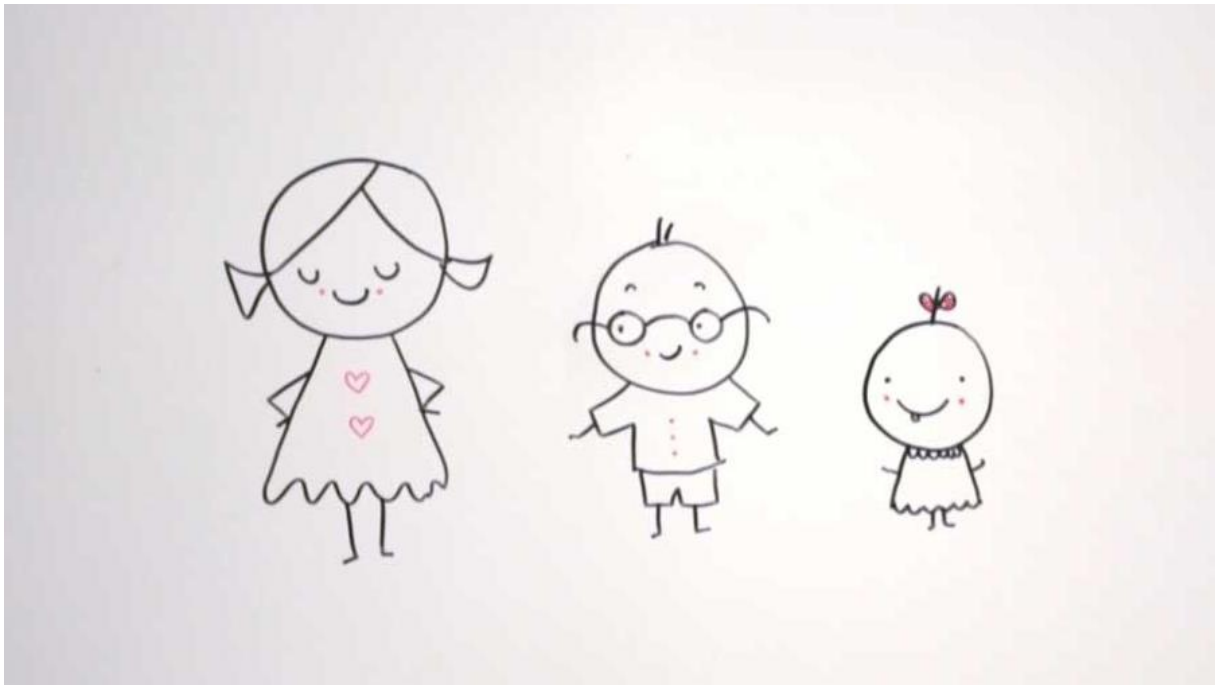
Siblings' influence on the cognitive development of a child

A quantitative research based on a German case



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SUMMARY

This research focuses on the influence of siblings on the cognitive development of a child. Research into the relationship between siblings and cognitive development are not that well researched as parental relationships, so that makes it relevant to look into. The central aim of this thesis is to look into different factors relating to the siblings of a child. The data used for this research is secondary data. This was a data set done by the Robert Koch institute (KiGGS data set), which is a health study of children and adolescents in Germany. Different regression models were used for different factors which could affect cognitive development. Controlling for socioeconomic status, sex and age. A binary logistic regression for the socioeconomic status of the family and for the amount of siblings was used, and a multiple linear regression for the age of siblings. No strong relation was found between different sibling characteristics and cognitive development. One of the findings about siblings that was significant actually showed the opposite from what was expected. Having one older sibling showed an association with speaking your first words at a later age. There do was a strong relation found between sex and cognitive development.

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1.1 BACKGROUND

Cognitive functions are an important component of how we understand and engage with the world and ourselves. Cognitive functions are described as: 'the processing of information, applying knowledge, and developing and changing mental representations (or mental maps) based on experience' (Kuh et al., 2013). According to this definition, for children, cognitive functions are mostly measured as general cognitive ability. With one factor referring to the attainment and use of knowledge (e.g. vocabulary, pronunciation) and the other factor referring to reasoning and problem- solving in new situations (like completing a logical sequence). However, Kuh et al. (2013) argue that cognitive functions are holding more than can be captured by test scores alone. It also includes functions which are referred to as everyday cognition, such as communicating, planning, managing day to day tasks and circumstances, and being able to process information that has emotional value. This emphasis on functionality rather than process leads to the notion of cognitive capability: 'the capacity to undertake the mental tasks of daily living' (Kuh et al. 2013).

In childhood and adolescence cognitive ability is correlated with cognition in adulthood and old age. So, cognitive functions are tracked across life. Therefore, different influences on cognition at any life stage can indirectly influence cognitive functioning at stages following (Feinstein & Bynner, 2004).

A number of factors are associated with cognitive development. These are for example biological factors like genetic influences (Kuh et al. 2013). A high proportion of differences between individuals in general cognitive ability is due to the genetic variation. Also, by interaction with the environment epigenetic alteration of gene expression can occur and this can affect cognitive development. Beside these individual factors, there are many social factors that are associated with cognitive development (Kuh et al., 2013; Feinstein & Bynner, 2004; Barclay et al., 2018). For example, these can be parenting and the role of the caregiver, educational experiences like school years offered and household composition and size. For example, poverty can have a negative effect on cognitive stimulation and affection from parents.

With regards to household composition and size, brothers and sisters could be potential determinants for cognitive development. According to Brody (2004), relationships between siblings can contribute to children's cognitive, social, and emotional development. These contributions can be direct when siblings encounter each other, or they can be indirect, due to the impact that a sibling has on parents that then influences the support that the child receives. Differential treatment by parents is a third way in which having a sibling can contribute to child development. Children may be treated differently than their siblings are treated by their parents, or at least think that they are treated differently. The development of believing that you are treated differently has implications for the mental health of children and adolescents. Freijo et al. (2006) state the importance of these relationships for the development of perspective- taking skills and the understanding of other people's emotional and mental states.

Also, the socioeconomic status (SES) of a child's family can contribute to its cognitive development. Due to its own effect it has on cognitive development and due to the effect it has on sibling's relationships. The effect of different variables such as the amount of social

support received by the family during child- rearing, the quality of the physical environment of the family and the resources provided by parents can have different impacts on the cognitive development of a child (Freijo et al., 2006). For example, in an article of Ruhm (2000) is talked about parental employment and cognitive development. Parental employment can influence the time investment of parents during childhood. Increased employment can mean less time to invest in their children, which can promote unhealthy development. However, increased employment can also provide extra income in the household, which provides the household with more resources.

According to McHale et al. (2014) relationships between siblings have been relatively neglected in research. Between 1990- 2013 they found around 741 citations for sibling relationships abstracts and more than 30.000 for parent relationships. So, with this thesis the influences of siblings on child and adolescent development can hopefully be portrayed.

1.2 RESEARCH PROBLEM

Research aim

The aim of this research is to look into different factors relating to the siblings of a child. These factors then will be used to see the effect it has on cognitive development of children in Germany (by using the KIGGS data set). The goal of this research is to examine if underlying determinants like socio- economic status, sex and age affect this relationship, thus creating a better understanding of the underlying determinants for cognitive development.

Research questions

Main question: *How do siblings contribute to the cognitive development of a child?*

Secondary questions:

1. *Does the socioeconomic status of the family moderate the potential effects of siblings on cognitive development?*
2. *Does the amount of siblings (or not even having siblings) show differences for the cognitive development of a child?*
3. *Are there differences to be seen between older and younger siblings of a child for its cognitive development?*

1.3 STRUCTURE OF THESIS

In the following chapter the theoretical framework and the main subjects of this thesis will be explained. Based on existing academic literature the concepts of socioeconomic status, cognitive development, siblings and other concepts that relate to this will be explained. Previous findings about these concepts and the relations between them will be discussed. Based on this literature review hypothesis will be formulated and a conceptual model will be

presented. The three secondary questions will be looked into by using secondary data, which will be described elaborately in the methodology section. Finally, drawing on the discussion and results of the three secondary questions, the central aim will be addressed in the concluding section.

2.1 THEORETICAL FRAMEWORK

This theoretical framework will focus on the contributions of siblings for the cognitive development of children. So firstly, influences will be discussed for different sibling characteristics.

2.1.1 Siblings' contributions: older sibling(s) and birth order

As was said in the background, there is a relationship between sibling interactions and cognitive development. Freijo et al. (2006) for example stress the importance of these relationships in the development of perspective- taking skills and the understanding of others' emotional and mental states. They also state the hypothesis that children with older siblings develop theory of mind skills at an earlier age. Brody (2004) argued that older siblings who are in middle childhood can teach new language skills and cognitive concepts to their younger siblings who are in early childhood. During the middle childhood years, older siblings become better teachers, because they learn how to simplify tasks for their younger siblings. The ability to adjust their teaching behaviours to their younger siblings' capacities increases as older siblings develop the ability to take other people's perspectives.

Zajonc & Markus (1975) found that birth order has an impact on a number of dimensions. They showed that firstborns tend to have higher intellectual abilities than later born. For instance, Kuba et al. (2018) mention that they achieve higher scores in tests that require divergent thinking and they perform better in abstract reasoning as well as in other tests that measure intellectual performance or intelligence.

2.1.2 Siblings' contributions: amount of siblings

According to the confluence model designed by Zajonc and Markus (1975), as the number of siblings in the family increases, the richness of the stimuli for cognitive development received in family interactions gradually decreases. This is due to the fact that siblings are not such effective, complex role models as their adult parents. The relation between the amount of siblings and cognitive development is therefore inversely proportional. An argument that supports this given relationship is that parents' material, educational and interactive resources are limited, and that therefore an increase in the number of siblings results in a progressive dilution of these resources. Also, Downey (2001) confirms this association, linked to the dilution of resources. A research was done between the number of siblings and the educational level reached by eighth- grade students. The author confirms that the availability of parental resources (both economically and interactive) decreases as the number of siblings increases. This can have negative consequences for their future educational level. There are also authors critical towards this theory. Arranz et al. (2001) point out that the effects of

family size are false and the result of a failure to consider other associations such as that between low socioeconomic status and large family size.

2.1.4 Siblings' contributions: parental differential treatment

It is important to acknowledge parental differential treatment (PDT). Having a sibling creates a context in which parental behaviour takes on symbolic value. Because children use it as an indicator for the extent to which they are loved, rejected, included, or excluded by their parents. If children and adolescents believe that they are receiving more negative treatment and less warmth from their parents than their siblings do, poor emotional and behavioural functioning can follow as a result (Brody, 2004). The perception that children have of this differential treatment from parents plays a role. Children who believe their parents' differential behaviour to be just report less behaviour problem than children who consider it to be unjust. Children and adolescent who perceive PDT as unfair often experience lower levels of self- worth and have higher levels of behaviour problems. By citing ways in which they and their siblings differ in age, personality and special needs, children justify differential treatment. It is important that children understand why parents treat siblings differently from one another so that they will be protected from interpreting the differences as evidence that they are not valued or worthy of love. Not only is the less- favoured child associated with greater behaviour problems, but PDT has also been associated with worse sibling relationships (Meunier et al., 2012).

2.1.4 The socioeconomic status of the family

The article of Cohen et al. (2010) describes a wide range of adult health outcomes determined by socioeconomic status (SES) exposure during childhood. They explore different environmental, behavioural and physiological pathways that can explain how childhood SES would influence adult health. For example, one explanation for this relation involves the access to and affordability of adequate health care. Another explanation involves that children with college educated and relatively rich parents are more likely to achieve higher educational opportunities and a higher status. In one of their models Cohen et al. (2010) describe physical environmental exposures which include factors present within the home, neighbourhood and school. Mentioned for the concept of neighbourhood is for example the condition of public spaces and air and water quality, but can also include crime or violence in the neighbourhood. These conditions can have immediate effects on children's psychological development. For example, they could cause stress and depression, anxiety that is related to school, wrong expectations about their abilities and a lower self- esteem. These then can be potential beginnings of biological responses related to stress and of health- damaging behaviours that increase the risk for diseases over the life course. Their other model describes psychosocial environmental exposures within the home, neighbourhood and school. Within the home, a family's SES can influence how well that family functions. When the SES increases, so also does the likelihood that families are characterized by low levels of conflict, warm and attentive family relationships, and consistent parenting practices.

In an article by Bradley & Corwyn (2002) they go more into the relation of SES and cognitive development. According to them there is a belief that high SES families supply their children an array of services, goods, parental actions, and social connections that potentially benefit

children. On the other side, a concern that many low SES children lack access to those same resources and experiences, therefore putting them at risk for developmental problems. Poverty and low parental education are associated with lower levels of educational achievement and IQ later in childhood. According to Bradley & Corwyn (2002) there has been some debate regarding which aspects of SES is most strongly associated with cognitive development. Each SES measure (family income, parents' education and occupation) predicted intellectual attainment, with education being the best predictor.

Guo and Harris (2000) describe that in theory, the effect of SES of the family operates through a mediating process, for example a low SES in which poverty or lack of income affects some mediating factors and these factors, in turn affect child outcomes. They explain two models that are typically invoked to explain this mediating process. The 'financial capital model' states that a poorer family has fewer material resources, and children growing up with fewer resources tend to do less well in education and other aspects of life. The other model is the 'family process or parental socialization model'. Next to restraining family material resources, poverty may affect the ways in which parents monitor their children and respond to their needs. For example, poverty and unemployment decrease parents' responsiveness, warmth and supervision to their children.

2.2 CONCEPTUAL MODEL:

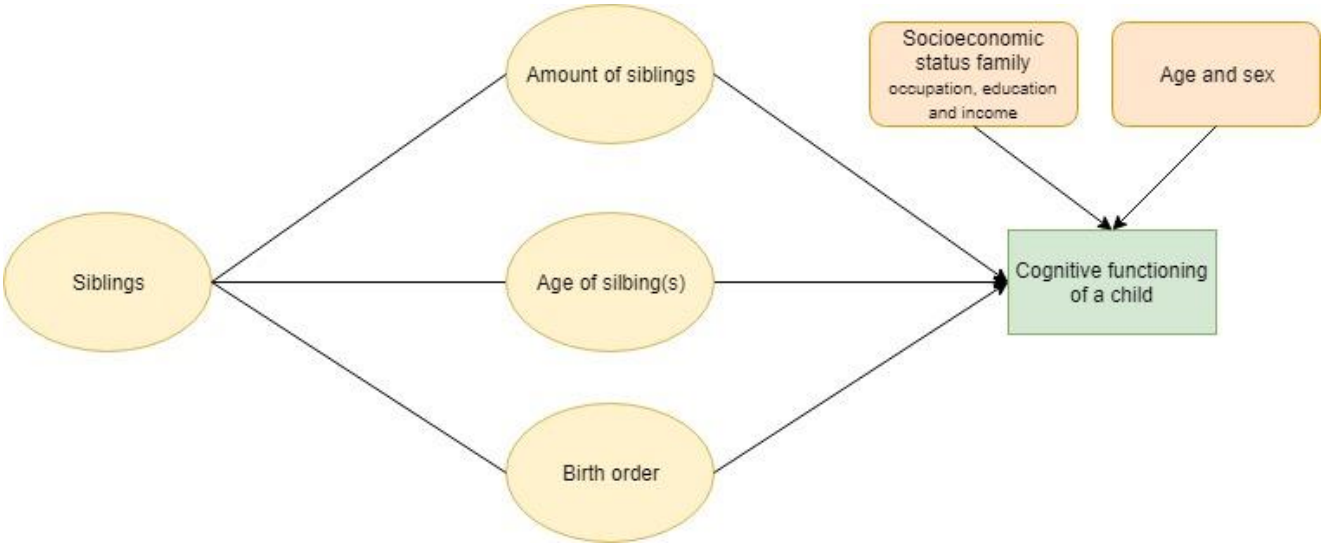

Figure 1. Conceptual Research model

The conceptual research model (figure 1) is based on the literature and theory that discusses the relationship between siblings' characteristics and cognitive outcomes and SES. This conceptual model shows the effect that siblings may have on cognitive development for the characteristics of amount of siblings, the age of sibling(s) and the birth order. Also shown is the effect of socioeconomic status of the family, age and sex which is needed to control for. This also influences the impact of siblings on cognitive development.

2.3 HYPOTHESES:

For the first research secondary question, considering the literature review about socioeconomic status, it can be expected that (H1) *in a high SES family cognitive outcomes will be higher than cognitive outcomes in a lower SES family*, so when controlling for SES on the relationship between siblings and cognitive development this will have to be kept in mind.

With regards to the second secondary question about the effect of the amount of siblings it can be expected that (H2) *as the number of siblings increases, cognitive development gradually decreases.* This due to the confluence model described by Zajonc & Marcus (1975).

Looking at the third secondary question and the theories about birth order and the effect of the age of a child's sibling(s), it can be expected that (H3) *older siblings contribute more to cognitive development of a child than younger siblings do.*

3. METHODOLOGY:

In this chapter the choice of research methods used in this study will be described to be able to answer the main research question. Also, some ethical issues will be addressed.

This research will focus on quantitative data and for this a secondary data set from Germany will be used. The research will rely on data collected in the KIGGS dataset. This is a health study of children and adolescents in Germany. It provides rich information on children's parental characteristics, their schooling career, health and behaviours, health status or educational success. For example, the concept of socioeconomic status was calculated as a sum of point scores for the parents' education level, occupational status and disposable income. 17,641 girls and boys aged 0 to 17 participated together with their parents during a three – year period in which the study was conducted. The first study ran from 2003 to 2006 and since 2009 they continued with long- term studies. All the collected data that will be used will be placed in a SPSS dataset for analysis.

The ethical considerations in this research mainly depend on how the KIGGS data set got their data. But, according to Clifford et al. (2010) it is important to be aware that secondary data consist of information that has already been collected for another purpose, but which is available for others to use. The release of data to others may have involved the simplification or re- categorization of information in ways that might be unhelpful for own research. Secondary data may already have been manipulated for particular purposes, so it may not be entirely trustworthy.

The variables that will be used from the KIGGS data set in this research are showed here:

Variable	Descriptives	Type
Corporal (half) siblings	20,5% only child	Nominal
	3,2% twin	
	76,3% stated number of sibling(s)	
Number of older siblings (physically)	32,2% no older sibling	Ordinal
	45,2% 1 older sibling	
	22,6% 2 or more older sibling	
Number of younger siblings (physically)	54,2% no younger sibling	Ordinal
	35,6% 1 younger sibling	
	10,2% 2 or more younger sibling	
Number of siblings of the same age (physically)	98% no same age sibling	Ordinal
	1,9% 1 same age sibling	
	0,1% 2 or more same age sibling	
Siblings (in the household)	75,8% Yes	Nominal
	24,2%No	
Number of older siblings (in the household)	36,1% no older sibling	Ordinal
	47,6% 1 older sibling	

	16,3% 2 or more older siblings	
Number of younger siblings (in the household)	52,7% no younger sibling	Ordinal
	37,2% 1 younger sibling	
	10,2% 2 or more younger siblings	
Number of siblings of the same age (in the household)	96,6% no same age sibling	Ordinal
	3,2% 1 same age sibling	
	0,2% 2 or more same age siblings	

Table 1: Variables for studying effect of siblings (KIGGS data set)

These variables all relate to siblings and can show if the child has siblings, for example, in table 1 can be seen that in this data set 76,3% of all children have siblings. Also, it can show the number of siblings a child has, if the sibling is older, younger or the same age and therefore also the birth order. By taking the sum of e005B1, B2, B3 or e006B1, B2 and B3 the total amount of siblings can be measured. In this data set siblings are divided in physically having siblings and siblings you are actually living with in the household. Because of this distinction the dataset made in these variables, for this thesis the variables stating all the siblings will be used (e005B1, B2 and B3), because there are only about 500 children that have siblings living outside the household (So, those are excluded in the siblings in the household variables). These variables relating to sibling characteristics will be used as independent variables in the data analysis to test for the outcomes that it has on cognitive development.

Variable	**Descriptives**	**Type**
Age (months): first words with meaning	Minimum: 5	Ratio
	Maximum: 36	
	Mean: 12,53	
	Std. deviation: 4,124	
(Current) development	6,1% slower development, 82,3% normal development, 11,7% faster development	Ordinal

Table 2: Variables used as outcome variable for cognitive development

In table 2 variables relating to the cognitive development of a child are shown. Of course, results can be different for different cognitive outcomes and therefore different variables are used. Age (months): first words with meaning is used, because this happens in early childhood and according to the literature siblings can teach each other new language skills especially when that siblings is older than you. The other variable that will be used is a general development variable that shows whether a child develops slower, normal or faster than average. Those are in a later childhood stage than the first variable. These variables relating to the cognitive development of a child will be used as the dependent variable in the data analysis in SPSS.

Variable	Descriptives	Type
Social layer according to Winkler	27,8% low SES	Ordinal
	46,5% middle SES	
	25,7% high SES	
Winkler index score	Minimum: 3	Ratio
	Maximum: 21	
	Mean: 11,44	
	Std. deviation: 4,340	
Age groups	0-2: 15,9%	Ordinal
	3-6: 22%	
	7-10: 23,5%	
	11-13: 17,4%	
	14-17: 21,2%	
Sex	50,9% male	Nominal
	49,1% female	

Table 3: Control variables for studying effects of socioeconomic status, age and sex

The first two variables relate to the socioeconomic status of the family. With income, education and occupation as important measures for socioeconomic status as mentioned in the theoretical framework. The Winkler index score is a score that combines three social- status scores (education, profession and total net household income) categorized into low (3-8), middle (9-14) and high (15-21). The information used to calculate these indicators of SES was collected using a questionnaire that was completed by the parents (Winkler & Stolzenberg, 2009). These SES variables will be used as independent variables and will be used as a control variable. Also, age and sex will be used as independent variables to control for. Sex is evenly distributed. Also, age- groups are, but because age groups sometimes uses groups that differ two years and sometimes groups that differ three years, the groups with three years are bigger.

To be able to give an answer to the three secondary questions this data will be analysed in SPSS using different regression models depending on the type of variable. First, descriptives will be given of the two cognitive development variables to give an overview of the outcome variable. This will show a general picture of how well children in this data set develop. Then one by one the hypothesis will be addressed.

So firstly, the effect of SES will be put into a regression. To actually test if the Winkler- index score has a significant effect on the current development a binominal logistic regression will be used. This regression predicts the probability that an observation falls into one of two categories of a dichotomous dependent variable based on one or more independent variables (Burt et al. 2009).

A dummy variable was created for faster development from the current development variable. Value 1 then is faster development and value 0 are the other values (normal and slower

development). The independent variable that was used is the Winkler index score. Also, age and sex have been put in the second and third block of the model to control for.

The second hypothesis states that: *as the number of siblings increases, cognitive development gradually decreases.* For the amount of siblings, it will unfortunately be hard to test for the actual amount, because there was no exact number required in the survey. That is why there will be tested for the effect of actually having siblings. Variable e005 (corporal siblings) shows for every child if it is an only child, a twin or the number of siblings was indicated in the other survey questions about siblings. From the 17.122 cases 20,5% of the children is an only child. 3,2% has a twin and 76,3% indicated the number of siblings they have (these include both siblings living inside and siblings living outside the household). So, in the binary logistic regression we will see if there is a significant difference between having siblings and being an only child. Again, a dummy variable was used for the current development variable with value 1 being faster development and value 0 being the others (slower and normal development). For independent variables corporal siblings as was stated above was used and sex, age and the Winkler- index score are used to control for.

The third hypothesis states that: *older siblings contribute more to cognitive development of a child than younger siblings do.* A multiple linear regression will be done with the dependent variable age(months): first words with meaning. This is because the literature said that siblings can teach each other new language skills especially when that sibling is older than you. The independent variables that will be used are: e005B1: number of older siblings (physically) and e005B2: number of younger siblings (physically). Both these variables have three categories: don't have a younger/ older sibling, 1 younger/ older sibling or 2 or more younger/ older siblings. Therefore, dummies were created for these variables to see all of the specific effects. Also, sex, age and the Winkler- index score for socioeconomic status were added to control for.

4. RESULTS

In this section the results will be discussed in the context of the theoretical framework. Trying to find out if the data illustrates the arguments. So, does this data analysis come up with similar or completely different findings as the theories in the theoretical framework. Identifying the main effects of the dependent and independent variables while controlling for mediating, moderating and biasing factors (e.g. sex and age).

In all the tests cognitive development related variables are dependent of the effects of the other variables. First, descriptives will be given of the cognitive development variables that will be used.

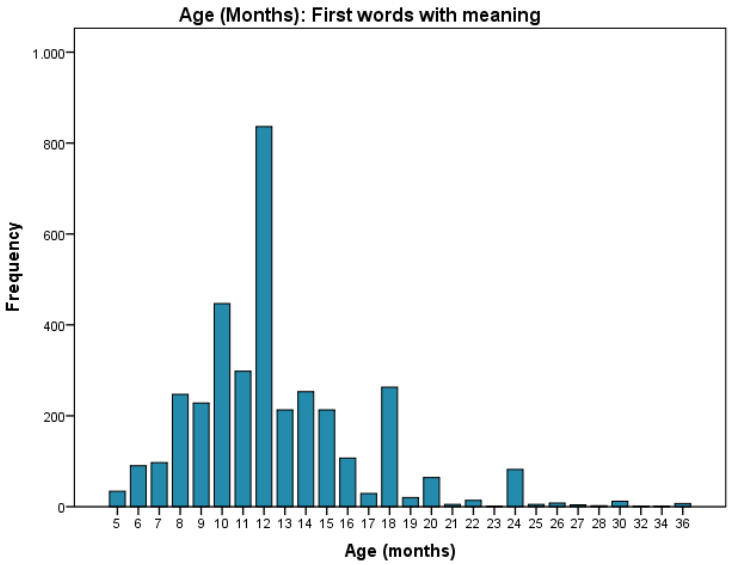

Figure 2 shows the cognitive development variable that presents the age of speaking first words with meaning. Some children already speak their first words with meaning when they are 5 months old and other children only after 36 months. With an average of 12,53. Also noticeable, is that 12 months is the most common. This is probably the case, because that is exactly 1 year. The same goes for 24 months (2 years) which is pretty high considering the amounts surrounding it.

Figure 2: cognitive development: age (months): first words with meaning

The second variable for cognitive development that will be used is the current development. This variable will be used instead of school performance, because there were almost 16.000 missing cases from the 17.641 cases in total in that variable.

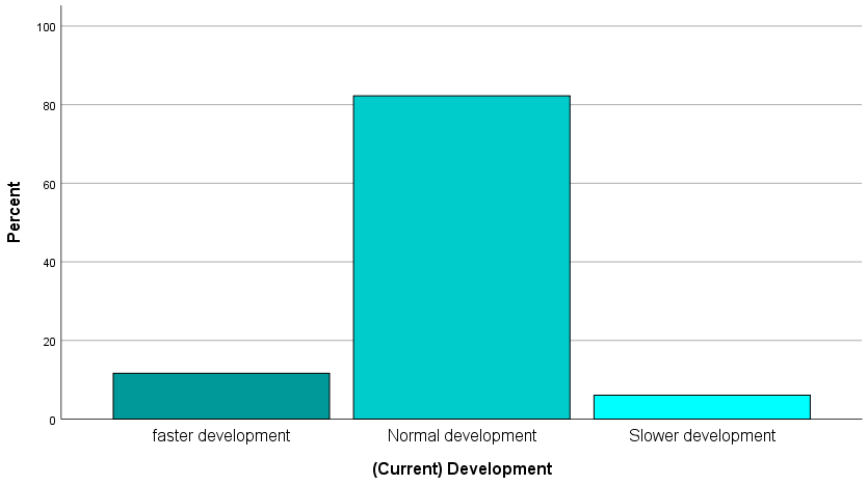

Figure 3: cognitive development: (Current) development

So, figure 3 shows three categories for how well a child develops currently. Most children (82,3%) develop normally. A few (6,1%) develop slower and 11,7% develop faster.

4.1 socioeconomic status

The first hypothesis states that: *in a high SES family cognitive outcomes will be higher than cognitive outcomes in a lower SES family.* This is because of for example the lack of resources available in low SES families.

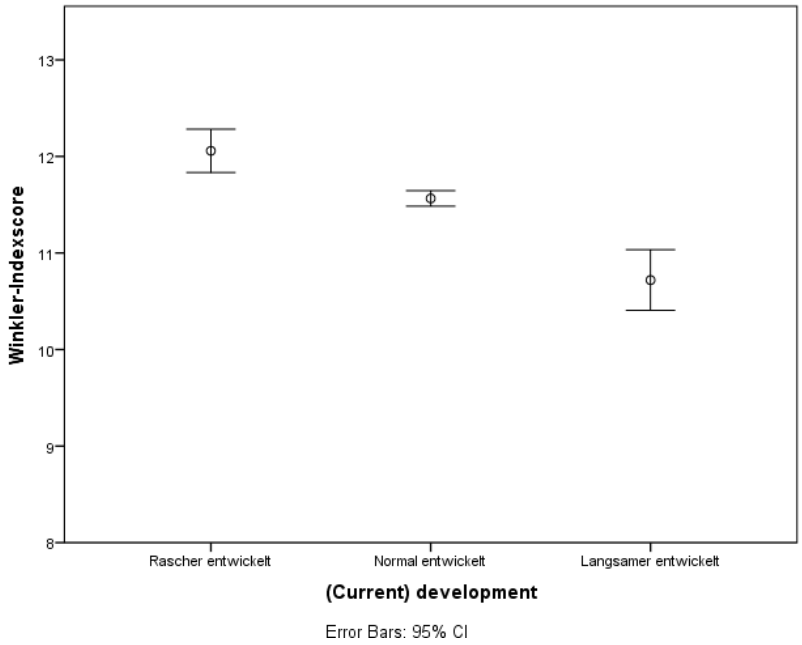

Figure 4: Error bar: Mean Winkler index score and current development

This simple error bar shows where the mean of the Winkler index score is per category of current development. The dependent variable is on the x- axis and the independent on the y-axis, because the dependent variable is ordinal. The points show the mean and the lines shows the precision of the estimation of the mean with a 95% confidence interval. For the category 'faster developed' the mean of the Winkler- indexscore is the highest of the three. For the other categories the Winkler- indexscore goes down. Faster developed and slower developed do not overlap, so they differ significantly from each other. So, this means that when there is a higher score on the Winkler index then there is a better change of higher current development of a child.

As was said in the methodology, a binary logistic regression was used. This was done in a hierarchical way to show the predicting values of the different variables. In table 4 it can be seen that the Winkler- indexscore and sex are both significant. For the SES index score it shows that it is 1,038 (Exp(B)) times more likely that higher SES scores go together with faster development than lower SES scores on the Winkler- index. For sex it is 0,707 times more likely that men have a faster current development than women. So, the girls in this data set more often have a faster development than the boys.

Noticeable, is that the Winkler- indexscore is a very small predictor for the current development. The Nagelkerke R square is 0,004 here (table 5). In the second model age groups are added which betters the model, because the Nagelkerke R square is now 0,111 and with sex added it becomes 0,115.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Winkler-Indexscore (D2003/4)	,035	,006	33,592	1	**,000**	1,036
	Constant	-2,749	,078	1238,186	1	,000	,064

a. Variable(s) entered on step 1: Winkler-Indexscore (D2003/4).

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Winkler-Indexscore (D2003/4)	,038	,006	37,160	1	**,000**	1,039
	Age- groups			92,559	4	**,000**	
	Age- groups(1)	19,464	670,825	,001	1	,977	283874981,7
	Age- groups(2)	19,296	670,825	,001	1	,977	240005728,3
	Age- groups(3)	18,939	670,825	,001	1	,977	167955292,9
	Age- groups(4)	18,755	670,825	,001	1	,978	139744167,0
	Constant	-21,650	670,825	,001	1	,974	,000

a. Variable(s) entered on step 1: Age- groups.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Winkler-Indexscore (D2003/4)	,037	,006	36,147	1	**,000**	1,038
	Age- groups			91,373	4	**,000**	
	Age- groups(1)	19,463	669,603	,001	1	,977	283658004,9
	Age- groups(2)	19,294	669,603	,001	1	,977	239545079,9
	Age- groups(3)	18,941	669,603	,001	1	,977	168177463,0
	Age- groups(4)	18,757	669,603	,001	1	,978	140010537,6
	Sex(1)	-,346	,055	39,421	1	**,000**	,707
	Constant	-21,481	669,603	,001	1	,974	,000

a. Variable(s) entered on step 1: Sex.

Table 4: Results from a binary logistic regression for the outcome of child development

Model Summary	
Model	Nagelkerke R square
1	0,004
2	0,111
3	0,115

Table 5: Predicting power of the three models

4.2 results effect of amount of sibling(s)

The entire model is significant. As can be seen in table 6, unfortunately, the category ‘indicated number of siblings’ (physically having siblings (2)) was not significant. The one for twins (physically having siblings (1)) is significant and has an Exp (B) of 0,662. So, this means that twins are less likely to develop faster than children who are only child. Notable is that men (Sex(1)) are 0,708 times more likely to develop faster than women. Which means that men are less likely to develop faster than women.

Step 4[d]	Physically having siblings			6,557	2	**,038**	
	Physically having siblings (1)	-,412	,180	5,237	1	**,022**	,662
	Physically having siblings (2)	-,114	,066	2,997	1	,083	,892
	Sex(1)	-,346	,055	38,955	1	**,000**	,708
	Winkler-Indexscore (D2003/4)	,038	,006	37,037	1	**,000**	1,039
	Age- groups			81,725	4	,000	
	Age- groups(1)	19,442	672,204	,001	1	,977	277744089,6
	Age- groups(2)	19,294	672,204	,001	1	,977	239602262,2
	Age- groups(3)	18,943	672,204	,001	1	,978	168629774,1
	Age- groups(4)	18,756	672,204	,001	1	,978	139898010,7
	Constant	-21,387	672,204	,001	1	,975	,000

Table 6: Results binary logistic regression for the outcome of faster development

4.3 results effect of age of sibling(s)

For the total model the results in the output of the ANOVA table show that the independent variables statistically significantly predict the dependent variable.

As can be seen in table 7, only the dummy for 1 older sibling is significant unlike the other dummies for siblings. For the dummy of 1 older sibling the B coefficient is 0,730, which means that there is a positive correlation between having one older sibling and the age of speaking first words with meaning. But, that has a negative impact on the cognitive development outcome, because a higher age of speaking your first words means that you are developing slower. Sex, the Winkler- indexscore and the age- groups also have a significant effect on speaking your first words with meaning.

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
4	(Constant)	11,378	,355		32,058	,000
	dummy for 2 or more older siblings	,231	,197	,021	1,176	,240
	dummy for 1 older sibling	,730	,157	,084	4,638	**,000**
	dummy for two or more younger siblings	-,612	,447	-,023	-1,369	,171
	dummy for one youngersibling	,153	,182	,015	,839	,402
	Sex	-,798	,136	-,097	-5,859	**,000**
	Winkler-Indexscore (D2003/4)	,063	,016	,066	3,986	**,000**
	Age- groups	,826	,147	,099	5,632	**,000**

a. Dependent Variable: Alter (Monate): Erste Worte mit Bedeutung

Table 7: Results from a hierarchical multiple linear regression for the effect of age of sibling

Table 8 shows the model summary of the hierarchical regression. First all the dummies for older and younger siblings were added and then one by one the other independent variables were added. The sibling variables on its own have a R square of 0,009. Sex adds a bit more to the R square (0,09), the Winkler- indexscore then adds 0,05 and the age-groups add 0,08. So, sex and the dummies for siblings have the biggest influence on speaking first words with meaning. Totalling the model to an adjusted R square value of 0,029. This means a total amount of 2,9% of the age of speaking first words with meaning can be explained by the variables used.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,097	,009	,008	4,107
2	,135	,018	,017	4,090
3	,151	,023	,021	4,081
4	,177	,031	,029	4,063

Table 8: Predicting power of each additional variable

5. CONCLUSIONS & REFLECTIONS

This research was focussed on the role that siblings have on the cognitive development of children. A dataset from Germany, named KIGGS, was used to do quantitative research and this data was analysed using SPSS.

The main findings from the results section were that variables relating to sibling characteristics didn't met the expectations that were set through the literature that was found in the theoretical framework. The expectations about socioeconomic status were met, because higher Winkler-index scores were associated with faster development of a child. It was 1,038 times more likely that higher SES scores go together with faster development than the low SES index scores.

The effect of actually having siblings was not significant. The one for twins was and this meant that twins are less likely to develop faster than children who are only child. For the effect of the age of the sibling most relevant variables were not significant, the one for having 1 older sibling was significant, but showed exactly the opposite from the expectations. There was a positive association between having one older sibling and the age when speaking first words with meaning. So, this means that having one older sibling increases the probability of speaking first words with meaning at a later age.

The biggest association was found between sex and cognitive development. Notable is that men were about 0,708 times more likely to develop faster than women. Which means that men are less likely to develop faster than women.

Previous literature which was discussed in the theoretical framework showed that children from high SES families are associated with higher levels of cognitive development than children from low SES families. Reasons therefore were for example the lack of access that low SES families have to resources and experiences. And also, when SES increases, families are more often characterized by low levels of conflict, warm and attentive family relationships, and consistent parenting practices. The findings for sibling characteristics noted that siblings are very important in understanding others and in the development of language skills especially if the sibling is older. Another finding is the relation between the number of siblings and cognitive development. When the number of siblings increases, cognitive development gradually decreases. This because siblings are not such effective, complex role models as adult parents and more importantly because of the limited amount of resources that a family has. This can result in a dilution of resources. Unfortunately, this saying from the literature could not be addressed, because there were no specific numbers given for having siblings. It was divided into three categories and the highest category was having 2 or more siblings.

The R square values were very low even though there were some statistically significant outcomes. The data set that was used, was conducted through a survey that did not focus only on the relationship of siblings or SES, but it looked at characteristics of children's overall life. To actually research the link that this thesis was trying to find, more specific data is needed on the number and characteristics of siblings. This could be useful for future research about this

topic. Also, because the association between sex and cognitive development was found, it would be interesting to know why girls would more likely have a faster development than boys.

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