The Experimental Effect of Parental Attentiveness on Children's Physical Activity Behavior

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ABSTRACT

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OBJECTIVES To assess children's physical and sedentary activity behavior, enjoyment (i.e., liking), and preference during two separate experimental conditions: *parent attentive* and *parent non-attentive*.

METHODS Ten children ($n = 6$ boys, 4 girls), 3 to 6 years old, along with one parent ($n = 6$ mothers, 4 fathers) per child participated in each condition on separate days for 30-minutes in which they could choose from a variety of physical and/or sedentary activities.

RESULTS A greater number of accelerometer counts ($p = 0.04$) were accumulated during the *parent attentive* ($96,547 \pm 33,075.26$ counts) condition than the *parent non-attentive* ($48,316.30 \pm 46,101.47$ counts) condition. More time ($p = 0.007$) was allocated to sedentary activities during the *parent non-attentive* (19.5 ± 13.3 minutes) condition than *parent attentive* (2.8 ± 3.55 minutes) condition. Children liked ($p = 0.004$) the *parent attentive* (9.05 ± 1.21 cm) condition more than *parent non-attentive* (4.42 ± 3.18 cm) condition. A non-significant ($p = 0.21$) proportion of children identified the *parent attentive* (70%) as their preferred condition over the *parent non-attentive* condition.

CONCLUSIONS *Parental attentiveness* may be an important component to take into consideration when trying to maximize children's physical activity behavior and enjoyment while simultaneously reducing sedentary behavior.

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Introduction

Childhood obesity continues to be a serious medical condition in the United States resulting in children and adolescents being at an increased risk for the development of many obesity-related disorders such as diabetes, high blood pressure, and high cholesterol [1-3]. According to the Centers for Disease Control (CDC) and Prevention [4], 13.9% of 2- to 5-year olds are obese, 18.4% of 6- to 11-year olds, and 20.6% 12- to 19-year olds. Due to this continued increase in the

prevalence of childhood obesity, it remains imperative that efforts are being placed into the development of physical activity interventions to decrease the number of obesity-related disorder cases. According to the CDC [4], one of the best strategies to reduce childhood obesity is to improve the exercise habits of the entire family. This type of strategy has been examined previously in several experimental and non-experimental investigations [5-9]. Since it is important to influence physical activity behaviors at an early age to decrease the risk of childhood obesity and obesity-related disorders, it is necessary to direct our focus on the parental interaction that occurs during children's physical activity interventions. This

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is imperative, because parent(s) are considered the primary role model for younger children and can therefore, influence physical activity behaviors to the greatest extent [5-16].

It has been recognized that parents play an influential role in shaping children's physical activity participation through support and behavioral modeling [7,14]. The Social Learning Theory can be used to explain this relationship that exists between parents and their children's habits and attitudes towards physical activity [11,15]. This theory suggests that if parents model physical activity (i.e., exercise in front of their children), then their children are more likely to be active. Another explanation for how parents may influence their children's physical activity is provided by the Behavioral Choice Theory. Children's decision to participate in one behavior (e.g., physical activity) is weighted against the decision to participate in an alternative behavior (e.g., sedentary activity) [16]. This theory suggests that parents must encourage physical activity rather than sedentary activity. This can be facilitated by parents creating environments that promote enjoyment of physical activity.

Recent investigations have attempted to understand the casual impact parental interactions has on children's physical activity [5,6]. Rebold and colleagues [5] conducted an experimental study which investigated how parents playing and parents watching influenced their children's physical activity behaviors. It was found that children were more physically active when their parents participated ($109,523 \pm 32,155$ accelerometer counts) in physical activity with them as compared to watching ($85,624 \pm 44,985$ accelerometer counts) them play or allowing them play alone ($67,938 \pm 37,857$ accelerometer counts) [5]. One of the limitations associated with this study was that the conditions were conducted inside a gymnasium and did not completely resemble a natural and realistic environment for children. To address this limitation Kobak and colleagues [6] conducted an experimental study that investigated children's physical activity while playing with their parents and their friends on an outdoor playground. It was found that children were more physically active when they played with their friends ($93,363 \pm 22,608$ accelerometer counts) as compared to playing with their parents ($87,503 \pm 37,063$ accelerometer counts) or playing alone ($70,672 \pm$

$35,228$ accelerometer counts) [6]. It has also been recognized that parents play a particularly important role in their children's physical activity behaviors when they are younger (e.g., less than six years of age) [12]. Kobak and colleagues' [6] investigation focused on 8.2 ± 1.7 years old children while Rebold and colleagues' [5] study focused on 4.05 ± 0.9 years old children, which may partially explain why parents had a greater impact on physical activity in Rebold and colleagues' [5] study. This does circle back to the CDC recommendations on why it is important to improve the exercise habits of the entire family, because different family members will have differing effects on children's physical activity behaviors at different life stages (e.g., parents at younger ages; siblings at older ages).

An environment that parents often take their children to play at is the playground, and when parents are at the playground many of them sit on the benches and engage in sedentary behaviors (e.g., work on their laptop, scroll through apps on their cell phone, etc.). But, can the attentiveness levels (*attentive* vs. *non-attentive*) of parents while watching their children play actually be influencing how much physical activity their children are actually engaging in? The purpose of this study was to assess the amount, intensity, enjoyment (i.e., liking), and preference of children's physical activity in a controlled setting under two experimental, conditions: *parent attentive* and *parent non-attentive*. To the best of our knowledge, this was the first study to experimentally examine the effects of parental attentiveness on children's physical activity behavior. This study involved the manipulation of what parents were required to do (*attentive* and *non-attentive*) while sitting on a bench watching their children interact in an environment that included both sedentary and physical activity options. It was hypothesized that the *parent attentive* condition would increase children's physical activity behavior relative to the *parent non-attentive* condition.

Methods

Subjects

Ten children ($n = 6$ boys, 4 girls) between the ages of 3-6 years old (mean age = 4.75 ± 1.28 years) <Table 1>, along with one parent ($n = 6$ mothers, 4 fathers) per child were

recruited from the local community through flyers. Children, along with one parent per child participated in two conditions (*parent attentive* and *parent non-attentive*) on separate days in a 4,360 square foot gymnasium. Both conditions took place inside a gymnasium even though this was a noted limitation in previous studies [5, 6]. Parents of the children indicated to the researchers that they preferred the gymnasium over the playground due to driving distance, and it was also easier to reserve the gymnasium to ensure no other children and parents were present that could have influenced our data collection procedures and our findings. Children were excluded from the study if they had any contraindications to exercise (i.e., orthopedic injury, cardiovascular disorder, etc.). This study was a within-subjects design with all children being exposed to the two conditions in a randomized order. The same parent participated in both the *parent attentive* and the *parent non-attentive* conditions with their child. This study received approval from the University Institutional Review Board.

Table 1. Children's Physical Characteristics (Data are Means $\pm$ SD)

	Boys (n=6)	Girls (n=4)
Age (yrs)	5 $\pm$ 1.26	4.5 $\pm$ 1.29
$p = 0.59$		
Height (cm)	114.08 $\pm$ 13.14	110.78 $\pm$ 10.77
$p = 0.67$		
Weight (kg)	21.41 $\pm$ 3.57	19.89 $\pm$ 3.31
$p = 0.51$		

Procedures

Upon arrival for the first visit, parental consent and child assent was obtained. The child then underwent anthropometric assessments (i.e., height and weight) <Table 1>. Children were measured for height via a stadiometer and weight by using a balance beam scale (Health O Meter, Chicago, IL). In addition, gender and age were also recorded. During each of the two separate conditions, participants were taken to a 4,360 square foot gymnasium where there was a variety of age-appropriate physical activity options and sedentary alternatives. The set-up of the gymnasium was similar to what was utilized in previous studies conducted

by Rebold colleagues [5], Sanders and colleagues [17], and Barkley and colleagues [18]. Physical activity equipment consisted of jump ropes, basketballs and hoops, hurdles, footballs, soccer balls, and multiple obstacle courses which was made up of gymnastic soft-play equipment [5,17,18]. The sedentary activity area was equipped with one table and one chair to accommodate the child. Children were instructed that they had to sit if they were playing with the sedentary alternatives. The age-appropriate sedentary alternatives included action figures, toy dolls, board games, reading books, crayons, markers, colored pencils, blank paper for drawing, and coloring sheets [5,17,18]. After being shown the physical activity options and sedentary alternatives the child was fitted with a validated accelerometer (Actigraph GT1M, Pensacola, FL) that was comfortably wrapped around their waist and it recorded the number of physical activity counts per session for each child [19]. After being fitted with the accelerometer, the child was given permission to participate in any of the physical and/or sedentary activities they wished, in any pattern for 30-minutes by themselves (i.e., no other children present) while their parent was seated in a chair in the gymnasium.

The *parent non-attentive* condition consisted of the child participating in the physical and/or sedentary activities while their parent was seated in a chair in the gymnasium. During this condition, the parent was instructed not to speak with their child and to remain active on their electronic device (e.g., laptop or mobile tablet) for the entirety of the condition. Parents were not allowed to leave their chair, and if their child tried to talk to them, parents were instructed to tell their child that they were busy. The *parent attentive* condition was the same as the *parent non-attentive* condition except the parent was allowed to speak with their child, however, they were informed not to instruct the child about which activities they should or should not utilize. Parents were not allowed to leave their chair, and while seated in the chair parents were not allowed to be on their electronic devices. Apart from the participant child, the parent, and research personnel, there were no other individuals present in the gymnasium during each condition.

In addition to accelerometry data, the time children allocated to physical and sedentary activities during each

30-minute activity session was recorded by direct observation of research personnel using a stopwatch. To record how much time children spent engaged in the physical activities, the research personnel started the stopwatch when children were actively moving (i.e., walking, running, jumping, etc.) and then stopped the stopwatch as soon as they stopped moving or sat down. And, to record how much time children spent engaged in the sedentary activities, the research personnel started the stopwatch when children were sitting in the chair located by the table with the sedentary alternatives and stopped the stopwatch as soon as they stood up and started to move. As stated previously, children were instructed to remain seated while engaged in the sedentary alternatives. At the end of each 30-minute session, each child was asked to indicate their liking of the activity using a validated visual analog scale by marking on a 10-cm line anchored by “like it very much” on the left and “do not like it at all” on the right [20]. Children were then asked if they would like to play for an additional 10-minutes or if they wished to be finished for the session. If a child elected to participate in an additional 10-minutes of activity they followed identical procedures to their initial 30-minutes for that day. After both conditions were completed, each child was asked to indicate which condition (*parent attentive* or *parent non-attentive*) was their favorite.

Analytic plan

All data were analyzed with SPSS version 20.0 (SPSS Incorporated, Chicago, IL) with an a-priori α level of ≤ 0.05 . Independent samples t-tests were used to examine any sex differences (boys, girls) in physical characteristics (i.e., age, height, weight). A two sex (boys, girls) by two condition (*parent attentive*, *parent non-attentive*) analysis of co-variance (ANCOVA) with repeated measures on social condition and co-varying for age of the child (3-6 years old) and sex of the parent (mother, father) was utilized to assess differences in accelerometer counts and sedentary minutes during the 30-minute session. Post-hoc analyses for all significant main and interaction effects were completed by using t-tests with the Benjamini and Hochberg False Discovery Rate correction [21]. A Wilcoxon signed rank test was used to examine any differences in the children's decision to choose to participate

in the additional 10-minutes across the two conditions. Additionally, a chi-square analysis was performed to assess any differences in the children's preference of the two conditions. Finally, a Pearson's correlation coefficient was performed to assess the relationship between accelerometer counts and sedentary minutes of the two conditions. Differences in estimated METs and kilocalories across the two social conditions were not analyzed as each of these variables was ultimately calculated from accelerometer counts. Therefore, analyzing estimated METs and kilocalories using the above ANCOVA model would yield the exact same results as the analysis of accelerometer counts.

Results

Independent samples t-tests revealed no significant differences <Table 1> between boys and girls in any of the physical characteristics (age, height, and weight).

Social conditions

Accelerometer counts

A Pearson's chi-squared test for normality revealed that accelerometer counts were normally distributed for both the *parent attentive* and *parent non-attentive* conditions ($\chi^2[9, N = 10] = \geq 16.93, p \leq 0.05$). There was a significant main effect of condition for accelerometer counts ($F = 5.79, p = 0.04$) <Table 2>. More counts ($t = 2.41, p = 0.04$) were accumulated during the *parent attentive* ($96,547 \pm 33,075.26$ counts) condition than the *parent non-attentive* ($48,316.30 \pm 46,101.47$ counts) condition. There were no significant main effect for sex or interaction effect between sex and condition ($F = 1.04, p = 0.34$).

Time allocated to sedentary activities

A Pearson's chi-squared test for normality revealed that sedentary minutes were normally distributed for both the *parent attentive* and *parent non-attentive* conditions ($\chi^2[9, N = 10] = \geq 17.21, p \leq 0.05$). There was a significant main effect of condition for time allocated to sedentary activities ($F = 11.99, p = 0.007$) <Table 2>. More time ($t = -3.46, p = 0.007$) was allocated to sedentary activities during the *parent*

Table 2. Children's Accelerometer Counts, Sedentary Minutes, Liking, Bonus Activity, and Preference of Condition (Data are Means $\pm$ SD)

	Parent Attentive (n=10)	Parent Non- Attentive (n=10)
Accelerometer counts (counts)	96,547 $\pm$ 33,075.26*	48,316.30 $\pm$ 46,101.47
$\eta^2 = 0.12$		
$p = 0.04$		
Sedentary minutes (min)	2.8 $\pm$ 3.55	19.5 $\pm$ 13.3†
$\eta^2 = 0.14$		
$p = 0.007$		
Liking (cm)	9.05 $\pm$ 1.21*	4.42 $\pm$ 3.18
$\eta^2 = 0.14$		
$p = 0.004$		
Bonus Activity (percent)	60%	40%
$p = 0.56$		
Preference of condition (number)	7	3
$p = 0.21$		

Data are Mean $\pm$ SEM

*condition was significantly greater than parent non-attentive

†condition was significantly greater than parent attentive

 $p < 0.05$ for all

non-attentive (19.50 $\pm$ 13.30 minutes) condition than the *parent attentive* (2.80 $\pm$ 3.55 minutes) condition. There were no significant main effect for sex or interaction effect between sex and condition ($F = 0.002$, $p = 0.97$).

Liking for each condition

There was a significant main effect of condition for liking ($F = 15.18$, $p = 0.004$) <Table 2>. Children liked ($t = 3.90$, $p = 0.004$) the *parent attentive* (9.05 $\pm$ 1.21 cm) condition more than the *parent non-attentive* (4.42 $\pm$ 3.18 cm) condition. There were no significant main effect for sex or interaction effect between sex and condition ($F = 0.06$, $p = 0.82$).

Bonus period of activity

There was not a significant difference ($Z = -0.58$, $p = 0.56$) <Table 2> between the proportion of children who chose to participate in the additional 10-minute bonus period between the *parent attentive* ($n = 6$) and *parent non-attentive* ($n = 4$) conditions.

Preference of condition

Chi-square analysis revealed a non-significant difference ($\chi^2 = 1.60$, $p = 0.21$) <Table 2> between the number of children that indicated they preferred the *parent attentive* ($n = 7$) condition versus the *parent non-attentive* ($n = 3$) condition.

Relationship between accelerometer counts and sedentary minutes

A Pearson correlation revealed a moderate negative relationship ($r = -0.31$) between accelerometer counts and sedentary minutes for the *parent attentive* condition. For the *parent non-attentive* condition, there was almost a perfect strong negative relationship ($r = -0.94$). This suggests that as children engaged in more physical activity their time spent in sedentary alternatives decreased.

Discussion

To the best of our knowledge this was the first experimental study examining the effects of parental attentiveness while watching their child play and how it affects their child's physical activity behavior. The results of this current study indicated that children were more physically active when parents were *attentive* versus when parents were *non-attentive*. Children had a 99% increase in accelerometer counts from the *parent non-attentive* condition to the *parent attentive* condition. Children also had a 596% decrease in time spent in sedentary activity from the *parent non-attentive* condition to the *parent attentive* condition. Finally, children reported a 105% increase in liking from the *parent non-attentive* condition to the *parent attentive* condition, which may explain why majority of the children (70%) indicated that they preferred the *parent attentive* condition. Additionally, only 60% of children elected to participate in the 10-minute bonus activity when their parent was *attentive* versus when their parent was *non-attentive*. This finding was surprising because previous studies that have implemented similar protocols have found that when children like (i.e., enjoy) a condition more, they are more likely to engage in the 10-minute bonus activity for that condition [5,6]. These current findings indicate that children are likely to engage in more physical activity and have less sedentary minutes when parents are *attentive*. Overall, if

parents are *attentive* while watching their children play, then that could lead to children participating in greater amounts of physical activity resulting in greater caloric expenditure and ultimately helping combat childhood obesity and obesity-related disorders.

When converting accelerometer counts to caloric expenditure, children “burned” an average of 86.16 kcals in the 30-minute *parent attentive* condition and 40.83 kcals in the *parent non-attentive* condition. The Freedson and colleagues [22] equation $(0.00094 \times \text{cnts} \cdot \text{min}^{-1}) + (0.1346\text{BW}) - 7.37418$ was utilized to convert accelerometer counts to caloric expenditure. Assuming children participated in similar 30-minute activity sessions three times per week for one year while using the caloric expenditure rates noted above, they would expend 10,483 and 4,968 kcals per year in the *parent attentive* and *parent non-attentive* conditions, respectively. This results in 5,515 kcals greater expenditure in the *parent attentive* than the *parent non-attentive* condition. Assuming 3,500 kcals expended is equivalent to one pound of body weight [3], this greater caloric expenditure when a parent is *attentive* would equate to 1.58 pounds of body weight lost per year more than the *parent non-attentive* condition. Additionally, children engaged in 111% more moderate-to-vigorous physical activity (MVPA) from the *parent non-attentive* to the *parent attentive* condition. Cauwenberghe and colleagues [23], developed accelerometer cut points to classify physical activities by intensity in pre-school children (5.8 ± 0.4 years). According to Cauwenberghe and colleagues [23], $\geq 2,340$ counts/60 s would classify as MVPA. If we convert the 2,340 counts/60 s to 30-minutes that would equate to 70,200 counts needed in 30-minutes to be considered engaging in MVPA. Children had 96,547 and 48,316.30 counts during the *parent attentive* and *parent non-attentive* conditions, respectively. Therefore, making simple changes, such as parents being *attentive* while their children are physical activity, may help offset this gradual excess weight gain.

As we hypothesized children accumulated significantly more accelerometer counts and less sedentary minutes when their parent was *attentive* versus the *parent non-attentive* condition. This is an important finding because parents simply being *attentive* offers a simple, yet effective means to

increase physical activity in children. Rebold and colleagues [5] previously thought that children’s physical activity would not significantly increase while parents were watching them play because parents were not modeling nor encouraging physical activity behavior, however, the findings from this current study demonstrate this not to be true. Therefore, the findings from this current study are not in agreement with the Social Learning and Behavioral Choice Theories, which suggests that parents play an important role in shaping children’s physical activity participation through support and behavioral modeling [7,14,16]. Although not recorded, it appears from these findings that no matter how much parents modeled or encouraged physical activity to their children prior to participating in this current study, as soon as parents were *non-attentive* children significantly increased their sedentary activity. This possibly means that if a child receives no modeling nor encouragement from their parent(s), something as simple as the parent(s) being *attentive* while at the playground can result in significantly more physical activity. Our results provide casual evidence that when parents are *attentive*, it results in a positive impact on children’s physical activity behavior.

The present results also demonstrated that children liked (i.e., enjoyed) the *parent attentive* condition more than the *parent non-attentive* condition with seven children reporting that the *parent attentive* condition was most preferred. As mentioned earlier, the Behavioral Choice Theory states that parents play a critical role in shaping children’s interest and involvement in physical activity by creating environments that promote enjoyment of physical activity [7,14,16,24]. The findings from this current study are in agreement with the Behavioral Choice Theory, demonstrating something as simple as being parents being *attentive* has the potential to create a more enjoyable environment that promotes greater physical activity participation. However, what was surprising was that the *parent attentive* condition did not result in greater amounts of children to elect to participate in the additional 10-minute bonus period when compared to the *parent non-attentive* condition. Previous studies [25-30] have suggested that if children find an activity to be more enjoyable it has the potential to lead to more engagement

with the activity. A method that was previously utilized by Barkley and colleagues [30] was used in the present study to assess children's motivation by providing them with the option to play for an additional 10-minute bonus period after completing each initial 30-minute activity session. Currently, only 60% of children chose to participate in the additional 10-minute bonus period during the *parent attentive* condition while only 40% chose the bonus period in the *parent non-attentive* condition. It is reasonable to suggest that since more accelerometer counts were accumulated during the *parent attentive* condition and children liked and preferred this condition more, it would be expected that children would engage in more total physical activity if the session were not stopped at 30-minutes. Future studies should consider examining the impact of parental attentiveness on children's physical activity over a longer time frame such as the recommendation of 60-minutes set forth by the American College of Sports Medicine [3].

While this was the first experimental study to examine parental attentiveness on children's physical activity behavior and the results are encouraging, it is not without limitations. This study was conducted inside a gymnasium that utilized equipment (e.g., jump ropes, basketballs and hoops, footballs, soccer balls, obstacle courses made up of gymnastic soft-play equipment, etc.) that children may not necessarily have access to. Although the set-up of the gymnasium was similar to what has been utilized in previous studies [5,17,18] the findings would possibly be more meaningful if children were allowed to be in a more natural and realistic environment similar to what Kobak and colleagues implemented while allowing children to play on a playground [6]. Children also participated in the conditions with only one parent, with 6 of the 10 parents being mothers. Although this is a realistic social environment at times because it has been reported that children generally tend to spend more time with their mothers than fathers [31], children do encounter interactions that involve the other parent and/or both parents simultaneously. It is possible that the presence of the other parent and/or both parents may differentially alter physical activity behavior. Another limitation is the 30-minute free choice activity session. Since more accelerometer counts were accumulated, and children

liked and preferred the *parent attentive* condition more, would children exhibit greater increases in total physical activity if the session were not capped at 30-minutes? A fourth limitation was that parental physical activity behavior was not assessed. Previous non-experimental studies have found that parents who are more physically active in front of their children or who encourage physical activity have children who are more physically active [7-9,11,12]. A fifth limitation was that the Freedson and colleagues [22] equation was utilized to convert accelerometer counts to caloric expenditure. This equation was developed based on the adult population, so it should be used with caution. It is recommended that the further development of equations applicable to children in free-living scenarios is needed. Lastly, we can only draw conclusions about the effect parental attentiveness has on children's physical activity behavior. We cannot make any inferences about the effect interactions with other adults may have. Children do interact with other adults in physically active environments such as teachers, sport coaches, older siblings, and extended family and these individuals may also effect physical activity behavior in children. Future studies should consider examining the following: the impact that both parents would have on children's physical activity behavior; the impact of parental attentiveness on children's physical activity over a longer time frame such as 60-minutes; comparing children whose parents are more physically active versus parents who are less physically active; and how other important adult figures (e.g., sport coaches, teachers) attentiveness may impact children's physical activity behavior.

Conclusion

This was the first experimental study designed to assess the impact of parental attentiveness on an acute bout of children's physical activity behavior. Prior experimental and non-experimental studies have suggested that when children are young, parents may have a significant impact on their physical activity behavior [5-9]. Since parental attentiveness was manipulated in the present study and its effects on children's physical activity behavior were assessed objectively we can conclude that when parents were *attentive* there was

an increase in children's physical activity behavior, their liking of the activity, and decreased sedentary behavior relative to when parents were *non-attentive*. It is important for parents to create social and physical environments that support physical activity, so that children can make healthy choices and establish healthy behaviors. Based upon the present results, it is reasonable to conclude that parents should remain *attentive* in physical activity environments (e.g., playgrounds) to maximize physical activity behavior in children.

Conflicts of Interest

The researchers claim no conflicts of interest.

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