas age is determined according to the year of birth. We investigated children's understanding of this complexity by posing two separate questions, each presenting a pseudo paradox.

The first question tested children's reaction to the fact that two people may celebrate their birthday on the same day even though their ages are different. It was presented in the form of the following story:

> Do you know my neighbor, Ron's Grandpa? Who is older, Ron or his Grandpa? You know, Ron told me a peculiar story: He said that tomorrow both he and his Grandpa

> have a birthday. I don't know whether to believe him. How can it be that such an old Grandpa and such a little boy have a birthday together?—on the same day? They are not the same age, are they?

(Paradox 1) Too paradoxical to understand. A few of the youngest children replied, "I don't know," indicating their inability to understand the question or the perception of a paradox.

(Paradox 1) The situation is impossible. The children who thought the situation was impossible, that it represented a paradox, did not fully comprehend the concept of date or the distinction between its components (day, month, year) in relation to a birthday. Sample response: "Impossible! It's not true! You can only do that for two kids. But a boy and a man can't have [their birthdays] together" (Group 1).

(Paradox 1) The situation is possible. Children who believed the situation was possible did not see it as being paradoxical. Their answers involved a full understanding of the concept of date and revealed that they had the ability to differentiate its parts (day, month, year) in relation to the concept of birthday. One child responded, "Yes! It is possible, because Ron was born on the same day and the same month but several years later" (Group 4).

With the second question for Issue 4, we confronted the children with a situation in which a person who is older than another (and therefore was born a few years *before* the other person) celebrated his or her birthday *after* the other person. The question was presented as follows:

> You know, my son [or my brother] is much younger than I am. He is in the third grade, and I am this big. So isn't it true that if I am bigger, it's a sign that I was born before him?—much before him, right? So how is it possible that my birthday is always after his? His birthday is always at the beginning of the year, and mine is at the very very end of the year, I have a birthday long after he does!

Answers were classified according to the same three categories.

(Paradox 2) Too paradoxical to understand. As in the first question, a few children did not appear to understand the question and responded, "I don't know."

(Paradox 2) The situation is impossible. Children answering in this category regarded the situation as a paradox and sometimes suggested a way to resolve it, demonstrating that their understanding of the concept of date was not yet complete. Responses included, "No! It's not true. It has to be for you first and then for your son, because he is younger" (Group 1); "How can it be? Because this man (probably your son) saw a star and made a wish. Because when a star falls you make a wish. So he made a wish to have his birthday before you. So that was his wish" (Group 2).

(Paradox 2) The situation is possible. Responses indicated that children perceived the situation as possible and not paradoxical. Sample responses: "Because you weren't born in the same year" (Group 2); "There are months. When they end they start again. So, for example, he was born and then you were born. But he was born in 1994 and you in 1993 (Group 4); and "It's possible, because you were born way before him, but he was born a month before you" (Group 4).

Again, our findings revealed a progression of understanding from youngest to oldest. The younger children could not resolve the perceived paradoxes, but the 9-year-olds no longer had difficulty with them (see Table 1).

Issue 5: The Relationship of a Birthday to Growth (Can a Birthday Affect Growth?)

We were interested in whether children believed that a birthday could serve as a means to manipulate age or size (in Hebrew, no distinction needs to be made between growing in size or age). Because age may be perceived to be *increased* or *decreased*, we tested these directions separately, posing two questions to the children.

For the first question, which described increasing a child's age, we returned to the story of the boy who had no birthday party (because his mother was sick) and did not know how old he was (see Issue 2) and presented the children with the following situation:

> Do you remember the boy whose mother became sick and could not give him a birthday party? And he was very sad because he did not know how old he was? You know what? His mother suggested that because he is a nice boy she would make up for it. The following year she will give him a birthday party not only once like everybody else has but rather again and again until he is older than everybody else. Do you understand? One birthday for age 5, like his friends, and then quickly another birthday for age 6, and then a few days later one for age 7. Two extra birthdays—so that he can grow and catch up with his friends. What do you think? Is that a good idea?

(Question 1) It is possible. The answers in this category revealed a misconception of the role of a birthday as an event that can actually increase age. Responses included, "Yes! He will be bigger [or older]. He will be bigger than everybody. . . . It is a good idea" (Group 1); and "It's not good to have so many birthdays so close together, because he will be disappointed, because he will get to his age suddenly, and the kids will start envying him, and all sorts of trouble can start—he can lose them" (Group 4).

(Question 1) It is impossible. Overall, the majority of the children believed that it is impossible to increase age by means of a birthday (see Table 1). Sample responses: "But even if they give him a birthday party at 6, he will remain only 5 years old, because that's how it is in his body according to the real age" (Group

2); and "You can do it, but it's not real. Really it doesn't matter. The birthday party can't change anything" (Group 4).

The second question for this issue was similar to the first but involved a decrease in age (or size) following a birthday. The interviewer posed the question after reading the children the following story:

> Yesterday I saw in the paper a picture of a very, very, old man—so old he was all wrinkled, with glasses and a beard. He even needed a cane to help him walk. And his back was all bent. Do you know why they put his picture in the paper? Because he wanted to let every one in his family know that from now on he does not want to grow anymore. He told his family, through the paper, that being 80 years old is enough for him, and instead of growing older and older, he would like now to grow younger and younger. So, on his coming birthday he wants to have a birthday party for 79 [or 70 depending on the age of the child questioned], and the year after that he wants to have a birthday party for 78 [or 60], and the year after that he wants a birthday party for 77 [or 50], and the year after that he wants to have a birthday party for 76 [or 40] and so on, and he wants to continue like that until he becomes young. So what do you think of his request? Good, isn't it? Well, *is* it a good idea?

(Question 2) It is possible. The children responding that it was possible perceived of a birthday as an event that can change age and can be used to decrease age. Responses included, "If he wants to, it's possible. He will be younger" (Group 1); and "Yes, it's good that way, because he won't be old anymore" (Group 3).

(Question 2) Yes and no. Responses in this category were by children who differentiated between size and age and perceived a birthday as an event capable of bringing change. They seemed to believe that size changes regardless of the birthday party, but they perceived age as arbitrary or conventional and, therefore, capable of being changed by means of a birthday. Sample response: "It's really a good idea. But if at his age he becomes smaller, his body will definitely not become smaller, and he will also have wrinkles" (Group 3).

(Question 2) It is impossible. Most children responded that it was impossible to decrease age by means of a birthday party. Sample responses: "Even if he suggests this, he won't be any smaller—or younger. Even if they give him a 70th birthday party, he will still be 81" (Group 2); and "It's not true! It's just a story" (Group 4).

Our findings for Issue 5 indicated that younger children believed that a birthday celebration affected age and could be used to change age. Older children abandoned this conception. Overall, very few children accepted the possibility of decreasing age (see Table 1).

Discussion

The results of this study reveal that the development of children's understanding of birthday as a concept spans more than one type of cognition. In our exploration of the five issues, we found three main trends.

First, younger children (4- and 5-year-olds) tended to rely almost entirely on the explicit, concrete, and sensible characteristics of a birthday. The ability to grasp the overt as well as the covert aspects of the concept of birthday develops gradually (see Watters & English, 1995) and was evidenced by none of the 4-year-olds but by nearly all of the 9-year-olds. Regarding Issue 1, for example, 4-year-olds defined a birthday on the basis of only its explicit aspect of celebration; by and large, 5-year-olds did so also. Seven-year-olds did so rarely, whereas most 9-year-olds extracted the implicit aspect of the birthday as a cultural habit, combining it with the explicit social aspect of celebration into a more comprehensive, synthesized concept.

Another trend that emerged in our results was the gradual shift from younger children understanding only the *associative* relations between different aspects of the concept (e.g., celebration and growing up) to older children having a more *conceptually based* understanding of these relations (Markman, 1999), which enables a more elaborate reasoning. To illustrate, consider the responses for Issue 2 (What is the essence of a birthday?). Many of the 4-year-olds believed that birthday parties caused growing—an associative reasoning between two aspects that usually go together. By age 9, they came to see these parties as a celebration of growing up, and as a means to determine one's age—a more knowledgeable and qualitative reasoning. To the extent that children viewed the ritual enactment of the birthday as being responsible for this transformation (young children), they insisted that each and every custom was essential to the birthday (Issue 3). Most of the oldest children did not think that the props and customs were necessary for growth (although they thought that some of them were required for the birthday party to be fun).

Young children were impressively consistent, indicating that because birthday rituals actually effect an age change, they can also be manipulated to change age at will (a finding that emerged for Issue 5, "Can a birthday affect growth?"). Older children viewed increasing or decreasing age through birthdays as being impossible. However, even the younger children sensed a difficulty with age manipulation, for they also seemed to be aware that biological aging is irreversible. Although many children agreed that age can be increased by multiplying birthday celebrations, they were less willing to accept that this stratagem would be effective for reversing aging, and several children suggested compromises that clearly expressed the two positions that they were torn between.

The last trend was the shift from successive to simultaneous synthesis (Biggs & Moor, 1993; Das & Varnhargen, 1986; Watters & English, 1995). The former refers to concentrating on one aspect at a time, gradually integrating several aspects together into a cohesive unit. As discussed with respect to Issue 5, even the 4- and 5-year-olds who knew that aging is irreversible could not draw the appropriate conclusion—that celebrating birthdays backwards cannot make one younger—because they were unable to simultaneously synthesize the aspects. The same was also true for Issue 1, in which most of the 9-year-olds, many of the

7-year-olds, but none of the 4-year-olds could define a birthday as a synthesis between the celebration, the day of birth, and growing up. And again, the same was true regarding Issue 4. The structure of age, dates, and their relations to birthdays were inexplicable to the younger children. For them, time was only linear, as was growth, and the rankings of age and the order of birthdays had to coincide. Birthdays evolve, in a child's mind, from a performative social act to a social occasion to mark growth and rejoice in it. The early conception is social and self-contained: A group of friends and relatives convene to declare that the child is now an accredited member of the next higher age class. The mature conception is also socially based (people meet to rejoice together). However, the social aspect is integrated in the mature conception with external conceptual subsystems: the irreversible and independent unfolding of biological growth and the cyclical aspect of time. This higher understanding enables the child to transcend the performative and magical approach to the birthday ritual.

The concept of birthday is not as simple as it seems. It is a complex, multidimensional, integrative concept. Four-year-olds, who rely on a narrow basis of knowledge (their own limited experience), who are unable to integrate several aspects, and who lack the ability to extract the covert aspects to be integrated, construe a very partial concept of a birthday. Of the various conceptualizations possible, they elaborate one on the basis of its overt and explicit aspects. Even when 4-year-olds understand or sense another relevant aspect, they cannot construct the interrelations between these aspects, especially when the aspects span more than one type of cognition. The required synthesis, therefore, eludes them. By the age of 9 years, most children have overcome these limitations and have fully comprehended the birthday concept.

In concluding this discussion, we feel the final word belongs to Carroll:

> "I never ask advice about growing," Alice said indignantly.[2]

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[2]"Too proud?" asked the other.

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