Analysis on Play and Wellbeing

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1.Introduction

1.1.Purpose of This Analysis

This analysis explores how children's enjoyment of play affects their own wellbeing as well as their parents' wellbeing. International organizations such as the OECD (Organisation for Economic Co-operation and Development) and UNICEF (United Nations Children's Fund) emphasize that societal wellbeing is closely linked to economic, social, safety, and environmental factors. In particular, children's wellbeing is significantly influenced by external factors such as household economic conditions, environmental safety, and parental wellbeing.

This analysis examines, from both short-term and long-term perspectives, how children's daily lives through play are connected to these external factors. It consists of two main parts:

- **Part 1** (Sections 2 through 5) focuses on evaluating the relationship between play styles and psychological factors and wellbeing.
- **Part 2** (Section 6) focuses on answering the question of how play styles relate to psychological characteristics.

These two analyses differ in data structure, requiring appropriate methods for each, hence, the division of the analysis into two main sections.

1.2.Survey Content

1.2.1.Survey Design

- **Target area:** All 47 prefectures of Japan
- **Sample size:** 16,000 individuals
- Respondent breakdown:
    - Individuals responding about their own childhood and current wellbeing (18 years and older; Group 1b):5,500 individuals
    - Parents responding about their children's wellbeing (parents with children; Group 1a):5,500 individuals
    - Parents with children responding about their own wellbeing (parents with children 12 years and under; Group 2):5,000 individuals

1.2.2.Survey Items

To explore how play relates to children's wellbeing, this analysis draws on a questionnaire survey covering how children engage with play, the environments they live in, and their overall sense of wellbeing. Wellbeing itself is assessed through a combination of observable behavior, cognitive indicators, and the interests children express.

How Do Children Play?

Children's play styles vary, and through these differences, we can see how children express and explore themselves. In addition, an environment where children can freely play is crucial for the development of creativity and autonomy.

Previous research has indicated that the following two points are important for enhancing children's wellbeing:

- Ensuring sufficient time for play
- Experiencing different play styles

Therefore, play is not merely leisure but an important activity that serves as the foundation for mental health and development.

How Do Japanese Children Approach Play?

Japanese children, like children in other countries, are encouraged to discover their interests through play. In this analysis, we categorized children's play styles into the following four types:

- **Manual play:**Play with blocks, puzzles, and activities that require fine motor skills.
- **Physical play:**Running, jumping, playing with balls.
- **Digital play:**Video games, watching videos, and other activities with digital devices.
- **Play under age 3:**This variable distinguishes between current play styles represented by the above variables and play styles at ages under age 3.

How these play styles are chosen may not necessarily vary greatly by region, but differences in play culture across generations and households are thought to be influenced by factors such as:

- Technological advancement (spread of smartphones and tablets)
- Changes in educational styles at home and school
- Differences in cultural values and parental involvement

The present analysis captures children's play in a multifaceted way while being mindful of these backgrounds.

How Do Parents and Caregivers Relate to Children's Play and Wellbeing?

Children still have limited capacity to freely control their daily rhythms and environment. Therefore, the presence of parents and caregivers has a significant effect on a child's wellbeing. Caregivers influence children's wellbeing in the following ways:

- Creating opportunities for play and exploration
- Supporting social connections
- Providing a safe and secure environment

The family is the first social environment children encounter, and parent-child relationships are extremely important for children's mental development. To capture these relevant influences, the survey includes questions on the following themes:

- How much time the children spent with parents or caregivers
- With whom the children played most often
- Who primarily raised the children

Based on this information, we aim to deeply understand the relationship between the home environment during childhood and current wellbeing.

The wellbeing (mental health and happiness) of children under age 18 is evaluated through parental or caregiver observation. Since children may not always be able to adequately explain their emotions and thoughts verbally, we apply a method of indirectly grasping this through daily behaviors and attitudes.

Survey includes questions like:

- Does the child invite other children to play?
- Does the child express both positive and negative emotions?
- Does the child come up with new games on their own?

How Should We Understand Wellbeing?

This analysis focuses on five aspects considered to have a significant impact on individual wellbeing:

- **Daily enjoyment and interest:**How enjoyable daily life is, how absorbed one can become in things
- **Social connections:**Connections with people, participation in the community, sense of being a member of society
- **Family and home environment:**Relationships with family and the psychological and physical sense of security in the home environment
- **Non-cognitive abilities:**Self-control, empathy for others, motivation and perseverance—abilities that cannot be measured by academic performance
- **Subjective wellbeing:**One's own sense of happiness and life satisfaction, balance of positive and negative emotions

Does Childhood Wellbeing Have Long-term Effects?

This analysis also examines what effects childhood wellbeing has after becoming an adult. To do so, we investigate the relationship with the following current indicators:

- Subjective wellbeing and life satisfaction
- Relationships with family and friends
- How one engages with society and one's life philosophy

Through such analysis, we aim to clarify how the sense of security and joy felt in childhood connects to future mental stability and wellbeing.

How Does Children's Wellbeing Affect Parents?

Children and parents mutually influence each other. This analysis also examines how children's wellbeing affects parents' mental states.

While such effects are indirect, previous research has reported that there is a relationship between family playtime and parental happiness. This analysis will explore this topic further by relating the child’s characteristics and the parent’s wellbeing.

Hypothesis Testing

In the initial stages of this analysis, we formulated several hypotheses to clarify the direction of the research. These hypotheses are based on the current child-rearing environment and social background, and aim to explore the connections between parent-child relationships, quality of play, and wellbeing.

- **Hypothesis 1:Parent-child time decreases in low-income households**

This hypothesis focuses on the relationship between household economic conditions and parent-child interaction time.

In lower-income households, parents and caregivers are more likely to work long hours or hold multiple jobs, and as a result, the time spent playing, talking, and interacting with children may decrease.

We considered that such time constraints might also affect children's wellbeing.

Using regression analysis, we found that there is a linear correlation between respondents' income and playtime with children. However, even if income changes by 1 million yen, playtime changes by only about 0.018 hours, or approximately 1.075 minutes. This change is very small and almost negligible.

As shown in the Table 1 below, this effect remains virtually unchanged across all wellbeing factors.

These results indicate that low income may reduce playtime, but the magnitude of this effect is minimal, suggesting that playtime with parents or caregivers is not the main pathway through which income affects playtime.

Table 1: The effect of income on parent–child playtime: A regression analysis

Wellbeing elements	Annual income → Impact of play time with Parents	Playtime with parents → Impact on wellbeing
Wellbeing 1: Subjective wellbeing	0.0179	0.0513
Wellbeing 2: Family attachment	0.0179	0.0422
Wellbeing 3: Intrisic motivation for play	0.0178	0.0239

- **Hypothesis 2:Income and playtime are related to wellbeing**

This hypothesis is a further development of Hypothesis 1. Income may affect children's wellbeing not directly, but indirectly through the amount of playtime.
If this hypothesis is supported, the necessity for policy support to secure parent-child playtime would emerge as an improvement measure to enhance children's wellbeing.

This hypothesis is examined in more detail in later sections.

- **Hypothesis 3:Educational toy play under age 3 leads to improved wellbeing**

While educational toys for young children often aim to improve cognitive abilities, we examine whether early engagement also contributes to emotional wellbeing and happiness.

This hypothesis focuses on the quality of early play. It is based on the idea that exposure to educational toys (building blocks, puzzles, sound-making toys, etc.) during early childhood (especially under age 3) may have a positive impact not only on children's intellectual development but also on emotional fulfillment and sense of security (i.e., wellbeing).

Traditionally, educational toys have tended to be evaluated with a focus on intelligence, but this analysis examines whether they also contribute to emotional growth.

This hypothesis is also examined in more detail in later sections.

2.Part 1:Relationship Between Play Styles, Psychological Factors, and Wellbeing: Analytical Methods

Key Findings

- We applied a method called Very Simple Structure (VSS) to estimate several representative indicators, called latent variables, from the respondents' survey answers. These latent variables allow us to understand the respondents' characteristics and psychological trends more easily than the raw survey answers.
- The three indicators related to wellbeing (mental health and happiness) showed significant differences depending on the respondent group. This suggests that the relationship with other psychological factors may depend on the person's wellbeing level.
- Therefore, to examine how the impact varies depending on the level of wellbeing, we use an analytical method called Quantile Regression. This is a method for examining differences in detail across different segments, such as people with low wellbeing or people with particularly high wellbeing, rather than just looking at average trends.

2.1.Latent Variables

The survey questionnaire included more than 70 questions to measure wellbeing. However, treating each of these questions separately makes it impossible to extract meaningful insights about the relationship between wellbeing and play styles.

Therefore, we grouped questions with similar aspects and estimated latent variables common to each question group. For example, emotions such as connections with people and hope for the future appear across several questions and can be captured in a single latent variable. By using these estimated latent variables, we can organize the results of many questions in an easy-to-understand manner and capture people's wellbeing characteristics more simply and accurately.

The figure below shows the relationship between question groups and their corresponding characteristics.

Table 2: Correspondence Between Question Groups and Latent Variables

Characteristic	Play style in childhood	Children's lifestyle	Children's Perception	Children's Emotions	Wellbeing
Survey question range	Q8.1~Q8.20	Q2,Q3,Q4,Q9.1, Q1S3, Q1S4	Q9.2~Q9.11	Q9.12~Q9.20	Q10.1~Q10.23

2.1.1.The VSS Method

The VSS method is an analytical technique that estimates latent variables (factors) from a group of related questions. For example, a group of 10 questions related to wellbeing can be synthesized into a smaller number of latent variables through VSS. These latent variables are more meaningful and do not lead to significant loss of information. By using this method, complex data can be organized into simpler and more meaningful forms, making the results easier to interpret.

Each factor was given a name that best represents its content based on the strength of its connection to related questions, and names were made as intuitive as possible to reveal what the factor means. The strength of the relationship between a factor and its related questions is referred to as loading, and it plays an important role in the analysis and in extracting meaning from the factors, as we will see throughout this section.

Table 3: Number of Items and Top-loading Questions for Each Factor

Characteristic	Number of Questions	Name of the Factor	Main question related to the Factor	Factors' specific meaning
Play style in Childhood	20	**Manual play** (play1)	**Q8.5** Play that involve thinking, such as puzzles, mazes, and building blocks **Q8.8** Play that uses clay, drawing, singing, and creativity	Play style that require fine motor skills
		Physical play (play2)	**Q8.1** Play that requires running and jumping **Q8.2** Playing with balls (including sports)	physical activities in general
		Digital play (play3)	**Q8.9** Play with video-games, watching videos **Q8.10** Post on Digital platforms like like YouTube and Tiktok	Playing video-games, watching videos and similar digital entertainment
		Play under age 3 (play_un3)	**Q8.13~Q8.20** Same questions as play1 and play2, but for children under 3 years old	Play for children under 3 years old
Children's Lifestyle	5	**Time with parents/caregivers** (life1)	**Q1S3** Hours of playtime with a parent or caregiver per day **Q1S4** Hours spent with parent or guardian per day	Time shared between children and parents
		Toy availability (life2)	**Q3** Amount spent on toys per month **Q4** How many toys does your child (you) usually have available to play with?	Number of toys
Children's Perception	10	**Motor-social competence** (cog1)	**Q9.3** Movements are smooth and well-balanced when playing **Q9.4** Accepts other people approaching while playing	Physical skills enable social confidence
		Divergent thinking (cog2)	**Q9.9** The children comes up with new games on their own **Q9.10** Repurposes everyday items as toys	Creativity and innovative thinking
		Cooperativeness (cog3)	**Q9.5** Initiates play with other children **Q9.6** Can play cooperatively with other children	Cooperative behavior
Children's Emotions	14	**Playful humor** (emo1)	**Q9.16** Enjoy telling jokes to others **Q9.18** Engage with telling stories to others	Expressing humor while playing
		Emotional involvement (emo2)	**Q9.13** Shows a lively attitute while playing **Q9.14** Demonstration of excitement while playing	Emotional investment during play
		Emotional Release Ability (emo3)	**Q9.23** Often becomes irritable, depressed, or bursts into tears. **Q9.24** often gets into fights with other children (bulling included)	Expression of emotions

Each factor was given a name that best represents its content based on the strength of its connection to related questions, and names were made as intuitive as possible to reveal what the factor means.

The strength of the relationship between a factor and its related questions is referred to as loading, and it plays an important role in the analysis and in extracting meaning from the factors, as we will see throughout this section.

Table 2 demonstrates the advantages of using the VSS method to extract factors from the survey answers. Rather than treating each of the 49 questions individually, we use the resulting 12 factors with coherent content, allowing us to organize information while capturing essential differences.

These 12 factors (play styles, personality tendencies, etc.) play a central role in this analysis, as we estimate the relationship between these factors and wellbeing, the main focus of this study.

In the next section, we will examine the wellbeing factors extracted from the survey in detail.

2.2.Three Indicators of Wellbeing

Since wellbeing (happiness and satisfaction) is a central theme of this project, this section explains how wellbeing indicators were created from the survey data, what each indicator means, and how the results should be interpreted.

The survey includes 23 questions related to various aspects of wellbeing. The challenge of using these 23 questions directly is that while each question affects overall wellbeing, it is also influenced by responses to other wellbeing-related questions. Therefore, examining each question individually cannot provide meaningful insights.

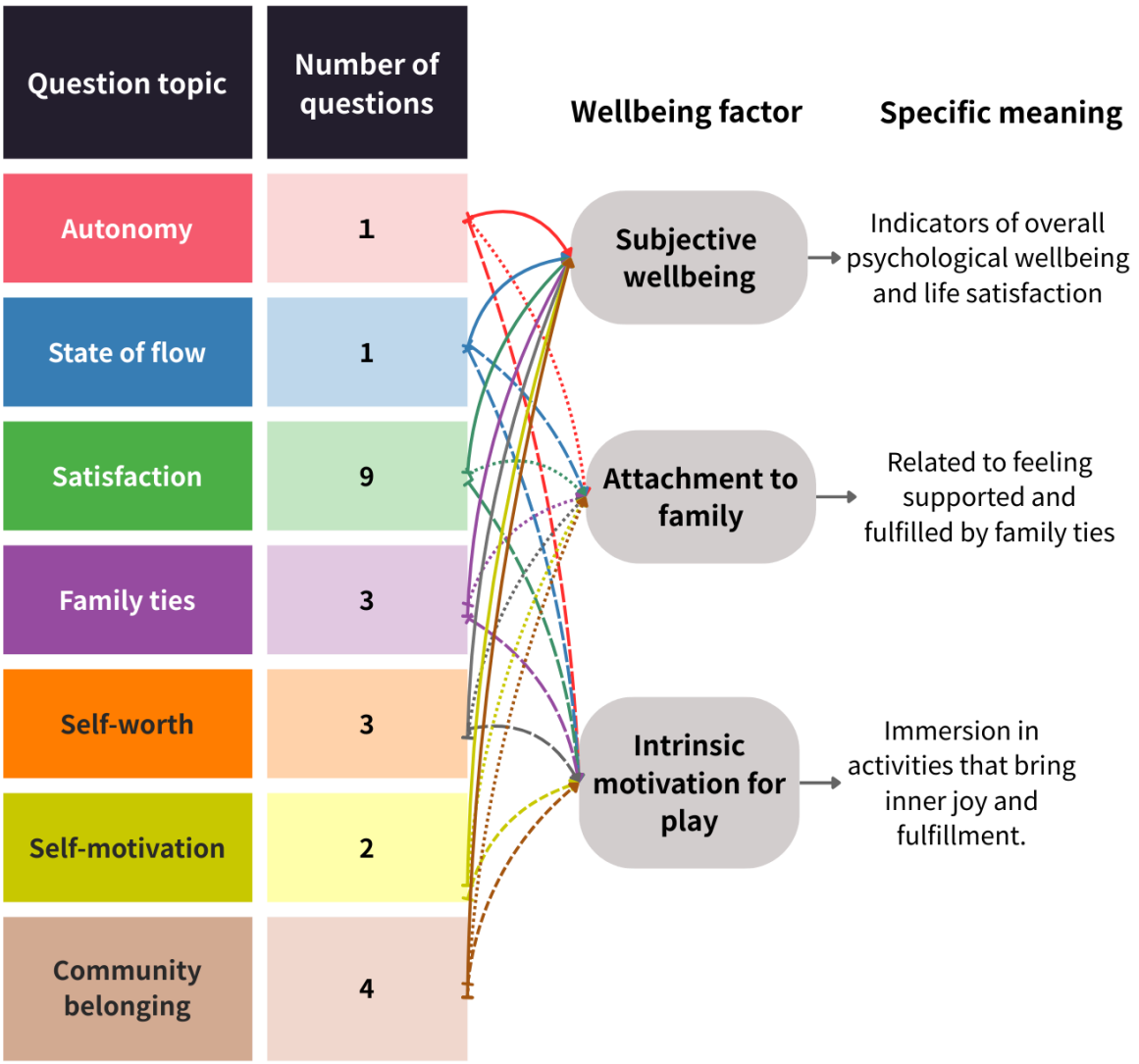
To make these wellbeing-related survey answers easier to interpret, we also used the VSS (Very Simple Structure) analysis to estimate the main factors related to wellbeing, similar to what was done with play styles and psychological traits (as described in Section 2.1).

Through VSS analysis, the 23 question items in the survey allowed us to extract three main wellbeing indicators:

- Subjective wellbeing
- Attachment to family
- Intrinsic motivation for play

The figure below shows how questions are organized into thematic groups and how each group contributes to the three wellbeing indicators. This visualization reveals how these psychological factors are intricately intertwined and not simply separable.

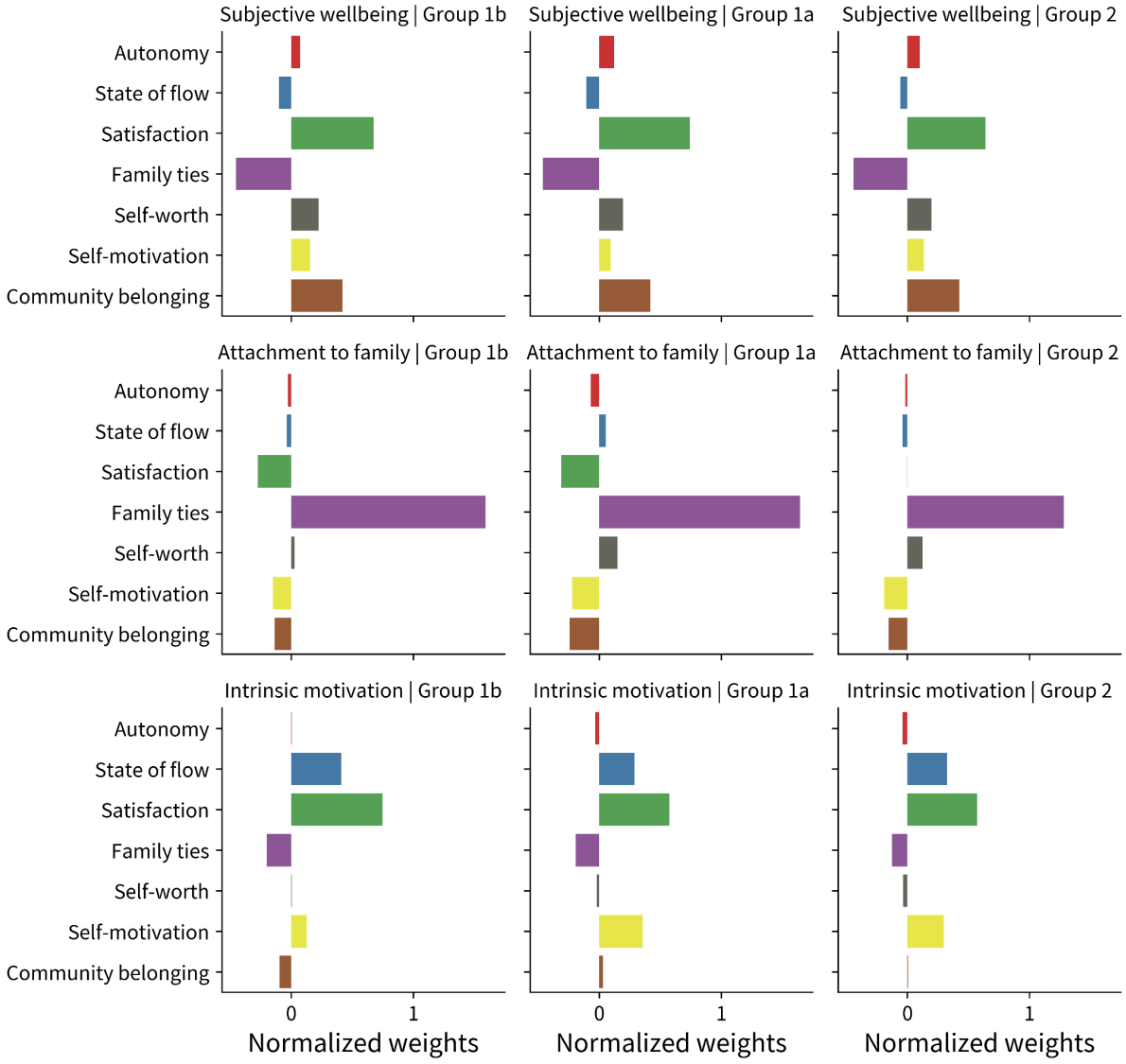
Figure 1: Relationship Between Question Groups and Three Wellbeing Indicators



By performing VSS analysis, we can numerically grasp how much each question topic contributes to each wellbeing factor in the form of weights (factor loading). In other words, it becomes clear how much each question topic contributes to each wellbeing factor.

The following graph allows us to visually grasp what contribution each topic has to the three indicators. Note that we are using normalized loadings here. Raw loadings cannot be directly compared between different groups, but normalization allows comparison on a unified basis.

Figure 2: Weights by Topic for Wellbeing Indicators



An important finding from Figure 2 is that the weight patterns are highly consistent across all three sample groups.

Note that the topic family ties has a negative weight for subjective wellbeing. This negative weight does not mean that family ties have a negative impact on subjective wellbeing. Rather, it shows a tendency where people with high subjective wellbeing scores tend to have relatively low scores on family ties. In other words, this does not mean that family ties reduce subjective wellbeing, but that both represent different aspects of wellbeing.

We all live with limited mental resources (time, energy, attention, etc.), and children face the same constraints and develop personal preferences. Therefore,

people adopt different strategies for wellbeing maximization, which can lead to competing priorities, as shown in Figure 2.

VSS analysis allows us to observe such differences in life choices within the respondents' data.

Another interesting pattern is the strong relationship between the factor attachment to family and family ties. People who value family ties tend to be relatively less interested in relationships outside the family, such as social participation and community belonging.

In this way, VSS analysis helps us understand how various wellbeing elements interact and sometimes compete with each other.

The table below summarizes what each wellbeing indicator measures, what the main factors are, and what trade-offs (inverse relationships) exist.

Table 4: Organization of Wellbeing Indicator Measurement Content, Main Factors, and Trade-offs

Wellbeing factor	Specific relationships	Main topics	Trade-offs
Subjective wellbeing (well1)	Indicator of overall psychological wellbeing and life satisfaction	1. Satisfaction 2. Community belonging 3. Self-worth 4. Self-motivation	1. Family ties 2. State of flow
Attachment to family (well2)	Related to being supported by family bonds and gaining fulfillment from it	Family ties	Other than family ties
Intrisic motivation for play (well3)	Related to being absorbed in activities that bring inner joy and fulfillment	1. Satisfaction 2. State of flow 3. Self-motivation	1. Family ties 2. State of flow 3. Community belonging

Most Important Results from This Table

- Satisfaction has a strong positive influence (weight) on both subjective wellbeing and intrinsic motivation for play, showing that it contributes broadly to overall wellbeing. Similarly, self-motivation also affects both, but its degree of influence (weight) is somewhat smaller than satisfaction.
- On the other hand, family ties strongly influence only the attachment to family wellbeing indicator, showing that it is a very specialized factor. Similarly, state of flow affects only intrinsic motivation for play, and self-worth affects only subjective wellbeing.

- Regarding autonomy, the weights for all indicators are very small, possibly because there was only one question, and the content of that question may have been too broad.

Based on these results, the sources of wellbeing can be classified into two types:

- **Foundational sources of wellbeing:**Factors such as satisfaction and self-motivation that contribute broadly to multiple wellbeing indicators. These serve as the foundation supporting overall wellbeing.
- **Specialized sources of wellbeing:**Factors such as family ties, state of flow, self-worth, and community belonging that are strongly related only to specific wellbeing indicators.

Relationship Between Community Belonging and Wellbeing

The analysis presented in the previous subsection revealed two groups of factors affecting wellbeing: foundational factors that broadly impact wellbeing, and specialized factors that impact specific aspects of wellbeing.

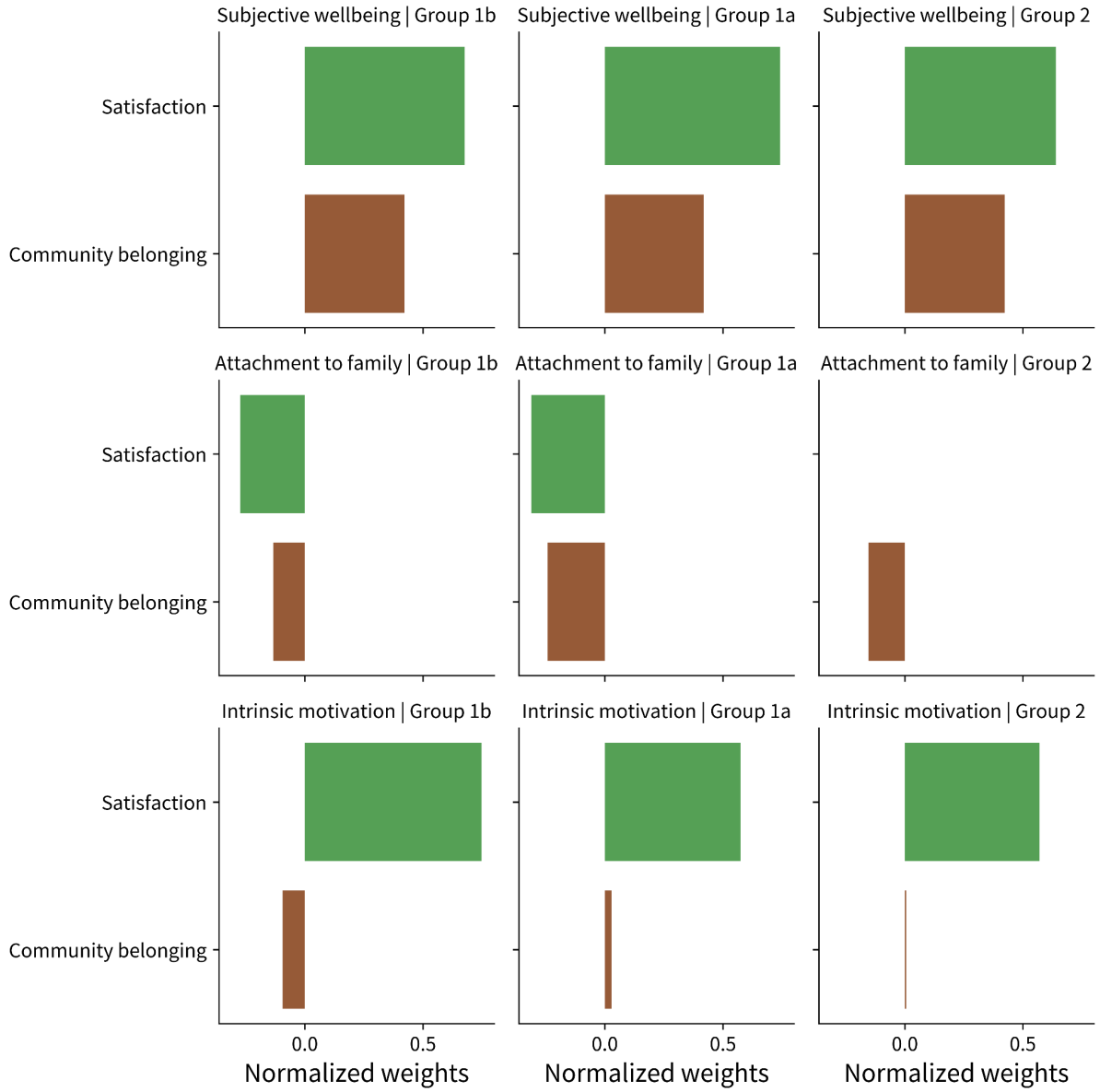
In this section, we will discuss the VSS (Very Simple Structure) results for two particularly important factors: satisfaction and community belonging, to clarify the difference between a foundational factor (satisfaction) and a specialized factor (community belonging).

Satisfaction has high weights for both subjective wellbeing (68%) and intrinsic motivation for play (over 60%), suggesting that it is a foundational factor for overall wellbeing.

On the other hand, community belonging is a more specialized factor. Its weight for subjective wellbeing is around 43%, while its weights for the other two factors—attachment to family and intrinsic motivation for play—are negative and close to zero, respectively. Understanding the differences between these two types of factors is important for clarifying how specialized and foundational factors contribute to wellbeing.

For ease of comparison, Figure 3 shows the weights of satisfaction and community belonging for each wellbeing indicator.

Figure 3: Weights of Satisfaction and Community Belonging



Satisfaction is broadly related not only to subjective wellbeing but also to intrinsic motivation for play, demonstrating strong connections across multiple wellbeing dimensions. In contrast, community belonging shows a strong relationship only with subjective wellbeing, while its weights for other factors are low, suggesting more limited and specialized influence.

Given the difference in weight structures between satisfaction and community belonging, we can apply reverse logic to understand the pathways connecting play styles to wellbeing.

While we know that higher satisfaction and higher community belonging lead to higher subjective wellbeing, the question is: does higher subjective wellbeing also

lead to higher satisfaction or community belonging? Exploring this reverse pathway is important because we want to understand whether higher wellbeing can change the components of wellbeing itself.

Relationship Between Satisfaction and Subjective Wellbeing

The relationship between subjective wellbeing and satisfaction is strong, with normalized weights exceeding 60% across all three sample groups (Group 1a, Group 1b, and Group 2). This suggests that when a certain play style affects subjective wellbeing, an improvement in satisfaction likely underlies this effect. Otherwise, satisfaction and subjective wellbeing would not exhibit such high correlation.

This finding suggests that higher subjective wellbeing may lead to increased satisfaction.

Relationship Between Community Belonging and Subjective Wellbeing

The relationship between community belonging and subjective wellbeing is moderate, with a normalized weight of 43%. This suggests that an increase in subjective wellbeing could be linked to an increase in community belonging.

However, this evidence alone is not sufficient, and more data is necessary to determine whether an increase in subjective wellbeing actually leads to an increase in community belonging.

2.3.Characteristics of Quantile Regression

Traditional regression analysis examines which elements (such as play styles) affect wellbeing on average and by how much. In other words, this traditional approach focuses on the average level of wellbeing and examines how much play styles and other characteristics affect it.

However, traditional regression analysis of looking only at the average has important limitations, as it assumes:

- The magnitude of the effect is the same across all wellbeing levels. This means the impact a play style has on wellbeing would be identical regardless of whether a person has high or low wellbeing.

- There are no outliers in the data, meaning there are no people with extremely high or extremely low wellbeing. In traditional regression analysis, people with extreme wellbeing levels would be misinterpreted by the model.

These assumptions are too restrictive when we consider the complex psychological processes underlying wellbeing. For example, the effect of a specific play style can differ considerably between children with high versus low wellbeing.

What Quantile Regression Can Do

This analysis is well-suited for quantile regression because this method can examine separate trends for each segment, such as:

- People with relatively low wellbeing (e.g., 10th percentile)
- People in the middle (50th percentile)
- People with relatively high wellbeing (90th percentile)

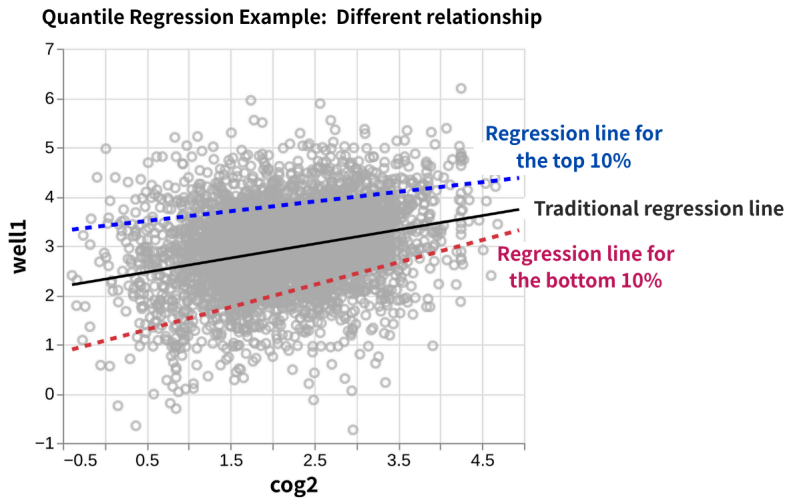
rather than focusing solely on the average.

Quantile regression allows us to answer questions such as: Does 'play type A' have a greater effect on people with low wellbeing than on people who already have high wellbeing? The flexibility of quantile regression enables deeper understanding by revealing whether different groups with varying wellbeing levels respond differently to the same factors.

2.3.1.Specific Examples of Quantile Regression

In this section, we present in concrete terms what differences become visible when using quantile regression.

Relationship Between Divergent Thinking and Subjective Wellbeing



The scatter plot on the left shows the relationship between divergent thinking (cog2) and subjective wellbeing (well1).

The black line is the result of the traditional regression analysis and shows the trend that the higher the divergent thinking, the higher the wellbeing on average.

Looking at the red line (bottom 10% of people in terms of subjective wellbeing) and the blue line (top 10% of people on subjective wellbeing), we can see interesting differences. The red line has a strong slope and gradually approaches (converges to) the blue line.

This means that the effect of divergent thinking in enhancing wellbeing is greater for people who originally have low wellbeing. The result is that even if we develop divergent thinking in people with high wellbeing, not much change is seen.

Relationship Between Motor–Social Competence and Subjective Wellbeing

Now, the scatter plot on the left shows the relationship between Motor–social competence (cog1) and subjective wellbeing (well1).

In this graph, the blue and red lines are almost parallel, showing a consistent trend overall.

This means that the higher the social and physical abilities, the more stable the wellbeing is in any segment. The result is that both people with low wellbeing and those with high wellbeing benefit at similar rates for a higher level of motor–social competence.

2.3.2.What We Can Learn from the Quantile Regression Analysis

In summary, quantile regression allows us to obtain more detailed insights by answering questions such as:

- Which play styles have stronger effects on children with low versus high wellbeing?
- Do the relationships between play and wellbeing vary across different wellbeing levels?
- Which factors benefit all children equally, and which are particularly important for specific groups?

By applying this method, we can move beyond simple averages to understand how play influences wellbeing differently across the wellbeing distribution. This nuanced approach is essential for understanding the complex pathways between play and child wellbeing.

In the following sections, we will apply both VSS and quantile regression analyses to examine these relationships across different respondent groups.

3.Analysis of the Relationship Between Childhood Play and Current Wellbeing

3.1.Research Questions

This analysis addresses three key research questions:

- How strongly is childhood play style related to current wellbeing?
- Do people who spend more time playing during ages 3-12 have higher current wellbeing?
- Is playing frequently with parents during childhood associated with higher wellbeing in adulthood?

3.2.Analytical Approach

To answer these questions, we use quantile regression where the outcomes are the three wellbeing indicators introduced earlier: subjective wellbeing, attachment to family, and intrinsic motivation for play. The explanatory variables—factors that potentially influence wellbeing—include:

- The 12 latent variables representing childhood play styles and personality traits, presented at the subsection 2.1
- Additional characteristics such as number of siblings and time spent playing

To improve analytical precision, we also include demographic control variables:

- Gender
- Decade of birth
- Current annual income
- Education level

We use these variables under the assumption that they were not influenced by childhood play styles or personality. However, we will revisit this assumption in later sections, as these background factors may affect our results.

Quantile Regression Specification

We conduct separate regression analyses for five different wellbeing levels (quantiles):

- 10th percentile: Very low wellbeing
- 25th percentile: Relatively low wellbeing
- 50th percentile (median): Average wellbeing
- 75th percentile: Relatively high wellbeing
- 90th percentile: Very high wellbeing

By analyzing each segment separately, we can examine how the effects of childhood play and personality on current wellbeing vary across individuals. This flexible approach enables deeper insights tailored to individual circumstances and backgrounds.

3.3.Interpreting the Results

How Results Are Organized

Our analysis produces 15 regression results: three wellbeing indicators × five quantiles each. To present these results clearly, we organize the variables into three categories:

- **1:Psychological characteristics (primary variables of interest)**
  - The 12 latent variables estimated from the survey, representing childhood personality and psychological tendencies.
- **2:Secondary characteristics**
  - Variables relevant to the analysis but requiring special treatment as categorical data (e.g., who the child played with most often).
- **3:Demographic characteristics**
  - Gender, education level, income, and other factors that may directly influence current wellbeing, but are secondary in terms of this analysis objectives.

3.4.Analysis of Group 1b

3.4.1.Survey Respondents and Content

This analysis focuses on Group 1b—adults reflecting on their own childhood and current wellbeing. Participants answered questions about:

- Play styles during childhood (ages 3-12) (Q8.1-Q8.12)
- Play styles before age 3 (Q8.13-Q8.20)
- Childhood psychological characteristics (personality, tendencies) (Q9.1-Q9.25)
- Current wellbeing (mental health and happiness) (Q10.1-Q10.23)

These responses allow us to examine from the individual's own perspective how childhood play styles and personality influence current wellbeing.

3.4.2.Key Findings: Psychological Characteristics

Different Wellbeing Dimensions Are Influenced by Different Factors

Each wellbeing indicator (well1, well2, well3) is explained by different factors. For example, time with parents strongly and positively affects intrinsic motivation for play (well3) but shows no clear effect on subjective wellbeing (well1).

Manual Play Has Positive Effects on Wellbeing

Manual play showed beneficial effects across multiple wellbeing indicators, though impacts varied by indicator and percentile level. While manual play affected subjective wellbeing (well1) across all percentiles, it showed particularly strong effects in the lower ranges of attachment to family (well2) and the upper ranges of intrinsic motivation for play (well3).

Digital Play and Physical Play Show Contrasting Effects

Digital play (video games, videos) positively affects subjective wellbeing (well1) and play motivation (well3) but negatively impacts attachment to family (well2), especially at higher percentiles. This suggests excessive digital play may weaken family connections.

Physical play showed limited effects, influencing only the lowest levels of subjective wellbeing (well1) and attachment to family (well2), and the highest levels of intrinsic motivation for play (well3).

Motor–Social Competence Has Broad Effects on Wellbeing

Motor-social competence (cog1) shows significant and stable influence across nearly all quantiles for all three wellbeing indicators.

Cooperativeness Shows Inconsistent Effects

Cooperativeness positively affects subjective wellbeing (well1) but shows negative relationships with intrinsic motivation for play (well3). This suggests that excessive cooperativeness may suppress self-assertion and weaken intrinsic play motivation.

Playful Humor and Emotional Involvement Have Broad Positive Impacts

These two variables show remarkable similarity in their broadly positive influence on wellbeing. Both may share emotional sensitivity as a common characteristic, though their influence likely extends beyond this trait in multifaceted ways.

For example, Salavera (2018) notes that strong playful humor correlates with good interpersonal skills, potentially contributing to increased happiness. Regarding emotional involvement, Thomsen (2023) demonstrates links between emotional recognition and regulation, suggesting emotional involvement may enhance wellbeing through improved emotional regulation capacity.

Emotional Release Has Complex Aspects

People who express emotions strongly show positive effects on subjective wellbeing (well1) and intrinsic motivation for play (well3), but negative effects on attachment to family (well2), particularly at higher wellbeing levels.

This suggests that while emotional expression benefits individual wellbeing and play motivation, it may create friction in family relationships. Possible explanations include parent-child communication gaps and generational differences in emotional norms.

Interpreting the Regression Results

The table below presents parameters estimated through quantile regression analysis. The outcome variable is wellbeing, while the explanatory variables are the play styles, lifestyle patterns, and psychological characteristics estimated using VSS (discussed in the previous section).

All VSS variables—including play styles, children's lifestyle, psychological characteristics, and wellbeing measures—have been normalized to enable meaningful comparisons across different measurement scales.

Interpreting the coefficients: The coefficients indicate how much wellbeing changes (in standard deviation units) when an explanatory variable increases by one standard deviation from its mean.

Note: The table displays only coefficients that are statistically significant at the 5% level.

Green numbers: Coefficients indicating positive effects on wellbeing

Red numbers: Coefficients indicating negative effects on wellbeing

Table 5: Group 1b: Regression analysis results of VSS variables on wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Manual play	0.09	0.09	0.05	0.05	0.06		0.04	0.04					0.04	0.09	0.06
Physical play	-0.09	-0.05	-0.05				-0.03							0.05	0.06
Digital play	0.18	0.14	0.08	0.04	0.04	0.07		-0.03	-0.08	-0.11				-0.06	-0.09
Play under age 3									0.07						
Time with parents							0.04		0.05		0.07	0.05	0.03		0.06
Toy availability											0.09	0.03	0.03	0.03	
Motor-social competence	0.09	0.12	0.15	0.13	0.11	0.16	0.12	0.11	0.11	0.06		0.10	0.13	0.10	0.08
Divergent thinking	0.25	0.25	0.24	0.13	0.06	0.06	0.08		-0.07	-0.07	0.14	0.10	0.03		
Cooperativeness	0.25	0.28	0.25	0.14	0.11	0.11	0.06	-0.02	-0.06	-0.12		-0.05	-0.07	-0.13	-0.12
Playful humor			0.10	0.16	0.16		0.16	0.25	0.21	0.18	0.11	0.14	0.24	0.19	0.18
Emotional involvement			0.11	0.17	0.17	0.09	0.16	0.30	0.25	0.21	0.19	0.22	0.32	0.28	0.23
Emotional release		0.07	0.10					-0.05	-0.12	-0.10	0.10	0.11	0.07	0.03	

As described above, this analysis clarified the influence of childhood play and personality on adult wellbeing from various perspectives.

3.4.3.Key Findings On Secondary Characteristics

Duration of Playtime

Playtime of 6 hours or less per day showed positive effects on wellbeing, though these effects were primarily observed at higher wellbeing levels (percentiles). However, when playtime extended to 7-8 hours, these positive effects diminished. At 8 hours specifically, negative impacts emerged for both subjective wellbeing (well1) and attachment to family (well2).

These findings suggest that more playtime is always better does not necessarily hold true. For instance, children in single-parent households or environments where adequate care is unavailable may spend significant after-school time alone. Such circumstances may create a concurrent pattern of long play hours and lower wellbeing.

The table below shows results by daily playtime duration. To estimate how each variable affects wellbeing, we need to establish a baseline category for comparison. For daily playtime, we use don't know/unsure as the baseline.

Note: All coefficients are rounded to two decimal places, and only those statistically significant at the 5% level are shown.

Table 6: Group 1b – Regression Results for Playtime Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Playtime per day (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
1 hour				0.15	0.17				0.16				0.08	0.15	
2 hours				0.11	0.18			0.08	0.15		0.18		0.08	0.19	0.17
3 hours				0.07					0.18				0.12	0.24	0.24
4 hours				0.11	0.34				0.17				0.08	0.25	0.22
5 hours									0.21					0.24	0.32
6 hours													0.37	0.43	0.44
7 hours															
8 or more hours	-0.69							-0.30						0.22	0.33

Who Children Played Most With

Positive effects emerged from playing with others—parents, siblings, and friends. However, for subjective wellbeing (well1) specifically, playing with friends or playing alone showed negative impacts. Several factors may explain this pattern:

- We lack information about play quality (e.g., structured activities vs. unstructured play)
- Qualitative aspects like the number and depth of friendships likely influence outcomes
- Children who played alone frequently may have experienced isolation or insufficient emotional support

The table below presents results based on who children played with most often. To estimate effects, we need a baseline category for comparison. We use parents as the baseline.

Coefficients are rounded to two decimal places, and only those statistically significant at the 5% level are shown.

Table 7: Group 1b – Regression Results for Playmate Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
The partner you played with most during the day (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Grandparents									-0.18						
Siblings								0.10							
Friends	-0.15	-0.14	-0.08											0.10	0.13
Pets															
Alone	-0.2	-0.15	-0.07			-0.25	-0.08							0.12	
Others															-0.25

Primary Caregiver

Being raised primarily by both parents showed positive effects on wellbeing. However, there was an interesting exception: for subjective wellbeing (well1), being raised by nonfamily members (such as grandparents or professional caregivers) also produced positive effects.

This pattern may reflect resilience developed in challenging family circumstances—psychological adaptability that manifests in the mental adjustment capacity measured by well1. Children who navigated alternative care arrangements may have developed coping skills that contribute to their current happiness, even if the original circumstances were difficult.

The table below presents results based on primary caregiver type. To estimate how each variable affects wellbeing, we need to establish a baseline category for comparison. For primary caregiver, we use single parent as the baseline.

Coefficients are rounded to two decimal places, and only those statistically significant at the 5% level are shown.

Table 8: Group 1b – Regression Results for Primary Caregiver Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
People primarily involved in child-rearing (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Parents						0.17						0.08			
Relatives such as grandparents, siblings, etc.				0.09			-0.20								
Friends or acquaintances	0.44	0.34					-0.23		-0.29						
Other	0.30	0.15							-0.15	-0.23				-0.25	-0.25

Number of Siblings

No consistent pattern emerged for this variable. The effects varied considerably across different wellbeing dimensions and levels.

For example, at the lower end of subjective wellbeing (well1, 10th percentile), having more siblings showed positive effects. In contrast, at the upper end of intrinsic motivation for play (well3, 90th percentile), more siblings had negative effects.

Moreover, at many quantiles, the number of siblings showed no significant effects at all. This inconsistency makes sibling count a variable that requires cautious interpretation. The relationship between family size and wellbeing appears highly context-dependent, likely influenced by factors such as family dynamics, resource availability, and the quality of sibling relationships—none of which our measure of sibling count captures directly.

Table 9: Group 1b – Regression Results for Number of Siblings Variable on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Number of siblings	0.06														-0.06

3.4.4.Key Findings: Demographic Characteristics

Demographic variables represent current circumstances rather than outcomes of childhood play or psychological traits. While this makes direct causal analysis challenging, these variables play an important role as controls that improve model precision.

Education level and income, in particular, are known to influence wellbeing. However, we must handle them carefully because they may themselves be related to childhood psychological characteristics. For instance, if people with high divergent thinking in childhood tend to earn higher incomes later, including income in our model might cause us to underestimate the true effects of psychological traits. Additionally, because both income and education are categorical variables, tracing the detailed causal pathways of why things turned out this way would require more sophisticated methodology. Our analysis does not attempt such causal decomposition.

Household Income

Higher income showed positive effects on subjective wellbeing (well1) and attachment to family (well2). However, for intrinsic motivation for play (well3), we observed the opposite pattern—higher income levels were associated with lower wellbeing in this dimension.

This counterintuitive finding suggests that material abundance does not necessarily align with intrinsic play motivation. Children from wealthier families may have faced more structured schedules, performance pressure, or reduced opportunities for self-directed play, potentially dampening their intrinsic enjoyment of playful activities.

The table below presents results by income category. To estimate how each variable affects wellbeing, we use up to 4 million yen as the baseline for comparison.

Table 10: Group 1b – Regression Results for Household Income Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Household annual income (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
¥4.01 million to ¥6 million	0.20	0.09				0.34	0.16	0.05	0.10	0.17					-0.10
¥6.01 million to ¥8 million	0.17	0.12	0.06			0.44	0.21	0.09	0.19	0.20					-0.11
¥8.01 million to ¥10 million	0.29	0.17				0.37	0.18	0.12	0.19	0.25	-0.18				
¥10.01 million to ¥12 million	0.28	0.23	0.19	0.19		0.44	0.25	0.14	0.20	0.33	-0.51	-0.17	-0.10	-0.12	-0.25
¥12.01 million to ¥15 million	0.40	0.26	0.15	0.21	0.29	0.37	0.20	0.13	0.20	0.25	-0.32				
Above ¥15.01 million	0.30	0.17	0.11	0.17	0.26	0.49	0.15	0.09	0.37	0.46		-0.15	-0.10	-0.16	-0.32

Gender

Men showed higher intrinsic motivation for play (well3) but lower attachment to family (well2). This gender difference may reflect distinct patterns of family involvement and differing values around family relationships shaped by cultural and social expectations.

These contrasting patterns suggest that while men may maintain stronger connections to playful engagement and intrinsic interests, they tend to report weaker emotional bonds with family. This could stem from traditional gender role socialization, where men are encouraged toward independence and achievement while women are socialized toward relational connection and family caregiving.

The table below presents gender differences in regression results. To estimate how each variable affects wellbeing, we use female as the baseline category for comparison.

Table 11: Group 1b – Regression Results for Gender Variable on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Gender (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Male				-0.08	-0.19	-0.14	-0.12	-0.14	-0.26	-0.30	0.16	0.06	0.04	0.12	0.11

Education Level

Positive effects appeared at higher levels of subjective wellbeing (well1) and attachment to family (well2)—that is, among those with already high wellbeing.

However, this pattern was not consistent across all quantiles. At middle to lower wellbeing levels, education showed no clear effects. This finding suggests that education's benefits for wellbeing may compound with existing advantages rather than lifting those at lower wellbeing levels. In other words, higher education appears to enhance wellbeing primarily for those already doing relatively well, rather than serving as an equalizing force.

The table below presents results by education level. To estimate how each variable affects wellbeing, we use middle school graduate as the baseline category for comparison.

Table 12:Group 1b – Regression Results for Education Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Highest level of education (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
High school															
Vocational school								0.16							
Junior college/ Technical college															
University															
Graduate school				0.25				0.21							
Currently enrolled															
Other									0.41						

Household Size

At lower to middle levels of attachment to family (well2), having more household members living together appeared beneficial. However, at higher levels of subjective wellbeing (well1) and intrinsic motivation for play (well3), larger household size sometimes showed negative effects.

This pattern reveals an important nuance: more family members is better doesn't always hold true. What matters isn't simply the number of people living together, but the quality of relationships within the household. A crowded home with strained relationships may actually hinder wellbeing, while a smaller household with strong connections can foster it.

The benefits of larger families appear most pronounced for those with weaker initial family attachment—perhaps because more family members provide additional sources of connection and support.

Table 13: Group 1b – Regression Results for Household Size Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Number of family members living together			-0.02	-0.02	-0.06	0.08	0.04	0.03	0.02		0.06				-0.04

Birth Cohort

We compared three generational cohorts:

- Born in the 1950s-60s
- Born in the 1970s-80s
- Born in the 1990s-2000s

The analysis revealed distinct generational patterns:

Subjective wellbeing (well1)

Those born in the 1990s-2000s tended to report lower wellbeing at both the lower end (10th percentile) and upper-middle range (75th percentile). This suggests that younger cohorts may face unique challenges to subjective wellbeing that span across wellbeing levels—possibly reflecting increased social pressures, digital connectivity stress, or changing economic conditions.

Attachment to family (well2)

The patterns here were more complex and sometimes contradictory. At lower wellbeing levels, the 1970s-80s cohort showed somewhat disadvantaged outcomes. However, at the highest level (90th percentile), the 1990s-2000s cohort reported stronger family attachment than earlier generations.

This divergence hints at increasing polarization in family relationships among younger cohorts—some experience very strong bonds while others struggle more than previous generations did.

The table below presents results by birth cohort. To estimate how each variable affects wellbeing, we use “born in the 1950s-60s” as the baseline category for comparison.

Table 14:Group 1b – Regression Results for Birth Cohort Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Decade of birth (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
70’s~80’s							-0.08								
90’s~2000’s	-0.28			0.17	0.18					0.24					

So far, we have looked at the relationship between childhood and current wellbeing from the individual's perspective. In the next section we will look at the parent’s perception of their children (Group 1a).

3.5.Analysis of Group 1a

Having examined individuals' reflections on their own childhood (Group 1b), we now turn to parents' perspectives on their children's experiences and wellbeing.

3.5.1.Survey Respondents and Content

This analysis focuses on Group 1a—parents reporting on their children's childhood experiences and current wellbeing. Participants answered questions about:

- Their child's play styles during ages 3-12 (Q6.1-Q6.12)
- Their child's play styles before age 3 (Q6.13-Q6.20)
- Their child's psychological characteristics (personality, tendencies) (Q9.1-Q9.25)
- Their child's current wellbeing (mental health and happiness) (Q10.1-Q10.23)

These responses allow us to examine from a parent's perspective how childhood play styles and personality influence current wellbeing, offering a complementary view to the self-reported data from Group 1b.

Model Structure Differences from Group 1b

The primary difference between Group 1a and Group 1b models is that Group 1a excludes two variables: digital play and emotional release.

We removed these variables because including them did not meaningfully improve model fit for the Group 1a sample. When variables fail to contribute substantially to explanatory power, keeping them risks overfitting—where the model performs well on current data but poorly on new data.

In such cases, simpler models are preferable. This decision reflects standard statistical practice: include only variables that genuinely enhance our understanding of the relationships being studied.

3.5.2.Key Differences Between Adults' Self-Reports and Parents' Observations

Physical Play Shows Opposite Effects on Subjective Wellbeing

Adults reflecting on their childhood (Group 1b) reported that physical play negatively affected their subjective wellbeing (well1). In contrast, parents observing their children (Group 1a) reported that physical play positively influenced their children's subjective wellbeing (well1).

Interestingly, from the parents' perspective, physical play negatively affected attachment to family (well2)—a pattern not seen in adults' self-reports.

Time with Parents and Toys Leave Deeper Impressions Than Parents Realize

Adults' self-reports showed that time with caregivers and availability of toys positively influenced both attachment to family (well2) and intrinsic motivation for play (well3). However, parents did not perceive these same consistent effects when observing their children.

This discrepancy suggests that experiences like parent-child time and having toys may leave stronger imprints on children's memories and emotional development than parents recognize at the moment. What seems ordinary to parents may be formative for children.

Cooperativeness Effects Differ at Mid-to-Low Wellbeing Levels

For attachment to family (well2) among those with mid-to-low wellbeing, adults' self-reports indicated that cooperativeness had positive effects, while parents observed negative effects.

Conversely, for intrinsic motivation for play (well3) among those with mid-to-low wellbeing, adults reported that cooperativeness had negative effects, while parents observed positive effects.

These opposing patterns highlight how internal experiences of cooperativeness may differ from external observations—children may feel constrained by excessive cooperation even when parents perceive it as beneficial, or vice versa.

The table below presents parameters estimated through quantile regression analysis. The outcome variable is wellbeing, while the explanatory variables are play

styles, lifestyle patterns, and psychological characteristics estimated using VSS (discussed in previous sections).

All VSS variables—including play styles, children's lifestyle, psychological characteristics, and wellbeing measures—have been normalized to enable meaningful comparisons across different measurement scales.

Interpreting the coefficients: The coefficients indicate how much wellbeing changes (in standard deviation units) when an explanatory variable increases by one standard deviation from its mean.

Note:The table displays only coefficients that are statistically significant at the 5% level.

Green numbers: Coefficients indicating positive effects on wellbeing

Red numbers: Coefficients indicating negative effects on wellbeing

Table 15: Group 1a – Regression Results for VSS Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Manual play	0.10	0.07	0.08	0.07	0.06			0.03							
Physical play		0.04	0.04	0.05		-0.13	-0.08	-0.06	-0.07		0.07	0.07	0.08	0.12	0.15
Play under age 3										0.08					
Time with parents															
Toy availability				0.05	0.07		-0.04							0.05	
Motor-social competence	0.24	0.23	0.19	0.16	0.14	0.13	0.06					0.13	0.10	0.04	
Divergent thinking	0.25	0.27	0.22	0.12	0.08	0.13		-0.08	-0.13	-0.14	0.15	0.12	0.06		
Cooperativeness	0.18	0.18	0.17	0.14	0.11	0.06	-0.07	-0.12	-0.15	-0.15		0.05		-0.04	-0.05
Playful humor	0.16	0.14	0.14	0.15	0.12	0.12	0.16	0.16	0.12	0.08	0.14	0.13	0.15	0.12	0.09
Emotional involvement				0.27	0.28	0.24	0.38	0.54	0.55	0.49	0.14	0.13	0.29	0.40	0.38

Note:In the Group 1a model, Digital play and Emotional Release Ability contribute nothing to model fit and have been excluded to avoid overfitting.

Playtime Shows Opposite Effects on Mid-Level Attachment to Family

Adults reflecting on their childhood reported that longer playtime negatively affected their attachment to family (well2). However, parents observing their children reported the opposite—more playtime positively influenced family attachment.

This divergence may reflect different interpretations of the same phenomenon. Adults remembering extensive playtime might recall it as time away from family, potentially indicating weaker family bonds. Parents, meanwhile, may view children's active play as a sign of healthy development and security within the family environment—children who feel secure at home are free to explore and play.

The table below presents results by daily playtime duration. To estimate how each variable affects wellbeing, we use don't know/unsure as the baseline category for comparison.

All coefficients are rounded to two decimal places, and only those statistically significant at the 5% level are shown.

Table 16: Group 1a – Regression Results for Playtime Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Playtime per day (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	###	0.75	0.90	0.10	0.25	0.50	0.75	0.90
1 hour				0.09				0.08	0.13					0.10	
2 hours	-0.12	-0.10						0.09	0.10					0.18	
3 hours	-0.20			0.10			0.08	0.12	0.16					0.17	
4 hours	-0.18					-0.13			0.22					0.11	
5 hours	-0.21							0.13						0.13	
6 hours			0.18	0.27		-0.22									
7 hours	-0.49								0.60						
8 or more hours	-0.33			0.20		-0.29								0.20	

Who Children Played With Most Often

The Group 1a findings are difficult to reconcile with Group 1b results, and these discrepancies likely stem from methodological differences in data collection.

Specifically, Group 1a responses rely on parents' judgments and observations of their children, introducing subjective parental interpretation into the results. Parents may misread their children's emotional states, project their own values onto their assessments, or simply lack insight into their children's internal experiences.

This inherent limitation means that parental reports and self-reports may capture genuinely different aspects of the same childhood experiences.

Overall, the effects of playmates on wellbeing appear more limited and localized in Group 1a compared to Group 1b—suggesting that the rich associations children form with different playmates may not be fully visible to parents.

Results That Differ from Group 1b:

- No effects on subjective wellbeing (well1) were detected—a striking contrast to Group 1b where playmate type significantly influenced happiness.
- Playing with siblings showed minimal impact on attachment to family (well2). Moreover, at the 10th and 25th percentiles, sibling play actually negatively affected well2—opposite to what we might expect and contrary to Group 1b patterns.

Results Consistent with Group 1b:

- Playing alone positively influenced intrinsic motivation for play (well3), suggesting that solitary play may foster creativity and divergent thinking regardless of whether this is self-reported or parent-observed.
- Playing with friends positively influenced intrinsic motivation for play (well3)—a pattern parents can apparently recognize even if they cannot fully gauge its impact on other wellbeing dimensions.

The table below presents results based on who children played with most often. To estimate effects, we use parents as the baseline category for comparison.

Coefficients are rounded to two decimal places, and only those statistically significant at the 5% level are shown.

Table 17: Group 1a – Regression Results for Playmate Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
The partner you played with most during the day (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Grandparents															
Siblings						-0.15	-0.1								
Friends														0.09	
Pets															
Alone												0.10			0.19
Others							-0.2		-0.30	-0.34					-0.20

Primary Caregiver

Results for this variable mirror patterns seen in the playtime analysis—showing both contrasts with Group 1b and limited overall effects.

Results That Differ from Group 1b:

- Being raised by caregivers other than parents negatively affected subjective wellbeing (well1). This contradicts the Group 1b finding, where non-parental care sometimes showed positive effects—possibly reflecting resilience developed through challenging circumstances. The discrepancy suggests that while adults may retrospectively appreciate the resilience they gained, parents observing their children perceive alternative care arrangements as detrimental to happiness.

Results Consistent with Group 1b:

- Being raised by parents enhanced attachment to family (well2) in both groups. Notably, in Group 1a, this effect reached statistical significance at four out of five quantiles, demonstrating a robust and visible relationship that parents can readily observe. This makes intuitive sense—parental caregiving naturally fosters family bonds in ways both children and parents recognize.

The table below presents results by primary caregiver type. To estimate how each variable affects wellbeing, we use single parent as the baseline category for comparison.

Coefficients are rounded to two decimal places, and only those statistically significant at the 5% level are shown.

Table 18: Group 1a – Regression Results for Primary Caregiver Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
People primarily involved in child-rearing (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Parents						0.13	0.06	0.05	0.09		0.22	0.10			
Relatives such as grandparents, siblings, etc.					-0.27			0.11							0.27
Friends or acquaintances					-0.36										
Other															

Number of Siblings

For sibling count, we found only limited evidence of effects: negative impacts on attachment to family (well2) at the 10th and 50th percentiles. This contrasts sharply with Group 1b, where sibling effects were more varied and appeared across multiple wellbeing dimensions.

This divergence is striking and warrants interpretation. Parents may struggle to observe how sibling dynamics actually affect their children's wellbeing, or the effects may manifest internally in ways parents cannot easily detect.

Alternatively, the negative effects at lower wellbeing levels might reflect parental awareness of sibling conflict or resource competition in families where children are already struggling—situations that are more visible to parents than the subtle benefits or costs siblings bring at higher wellbeing levels.

The limited findings here suggest that sibling relationships' impact on wellbeing is largely invisible from a parental vantage point, operating through mechanisms that children experience but parents cannot readily observe.

Coefficients are rounded to two decimal places, and only those statistically significant at the 5% level are shown.

Table 19: Group 1a – Regression Results for Number of Siblings Variable on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Number of siblings						-0.05		-0.02							

Household Income

Higher household income enhanced children's subjective wellbeing (well1) across nearly all wellbeing levels—appearing at every quantile except the 90th percentile. This exception is noteworthy: among children already experiencing very high subjective wellbeing, additional family income appears to make no further difference.

This suggests a ceiling effect, where material resources can lift happiness up to a point, but beyond a certain threshold, other factors become more important.

In contrast, household income showed no clear relationship with either attachment to family (well2) or intrinsic motivation for play (well3). This pattern implies that while money can provide comfort, security, and opportunities that contribute to happiness, it neither strengthens nor weakens family emotional bonds or children's intrinsic love of play. These dimensions of wellbeing appear to operate independently of economic resources—shaped instead by relationship quality and personal dispositions.

The table below presents results by income category. To estimate how each variable affects wellbeing, we use up to 4 million yen as the baseline for comparison.

Table 20: Group 1a – Regression Results for Household Income Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Household annual income (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
¥4.01 million to ¥6 million									-0.10	-0.15			-0.08		
¥6.01 million to ¥8 million					-0.12							-0.10			
¥8.01 million to ¥10 million					-0.13							-0.12		-0.12	-0.17
¥10.01 million to ¥12 million	0.24	0.14													
¥12.01 million to ¥15 million			0.11		-0.15										
Above ¥15.01 million	0.3	0.18	0.16	0.13										-0.12	-0.16

Gender (of Parent Respondent)

While not a primary focus of this analysis, gender results offer intriguing insights into how mothers and fathers perceive their children's wellbeing differently.

In Group 1a, male respondents (fathers) consistently rated their children's wellbeing lower than female respondents (mothers) at higher percentiles across all three wellbeing dimensions: subjective wellbeing (well1), attachment to family (well2), and intrinsic motivation for play (well3).

This pattern suggests that fathers and mothers apply different evaluative standards when assessing their children's wellbeing. Specifically, fathers appear to take a more conservative or critical stance—setting higher bars for what constitutes high wellbeing in their children.

This could reflect different parenting philosophies, with fathers perhaps emphasizing achievement and readiness for challenges, while mothers may focus more on emotional security and present happiness.

Alternatively, fathers and mothers may simply observe different aspects of their children's lives due to differing amounts of time spent together or different types of interactions, leading to genuinely divergent assessments rather than different standards applied to the same observations.

The table below presents gender differences in parental assessments. To estimate effects, we use female (mothers) as the baseline category for comparison.

Table 21: Group 1a – Regression Results for Gender (Parent) Variable on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Gender (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Male	0.25	0.10			-0.14			-0.13	-0.17	-0.18				-0.13	-0.12

Education Level (of Parent)

Evidence linking parental education to children's wellbeing is sparse. Significant associations appeared only at specific quantiles:

- Attachment to family (well2): 25th percentile only
- Intrinsic motivation for play (well3): 10th and 90th percentiles only
- Subjective wellbeing (well1): 90th percentile only

Given that these assessments come from parental observations rather than children's self-reports, drawing causal conclusions would be premature. What we can offer are tentative interpretations.

One plausible explanation centers on evaluation standards rather than actual differences in children's wellbeing. Parents with higher education may hold elevated expectations and more stringent criteria when assessing their children's wellbeing. Consequently, they might rate their children more conservatively or critically even when children's actual wellbeing is objectively similar to those of less-educated parents.

This would manifest precisely as we observe: limited and inconsistent effects scattered across quantiles, rather than the robust patterns we would expect if parental education genuinely and directly influenced child wellbeing.

The sporadic nature of these findings suggests we may be detecting measurement artifacts—differences in how parents perceive and report—rather than true differences in how children feel.

The table below presents results by parental education level. To estimate effects, we use middle school graduate as the baseline category for comparison.

Table 22: Group 1a – Regression Results for Education (Parent) Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Highest level of education of the parent (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
High school				-0.23	-0.41		0.37								
Vocational school					-0.31		0.29								
Junior college/ Technical college							0.41				0.47				-0.35
University							0.36								
Graduate school							0.34								
Currently enrolled										-1.44	1.98				
Other								-0.58							

Household Size

Overall, we found virtually no evidence that household size influences children's wellbeing. The lone exception appeared at the 25th percentile of intrinsic motivation for play (well3).

At this specific quantile, each additional household member was associated with a 0.02 standard deviation increase in children's wellbeing—a modest effect confined to this narrow range. This isolated finding suggests that, broadly speaking, the relationship between family size and wellbeing is weak. Neither larger nor smaller families appear to systematically advantage or disadvantage children's wellbeing as parents perceive it.

Birth Cohort (of Parent)

Parents born in the 1970s-1980s tended to rate their children higher on attachment to family (well2) and intrinsic motivation for play (well3) compared to earlier cohorts.

However, we should interpret this pattern cautiously—not as evidence that children of younger parents genuinely experience higher wellbeing in these

dimensions, but rather as reflecting generational differences in how parents evaluate and report on their children's wellbeing.

Parents from different eras may hold different benchmarks for what constitutes good family attachment or strong play motivation. The 1970s-1980s cohort, raised during periods of shifting family structures and evolving parenting philosophies, may simply apply more lenient or optimistic standards when assessing these aspects of their children's lives.

Alternatively, they may be more attuned to emotional dimensions that earlier generations overlooked or undervalued.

The table below presents results by parental birth cohort. To estimate effects, we use ”born in the 1950s-60s” as the baseline category for comparison.

Table 23:Group 1a – Regression Results for Birth Cohort (Parent) Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Parents' decade of birth (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
70's~80's						0.08	0.06				0.18	0.12	0.06		
90's~2000's															

4.Analysis of the Relationship Between Parenting and Parent Wellbeing (Group 2)

Key Findings

1.Playful Humor and Parent Wellbeing

Children who exhibit strong playful humor—enjoying jokes, telling funny stories, and appreciating humor—have broadly positive effects on their parents' overall wellbeing. This finding suggests that humor functions not merely as a form of expression but as an indicator of social competence.

Humor-based communication helps build positive relationships with others, and children with this quality likely generate more empathy and joy in their interactions with parents as well. This, in turn, enhances parents' own psychological fulfillment and sense of family connection, ultimately improving their wellbeing. What emerges here is a pathway of social spillover effects—the child's humor radiates outward, enriching the entire family's emotional climate.

2.Social Spillover Effects of Physical Play

Children who engage frequently in physical play (running outside, playing sports) and demonstrate related motor-social competence (ability to interact with others and physical capability) positively influence their parents' wellbeing.

The relationship unfolds as follows: children actively playing outdoors → building more social connections → this positive development benefiting parents' emotional state. Thus, children's active lifestyles can indirectly enhance parent wellbeing through spillover effects. The child's engagement with the world creates ripples that reach back to affect the parent.

3.Children's Emotional Engagement: Mixed Effects on Parents

Children with high emotional involvement—those who express feelings openly and seek deep connections with parents—tend to enhance parent wellbeing. When children honestly express their emotions and work to strengthen bonds with parents, they may create a warmer, more secure home atmosphere. This likely helps parents experience greater psychological fulfillment and connection.

However, we observed a notable exception: among parents with initially low subjective wellbeing (well1), emotional involvement had negative effects. This mixed pattern may reflect individual differences in how parents receive emotional demands, or it may be influenced by confounding factors such as background life stress and personality traits. Future research should examine more closely the mechanisms producing these negative effects.

4.The Paradox of Children's Emotional Release and Parent Wellbeing

Children's emotional release (their capacity to externalize feelings) showed inconsistent effects. On one hand, emotional demands can burden parents, potentially reducing attachment to family (well2). On the other hand, we also observed positive effects on subjective wellbeing (well1).

This pattern reveals what might be called the parent's paradox—children freely expressing emotions can be simultaneously healing and exhausting for parents. The same behavior that brings closeness and authenticity to the relationship also creates emotional labor and stress.

5.The Dilemma of Free Time Value and Parent Satisfaction

A particularly intriguing finding: parents who value hobbies and personal free time tend to report lower actual wellbeing. This suggests that for parents who desire personal time, the temporal constraints of childrearing create significant friction, potentially reducing life satisfaction.

In other words, being devoted to parenting and personal wellbeing do not always align. This result illuminates a fundamental tension in modern parenting—the conflict between fulfilling parental responsibilities and maintaining individual identity and satisfaction.

Focus and Purpose of the Analysis

This analysis aims to illuminate how children's play styles and personality characteristics influence parent wellbeing—their happiness and psychological fulfillment. This represents a fundamental shift in perspective from our previous analyses (Groups 1a and 1b).

Our earlier analyses examined:

- Group 1a:The relationship between children's play and their own wellbeing
- Group 1b:The relationship between adults' childhood play and their current wellbeing

In contrast, this analysis reverses the lens, focusing on how children's characteristics affect parents. We ask: What emotional and psychological impacts do parents experience depending on their children's play styles and personalities?

For instance, we explore whether children who play spontaneously and express emotions richly bring joy and reassurance to parents, or conversely, whether certain play patterns or personality traits create stress and burden. Both dynamics likely coexist, and understanding their balance is crucial.

Clarifying these relationships allows us to grasp the full picture of what parents experience—both the joys and burdens of raising children. This perspective is critically important in Japan's context of declining birth rates. In a society where parenting feels overwhelmingly burdensome, people naturally hesitate to have children. However, if parents can experience genuine joy and psychological fulfillment in time spent with their children, the value and meaning of parenting may be rediscovered.

This analysis seeks to determine whether children's play styles and psychological characteristics function primarily as sources of joy or sources of burden for parents, and which dimension exerts stronger influence.

Building clear evidence about these relationships can contribute to society in several ways:

- Designing support policies that consider not only children's development but also parent wellbeing
- Establishing foundations for sustainable family support policies that emphasize mutual growth—children and parents developing together
- Ultimately, contributing to comprehensive approaches addressing the social challenge of declining birth rates

This analysis represents an important step toward reexamining the connection between children's development and parent happiness, demonstrating the necessity of supporting childrearing as a collective societal responsibility rather than an individual burden.

Hypotheses and Research Questions

This analysis examines how children's play styles and personality characteristics affect parent wellbeing (mental health and life satisfaction) from two perspectives: positive effects (sources of joy) and negative effects (sources of burden). We formulate hypotheses from each angle and clarify our research questions accordingly.

Positive Effects:Children's Play as a Source of Fulfillment

We hypothesize that children's play can bring parents a sense of fulfillment and joy. For example, parent-child bonds may deepen (enhanced attachment to family, well2), leading to increased interaction with other parents and broader social connections. Parents may also rediscover their own interests and passions through their children's activities (heightened intrinsic motivation for play, well3), ultimately contributing to improved subjective wellbeing (well1).

Negative Effects:Children's Characteristics as Sources of Stress

Conversely, certain child characteristics and play styles may generate parental stress and psychological burden. Children who prefer physically active play may require substantial parental involvement, consuming parents' free time and reducing well1 and well3. Similarly, children with intense emotional expression may create friction with parents, increasing psychological strain.

Additionally, single-parent households face particularly pronounced burdens from shouldering childcare alone, likely facing higher risks of wellbeing decline.

Furthermore, our survey revealed an intriguing pattern: parents who answered that they value personal free time (ELAQ1.37) tended to report lower actual wellbeing. This observation suggests a hypothesis—parents with strong desires for personal time may struggle more with work-life balance, experience greater stress, and consequently suffer reduced life satisfaction.

Research Questions

Based on these hypotheses, this analysis addresses the following questions:

- Which children's psychological characteristics (e.g., cooperativeness, emotional release, introspection) are most strongly associated with parent wellbeing?
- Which children's play styles (e.g., physical play, digital play, creative play) are most strongly associated with parent wellbeing?
- Do single parents experience lower wellbeing compared to partnered parents? (→ examining how household structure affects parent wellbeing)

By answering these questions, we aim to elucidate the structure of factors influencing parent wellbeing, providing knowledge that can inform future childcare support policies and social interventions.

Understanding what helps parents thrive—not just survive—is essential for creating a society where raising children feels sustainable and rewarding.

4.1.1.Survey Respondents and Content

This analysis examines response data from participants classified as Group 2. Participants answered questions about:

- Their child's play styles between ages 3–12 (Q7.1–Q7.12)
- Their child's play styles under age 3 (Q7.13–Q7.20)
- Their child's psychological characteristics (personality, tendencies) (Q9.1-Q9.25)
- Their own current wellbeing as parents (mental health and happiness) (Q10.1-Q10.23)

Important sampling note: This survey targeted parents and caregivers of children aged 3 years and older. Consequently, families with only children under age 3 are excluded from this analysis.

We established this criterion to ensure stable and reliable assessment of both children's play styles and psychological characteristics. Children under age 3 undergo dramatically different developmental stages, making consistent evaluation challenging. By focusing on children aged 3 and above, we can obtain more dependable analytical results—comparing children at relatively similar developmental levels and assessing characteristics that have begun to stabilize.

This approach allows parents to reflect on patterns rather than momentary behaviors, and enables meaningful comparisons across the sample. While this excludes families in the earliest stages of parenting, it strengthens the validity of our findings about how children's established characteristics relate to parent wellbeing.

4.1.2.Analytical Approach

We apply quantile regression using the three wellbeing indicators (latent variables) introduced earlier as outcome variables. The explanatory variables include:

- Children's psychological characteristics and play styles
- Parents' characteristics regarding free time and hobbies

To improve analytical precision, we also include demographic control variables:

- Gender
- Birth decade
- Current income
- Education level

Among the available characteristics, we focused on two particularly revealing survey items that capture how much parents value free time and personal hobbies.

- (ELAQ1.17) I want to secure time for myself to enjoy hobbies, travel, etc. This question measures how much parents value their personal time—their preference for free time. It reveals the extent to which parents feel the need to maintain individual identity and interests alongside their parenting role.
- (ELAQ1.37) I have a hobby or interest I'm deeply absorbed in
  This question captures whether parents are actively engaged in personal passions. Parents who have something they're enthusiastic about tend to have stronger desires for personal time, making this an important clue for understanding the relationship with wellbeing.

These items provide crucial insights into how parents navigate the challenge of balancing childcare with personal time. Do parents who value personal time experience wellbeing differently? Does having absorbing interests buffer against or

exacerbate the stresses of parenting? These questions lie at the heart of understanding modern parenting experiences, where traditional expectations of self-sacrifice increasingly conflict with contemporary values around individual fulfillment and work-life balance.

Quantile Regression Specification

We conduct separate regression analyses for five different wellbeing levels (quantiles):

- 10th percentile: Very low wellbeing
- 25th percentile: Relatively low wellbeing
- 50th percentile (median): Average wellbeing
- 75th percentile: Relatively high wellbeing
- 90th percentile: Very high wellbeing

Analyzing each segment separately reveals how children's characteristics affect parent wellbeing differently depending on where parents fall along the wellbeing distribution. A factor that helps struggling parents (low percentiles) may have little effect—or even opposite effects—on thriving parents (high percentiles), and vice versa.

This flexible analytical approach enables deeper insights tailored to individual circumstances and backgrounds. Rather than assuming all parents respond uniformly, we can identify which factors matter most for whom—essential knowledge for designing targeted, effective support interventions that meet parents where they actually are.

4.1.3.Interpretation of the Results

How Results Are Organized

Our analysis produces 15 regression results: three wellbeing indicators × five quantiles each. To present these findings clearly, we organize variables into three categories:

- **1.Psychological characteristics** (primary variables of interest)
  The 12 latent variables estimated from the survey, representing children's personality and psychological tendencies.
- **2.Demographic characteristics**
  Gender, education level, income, and other factors that may directly influence current wellbeing.
- **3.Parenting burden**
  Variables related to potential childcare demands, particularly from a time requirement perspective. Examples include children's playtime, who holds primary responsibility for the child, and parents' preferences for free time.

4.1.4.Key Findings: Psychological Characteristics

Factors with Broad Influence

Playful Humor

Overall, children with playful humor positively influenced parent wellbeing. This suggests that children's humor makes parent-child communication more enjoyable and smooth, contributing to a positive home atmosphere.

Previous research (Yip 2006, Semrud-Clikeman 2010, Salavera 2018) supports this finding, reporting that children with strong sense of humor tend to possess higher social competence. Children with such social skills likely make relationships with parents more positive and fulfilling, ultimately enhancing parental subjective wellbeing.

Emotional Involvement

Emotional involvement also showed generally positive effects. This likely relates to such children forming stronger bonds with parents and creating better home atmospheres.

However, at lower levels of subjective wellbeing (well1), we observed negative effects instead. The reasons remain unclear—requiring further investigation into individual differences in how parents receive children's emotional expression and potential confounding factors.

Divergent Thinking

Though less pronounced than emotional involvement, divergent thinking (the ability to generate creative ideas) also positively affects parent wellbeing. Children with this trait may devise their own play more easily, requiring less parental intervention and thereby reducing burden.

Cooperativeness

Highly cooperative children positively influence subjective wellbeing (well1) and intrinsic motivation for play (well3) but negatively affect attachment to family (well2). Why this divergence occurs remains unknown, requiring further investigation and additional perspectives.

Emotional Release

Children who express emotions richly may bond more easily with parents, potentially benefiting wellbeing. However, we also observed negative effects on attachment to family (well2). This may indicate that intense emotional expression can create parent-child friction.

Factors with Limited Influence

Motor-Social Competence + Physical Play

These characteristics positively influence subjective wellbeing (well1). When children play actively and interact with other children, parents may gain more opportunities for outings and social connections, adding to life satisfaction.

However, negative effects sometimes appeared for attachment to family (well2). Active children may demand more parental involvement, increasing physical and psychological burden.

Digital Play

Digital play (video games, watching videos) shows patterns similar to physical play. For some parents, children absorbed in digital activities may require less attention, freeing up parental time.

Additionally, watching videos or playing games together may create new forms of parent-child bonding. However, negative effects on attachment to family

(well2) were also observed, possibly because digital play reduces face-to-face communication opportunities and creates distance.

Factors with Very Limited Influence

Play Under Age 3

Showed tendencies toward positive effects on subjective wellbeing (well1) and intrinsic motivation for play (well3).

Toy Availability

Showed negative effects on attachment to family (well2) but positive effects on intrinsic motivation for play (well3).

Time Spent with Parents

Longer time spent together may slightly negatively affect subjective wellbeing (well1), possibly related to increased time burden on parents.

The table below presents parameters estimated through quantile regression analysis. The outcome variable is wellbeing, while explanatory variables are play styles, lifestyle patterns, and psychological characteristics estimated using VSS (discussed in previous sections).

All VSS variables—including play styles, children's lifestyle, psychological characteristics, and wellbeing measures—have been normalized to enable meaningful comparisons across different measurement scales.

Interpreting the coefficients: The coefficients indicate how much wellbeing changes (in standard deviation units) when an explanatory variable increases by one standard deviation from its mean.

Only statistically significant coefficients ($p < 0.05$) are shown.

Green numbers: Coefficients indicating positive effects on wellbeing

Red numbers: Coefficients indicating negative effects on wellbeing

Table 24: Group 2 – Regression Results for VSS Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Manual play											0.07				
Physical play			0.03	0.04	0.05			-0.04	-0.03		0.09	0.05	0.04	0.06	
Digital play	0.15	0.11	0.08	0.07	0.07			-0.04	-0.05	-0.09					
Play under age 3		0.05	0.03												0.05
Time with parents				-0.03											
Toy availability						-0.05	-0.04								0.05
Motor-social competence	0.09	0.12	0.12	0.09	0.09		0.09	0.05			0.09	0.09	0.10	0.07	
Divergent thinking	0.24	0.20	0.15	0.11	0.10		0.08	-0.04	-0.05	-0.07	0.08	0.08	0.04		
Cooperativeness	0.21	0.16	0.14	0.12	0.08				-0.05	-0.07		0.05			
Playful humor	0.08	0.13	0.14	0.16	0.17	0.24	0.25	0.24	0.18	0.15	0.09	0.12	0.18	0.15	0.14
Emotional involvement	-0.24	-0.17	-0.07	0.07	0.10	0.26	0.31	0.48	0.49	0.46		0.13	0.29	0.38	0.35
Emotional release		0.04	0.03			-0.05	-0.09	-0.11	-0.13	-0.11	0.11	0.04		-0.03	

4.1.5.Key Findings: Demographic Characteristics

The most striking finding in this analysis is that many basic demographic factors showed no consistent effects on parent wellbeing. The following elements showed no clear relationships with any of the three wellbeing indicators (mental health, attachment to family, sense of fulfillment in personal activities):

- Birth decade (e.g., born in the 1970s vs. 2000s)
- Partner status (married vs. unmarried)
- Number of household members

These results suggest that these factors may not substantially influence parents' mental health or wellbeing—a counterintuitive finding that challenges common assumptions. We might expect single parents to struggle more, or larger families to create different wellbeing patterns, but the data reveal no such systematic differences.

Household Income

Higher-income parents showed higher wellbeing for subjective wellbeing (well1) and attachment to family (well2). However, for intrinsic motivation for play (well3), higher income was associated with lower wellbeing.

This paradoxical pattern likely reflects time constraints: dedicating extensive time to work may reduce personal time, leaving high-earning parents materially comfortable but personally unfulfilled. They may achieve financial security and family stability, yet feel disconnected from their own interests and intrinsic sources of joy—a modern parenting dilemma where professional success comes at the cost of personal engagement.

The table below presents results by income category. To estimate how each variable affects wellbeing, we use up to 4 million yen as the baseline for comparison.

Table 25: Group 2 – Regression Results for Household Income Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Household annual income (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
¥4.01 million to ¥6 million					0.02				0.12	0.21					
¥6.01 million to ¥8 million	0.14					0.20	0.15	0.08	0.11	0.26	-0.27				
¥8.01 million to ¥10 million	0.31	0.15				0.21				0.24	-0.22				-0.15
¥10.01 million to ¥12 million	0.31	0.16			0.17										
¥12.01 million to ¥15 million	0.40									0.29					-0.24
Above ¥15.01 million	0.37			0.17	0.26	0.26				0.24	-0.36				

Occupation

Occupations that positively influenced subjective wellbeing (well1) included:

- Private sector employees
- Educational sector workers
- Professionals (medical workers, lawyers, etc.)

In contrast, negative effects on intrinsic motivation for play (well3) appeared for:

- Public servants

This pattern suggests an intriguing possibility: even occupations offering job security may make it difficult to maintain personal time and pursue individual interests. Public servants, despite enjoying employment stability, may face rigid schedules, bureaucratic demands, or cultural expectations that constrain their ability to engage with activities they find intrinsically fulfilling.

The contrast with teachers (Educational sector) is particularly interesting—both are public service roles, yet teachers show positive wellbeing effects while civil servants do not. This may reflect differences in work culture, schedule flexibility, or how these professions allow parents to integrate work with family life and personal interests.

The table below presents results by occupation. To estimate how each variable affects wellbeing, we use other as the baseline category for comparison.

Table 26: Group 2 – Regression Results for Occupation Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Occupation (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Private sector employee	0.22	0.25	0.17	0.16	0.28							-0.18			
Civil servant				0.25	0.31							-0.21			
Education sector	0.55	0.27	0.23	0.24	0.29										
Professional (physician, nurse, lawyer, etc.)					0.24					0.18					
Freelancer	0.30	0.28	0.16	0.31	0.38										
Part-time worker															
Full-time housewife \ househusband															
Unemployed															
Currently enrolled In school															

Gender (of Parent)

Men showed lower attachment to family (well2) than women, but higher intrinsic motivation for play (well3).

This gender pattern mirrors what we observed in Group 1b—men maintain stronger connections to playful engagement and personal interests, while women report stronger family emotional bonds. These differences likely reflect both socialization and practical realities of parenting roles.

Women may experience family attachment more intensely because they often serve as primary emotional caregivers, creating deeper involvement with family relationships—for better or worse. Men, meanwhile, may preserve more psychological space for individual interests, maintaining intrinsic motivation for activities outside the family sphere.

Neither pattern is inherently better; rather, they reveal how gender shapes the subjective experience of parenting. Women's stronger family attachment could indicate richer emotional connection or greater burden from caregiving expectations. Men's higher play motivation could reflect healthy boundary-setting or problematic disengagement from family life. The data alone cannot distinguish these interpretations.

The table below presents gender differences in regression results. To estimate how each variable affects wellbeing, we use female as the baseline category for comparison.

Table 27: Group 2 - Regression Results for Gender Variable on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Gender (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Male						-0.21	-0.09	-0.06	-0.11	-0.11	0.23	0.15	0.07		

4.1.6.Key Findings: Parenting Burden

Factors with Broad Influence

Parents with Hobbies

Across all three wellbeing indicators (subjective wellbeing, family attachment and intrinsic motivation for play), parents who have hobbies showed somewhat lower happiness levels.

This counterintuitive finding reveals a painful paradox: the very parents who value personal interests and maintain hobbies may suffer more from parenting's time constraints. Their hobbies represent what they're missing—constant reminders of the personal time that childcare consumes.

Rather than hobbies providing refuge or balance, they may heighten awareness of the gap between desired and actual lifestyle. Parents without strong hobby attachments may adapt more easily to parenting's demands, while those with passionate interests experience ongoing tension between who they were and who parenting allows them to be.

This pattern echoes our earlier finding about parents who value free time—those who most desire personal space may struggle most with its absence. The psychological burden stems not from parenting itself, but from the clash between parental responsibilities and personal identity.

Table 28: Group 2 – Relationship Between Parents' Hobby Engagement and Wellbeing Indicators: Regression Results

Variable	Subjective happiness well1					Attachment to Family well2					Intrinsic motivation for play well3				
I have a hobby which I am absorved (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
2					-0.11			-0.13	-0.10	-0.13			-0.16	-0.16	
3	-0.19	-0.13		-0.11	-0.19			-0.09	-0.10	-0.12		-0.13	-0.21	-0.25	-0.18
4	-0.44	-0.36	-0.18	-0.20	-0.20						-0.47	-0.29	-0.23	-0.17	

Parents Who Value Free Time

The relationship between valuing free time and wellbeing varied dramatically across wellbeing levels, revealing a complex and context-dependent dynamic:

- At lower subjective wellbeing levels (well1): Valuing free time may actually help improve mood. For struggling parents, maintaining the desire for personal time might preserve a sense of individual identity and hope—reminding them that life exists beyond immediate parenting demands.
- At higher subjective wellbeing (well1) and intrinsic motivation for play (well3) levels: The same desire for free time creates stress and dissatisfaction. For parents already doing well, wanting personal time conflicts sharply with childcare responsibilities, generating tension between their fulfilled state and unfulfilled desires.
- At lower attachment to family (well2) levels: Parents who seek free time showed higher wellbeing—a puzzling pattern. We might expect that valuing time away from family would correlate with weaker bonds and lower wellbeing, yet the opposite appears true at lower levels of well2.

This counterintuitive finding requires further investigation. One possibility: parents with weaker family attachment who also desire personal time may have found some equilibrium—accepting limited emotional involvement and carving out individual space.

Table 29: Group 2 – Relationship Between Parents' Emphasis on Free Time and Wellbeing Indicators: Regression Results

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Desire to secure personal time (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
2	0.22				-0.25					-0.20					-0.23
3	0.38	0.23			-0.21			-0.11		-0.31		-0.12			-0.32
4	0.30	0.21						-0.24		-0.24					-0.30

Factors with Limited Influence

Primary Caregiver

Evidence shows a positive association between a higher attachment to family (well2) when parents or family members are the primary caregiver. However, these same parents showed somewhat lower happiness in intrinsic motivation for play (well3).

This reveals a fundamental trade-off in intensive parenting: deep involvement in childcare strengthens family bonds while consuming time for self-fulfillment. Parents who invest heavily in hands-on caregiving experience rich family connections but sacrifice personal pursuits and intrinsic interests.

The table below presents results by primary caregiver type. To estimate how each variable affects wellbeing, we use single parent alone as the baseline category for comparison.

Coefficients are rounded to two decimal places, and only those statistically significant at the 5% level are shown.

Table 30: Group 2 – Regression Results for Primary Caregiver Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
People primarily involved in child-rearing (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90	0.10	0.25	0.50	0.75	0.90
Parents						0.13	0.06	0.05	0.09		0.22	0.10			
Relatives such as grandparents, siblings, etc.					-0.27			0.11							0.27
Friends or acquaintances					-0.36										
Other															

Children's Playtime

For subjective wellbeing (well1), more children's playtime is generally associated with higher parent wellbeing. The mechanism seems straightforward: when children play extensively, they develop social skills and independence,

allowing parents to feel reassured about their development and less anxious about constant supervision.

However, a striking exception emerged at lower levels of attachment to family (well2)—here, more playtime actually reduced parent wellbeing.

This paradoxical pattern likely reflects two distinct dynamics operating at different child ages:

- **Younger children:**More playtime may require more parental support and supervision. Active play demands parental involvement—facilitating activities, ensuring safety, managing conflicts with playmates. For parents already experiencing weak family bonds, these additional demands may feel burdensome rather than rewarding, further straining an already fragile connection.
- **Older children:**Extensive independent play may create emotional distance. As children become self-sufficient in their play, seeking peers over parents, some parents—especially those with weaker initial attachment—may feel increasingly peripheral to their children's lives. The very independence parents theoretically want becomes a source of loss and disconnection.

Both interpretations point to the same insight: playtime's effects on parent wellbeing depend critically on the existing quality of family relationships and the child's developmental stage.

The table below presents results by daily children's playtime. To estimate effects, we use don't know/unsure as the baseline category.

All coefficients are rounded to two decimal places, and only those statistically significant at the 5% level are shown.

Table 31: Group 2 – Regression Results for Playtime Variables on Wellbeing

Variable	Subjective wellbeing well1					Attachment to Family well2					Intrinsic motivation for play well3				
Playtime per day (category)	Percentile					Percentile					Percentile				
	0.10	0.25	0.50	0.75	0.90	0.10	0.25	###	0.75	0.90	0.10	0.25	0.50	0.75	0.90
1 hour				0.11								-0.22			
2 hours					0.18				0.15	0.13				0.11	0.13
3 hours									0.15	0.15		-0.14			
4 hours					0.16				0.25	0.15					
5 hours				0.13					0.23	0.17					
6 hours				0.17			0.23	0.19	0.32	0.26					
7 hours															
8 or more hours				0.23	0.19										0.30

4.1.7.Conclusion

How children's play styles affect parent wellbeing involves numerous interacting factors, yet clear patterns have emerged from our analysis.

Two Perspectives: Joy and Burden

The relationship between children's play and personality and parent wellbeing can be understood through two frameworks:

- The joy framework: Positive effects (strengthened bonds, emotional satisfaction)
- The burden framework: Negative effects (time and emotional demands)

Emotional Connection Brings Joy to Parents

A key finding: emotionally engaged children tend to bring joy to parents. When children openly express their feelings and thoughts, parent-child bonds deepen and parents' own emotions become more positive. This effect may also relate to children's sense of humor and other social-emotional competencies.

The Intriguing Relationship Between Outdoor Play and Parent Wellbeing

Children who enjoy physical play and interacting with other children spend more time outside. This creates opportunities for parents to form new social connections and engage in activities, ultimately benefiting parent wellbeing as well. The child's social world expands the parent's social world—a spillover effect that enriches both.

Children with Divergent Thinking May Reduce Parental Burden

Children with creative, free-thinking minds (divergent thinking) tend to entertain themselves through inventive play, requiring less parental support and potentially lightening the caregiving load. These are the children who can spend an hour absorbed in building an elaborate structure or creating an imaginary world—giving parents breathing room.

Children with Strong Emotional Expression Have Dual Effects

Conversely, children with rich emotional expression (emotional release) deepen parent-child relationships while sometimes creating parental burden. Emotionally intense household interactions can become stressful, creating friction even as they foster authenticity and connection.

The Impact of Parents' Free Time and Hobbies

Our analysis examined how much parents value free time and hobbies. Results revealed that parents who prioritize personal time tend to struggle more with work-life balance and experience somewhat lower happiness:

- Parents absorbed in hobbies may feel stressed by the challenge of balancing them with childcare
- Parents who strongly desire free time find self-fulfillment difficult under time constraints, reducing happiness

This demonstrates the importance of understanding not just childcare as joy, but also the temporal and psychological burdens parents face. Modern parenting discourse often romanticizes the role, but genuine support requires acknowledging these tensions.

Do Children's and Parents' Wellbeing Create a Feedback Loop?

A final crucial point: the possibility of reciprocal feedback—children's wellbeing affects parents' wellbeing, which in turn affects children.

For example, when children grow happily through play, this positively affects parents. Consequently, parental stress decreases, enabling better parenting, which creates a virtuous cycle. Whether this mechanism actually operates requires further detailed research, but the bidirectional influence seems plausible.

Play Connects to Parents' Happiness Too

This analysis offers several implications for companies like Takara Tomy that provide play experiences:

- Emotionally engaging play positively affects not only children but also parents
- Outdoor play and socially-oriented activities create opportunities for parents to form new connections

- Children's and parents' happiness are linked—environments where children play joyfully significantly contribute to parent wellbeing

Considering these insights, supporting children's growth through play also enhances parents' childcare satisfaction and wellbeing. When companies and society recognize these mechanisms and cultivate better play environments, this becomes key to supporting families.

The child's play is not just developmental activity—it's an investment in the entire family's quality of life.

5.Conclusion

Understanding the Complexity of Wellbeing Factors

We must first recognize that while all factors—satisfaction, community belonging, self-worth, self-motivation, family bonds, and flow state—contribute to wellbeing in some form, each exerts influence in distinctly different ways.

For example, satisfaction and self-motivation broadly affect both subjective wellbeing and intrinsic motivation for play, functioning as foundational sources of wellbeing. In contrast, family ties show more concentrated effects, primarily influencing attachment to family.

Clarifying these differences is crucial for understanding how people orient differently toward wellbeing. When examining how play affects wellbeing, this distinction becomes indispensable—we cannot assume all positive experiences contribute equally or through the same pathways.

Critical Methodological Considerations

Even identical survey questions yield results requiring different interpretations depending on respondent characteristics. Our survey encompasses three distinct groups:

- **Group 1a:**Parents reporting on their children's play styles, psychological characteristics, and current wellbeing
  Measures: parents' perceptions of their children
- **Group 1b:**Adults reporting on their own childhood psychological characteristics and current wellbeing
  Measures: how childhood experiences affect current wellbeing
- **Group 2:**Parents reporting on their children's play styles and characteristics and on their own current wellbeing
  Analyzes: how children's characteristics and play styles influence parent wellbeing

Because each group's nature differs fundamentally, results carry different meanings. Group 1a captures parental observation—filtered through adult perspectives and potentially biased by projection or limited insight. Group 1b captures retrospective self-assessment—colored by memory reconstruction and

current emotional states. Group 2 reveals bidirectional family dynamics—how children shape parents' lives.

These are not three measurements of the same phenomenon, but three windows into related yet distinct aspects of how play, childhood characteristics, and wellbeing interconnect across the lifespan and family relationships.

Overall Findings

Across our analyses, play exerts relatively strong influence on subjective wellbeing and intrinsic motivation for play, while its effects on attachment to family appear more diffuse and indirect.

This suggests that the play-wellbeing relationship connects directly with psychological dimensions and intrinsic play motivation, but less directly with family attachment. As previous research indicates, attachment to family is primarily shaped by other factors—particularly involvement of primary caregivers and time spent together—rather than by play styles per se.

Play enriches individual psychological life and sustains intrinsic interest in playful engagement, but family bonds form through different mechanisms centered on relational presence and care.

Additional Findings

Can Play Enhance Psychological Satisfaction?

Our results reveal a positive relationship between play—particularly manual play—and satisfaction. Here, satisfaction represents a particularly broad wellbeing element; all factors influencing wellbeing likely also influence satisfaction.

Manual play showed remarkably consistent positive effects across both parental observations (Group 1a, Table 16) and adults' childhood recollections (Group 1b, Table 6), regardless of wellbeing level. This provides strong evidence that manual play contributes to enhanced satisfaction. Children who engage in thoughtful, internally-focused play—building intricate structures, creating stories, puzzling through problems—develop capacities for satisfaction that endure into adulthood.

Physical play effects proved more complex. Group 1a showed positive influences, while Group 1b revealed some associations with reduced wellbeing in

certain contexts. This divergence suggests that play types affect parents and individuals differently, or that how play is perceived and remembered varies by vantage point.

Satisfaction Versus Community Belonging as Pathways

The relationship between satisfaction and wellbeing was discussed in the Community Belonging and Wellbeing section. Satisfaction demonstrates broad influence on wellbeing, further supporting strong evidence that play styles affect satisfaction.

In contrast, community belonging exerts relatively limited influence on wellbeing. Therefore, we must be cautious about claiming that play styles influence wellbeing through community belonging pathways. Establishing this relationship more clearly requires more specific, targeted analysis—perhaps examining particular play contexts (team sports, group creative activities) that directly involve community participation, or longitudinal data tracking how childhood play predicts adult social integration.

The evidence supports play → satisfaction → wellbeing as a robust pathway. The play → community belonging → wellbeing pathway remains plausible but unproven.

Does Play Increase Family Involvement and Community Connections?

Our analysis revealed a strong relationship between play and sense of community belonging—one that transcends mere correlation. Community belonging connects deeply with subjective wellbeing; factors influencing subjective wellbeing likely also indirectly affect community consciousness. This relationship holds across both Groups 1a and 1b.

Moreover, social characteristics such as motor-social competence and cooperativeness also relate to wellbeing, suggesting that play may influence how people build connections and engage socially. The mechanism appears to work through multiple channels: play develops social skills, creates opportunities for interaction, and fosters the confidence needed to participate in community life.

These findings suggest that play can serve as a vehicle for expanding both parents' and children's social connections. When children play—particularly in social contexts like playgrounds, sports, or group activities—they create natural

opportunities for parents to meet other families, form friendships, and integrate into community networks. The child's play world becomes a gateway to the parent's social world.

Similarly, children who develop strong play-based social skills carry these capacities into broader community participation, building connections that enhance their sense of belonging and, ultimately, their wellbeing.

The evidence supporting this conclusion was discussed in the Community Belonging and Wellbeing section, where we examined how these factors interrelate through the VSS analysis framework.

Does Play Enhance Emotional Regulation Abilities?

This question yielded complex results requiring more cautious interpretation than other findings. While this survey was originally designed to measure children's emotional control abilities, what actually emerged was a structure suggesting play influences wellbeing, which in turn affects emotional regulation.

The directionality appears reversed from our initial assumption—rather than play directly building emotional regulation skills, play may enhance wellbeing, and higher wellbeing then supports better emotional regulation. This indirect pathway makes causal claims more difficult and requires acknowledging multiple mediating processes.

Limited but Intriguing Findings

Evidence remains circumscribed, with effects appearing only for specific wellbeing indicators:

- **Toy Availability:**Toy availability showed positive relationships with wellbeing, particularly with intrinsic motivation for play. Having access to diverse play materials may sustain children's engagement and autonomy in play, fostering the intrinsic interest that contributes to wellbeing. (See Table 5: Group 1b VSS Variables, Table 15: Group 1a VSS Variables)
- **Playtime:**Children playing approximately 6 hours daily showed higher wellbeing compared to others. This sweet spot suggests that substantial but not excessive playtime optimizes wellbeing—enough to develop skills and relationships, but not so much as to indicate

problematic avoidance of other activities or lack of structure. (See Table 6: Group 1b Playtime Variables, Table 16: Group 1a Playtime Variables)

- **Play under age 3:**Play styles during this early period showed weak associations with wellbeing, with no clear patterns. However, at higher levels of attachment to family, slight positive associations emerged. This may reflect that very early play matters most for children in families with strong emotional bonds, where parents actively engage with infant play and use it to strengthen relationships—effects invisible in less attached families.

Reconsidering What Was Measured: Emotional Control or Emotional Expressiveness?

The positive association we observed between emotional release ability and wellbeing likely reflects children's capacity to express emotions—emotional expressiveness—rather than the originally intended construct of emotional control ability.

In children under age 10, emotional control and emotional expression are difficult to distinguish clearly, a challenge widely recognized in psychological research (e.g., Kennedy-Moore 2001). Young children who freely express emotions may appear emotionally uncontrolled to adults, yet this openness can be psychologically healthy—indicating comfort with their feelings and trust in their environment.

Conversely, what appears as good control in young children sometimes reflects emotional suppression or insecurity rather than genuine regulation skills. A quiet, compliant child may be highly controlled or deeply inhibited—and our measures cannot reliably differentiate these patterns.

After carefully examining the survey items most strongly associated with emotional expressiveness in VSS analysis (Q9.21, Q9.22, Q9.23), we concluded these questions measure how children express negative emotions rather than how well they control them. These three questions are presented below:

Figure 4: Survey Questions Related to Emotional Release Ability

Q9.21: The children (or the respondent) often throws (threw) tantrums	**Q9.22:** The children (or the respondent) often gets (got)into fights with other children	**Q9.23:** The children (or the respondent) often become irritable, depressed or burst into tears

As Kennedy-Moore (2001) notes, neither excessive suppression nor excessive expression of emotions is ideal for psychological health. Our survey lacked sufficient items to properly measure emotional control itself, so the analysis predominantly captured expressive dimensions instead. This is why we use the term emotional release ability rather than emotional control.

Our analysis also suggests that both over-suppressing emotions and over-expressing them may negatively affect wellbeing for both children and parents. Because the survey included few questions about emotional difficulties or self-restraint, we cannot draw definitive conclusions about emotional control per se.

However, we did find positive relationships between emotional release ability and wellbeing, particularly noteworthy: characteristics deeply tied to emotional expression—playful humor and emotional involvement—broadly and positively influence parent wellbeing. These findings empirically support the hypothesis that play facilitates children's emotional expression.

Possibilities for Future Analysis

Wellbeing Profiling and Clustering

Our analysis revealed that while some factors like satisfaction and self-motivation broadly influence wellbeing, others like family bonds and flow states exert more specialized, targeted effects on specific wellbeing indicators.

Given that children possess diverse preferences and tendencies, clustering (classification) based on the three wellbeing indicators could yield distinct profiles. Analyzing how these profiles relate to play styles would deepen our understanding of the complex play-wellbeing relationship.

Key research questions:

- Can we identify distinct wellbeing personality types and their corresponding play tendencies?

- Within specific wellbeing preference profiles, which play types (introspective play, physical play, digital play) show strongest associations?
- How do these profiles vary across age groups and family structures?

Understanding these patterns could enable personalized recommendations—matching play experiences to children's wellbeing profiles rather than applying one-size-fits-all approaches.

Understanding Differences by Wellbeing Level

Our analysis revealed that play styles and psychological characteristics may affect wellbeing differently depending on baseline wellbeing levels. For instance, respondents at lower wellbeing levels (25th percentile) may improve through different factors than those at higher levels.

Key research questions:

- Does wellbeing level relate systematically to play styles? Are certain play types particularly strongly associated with specific wellbeing segments?
- What interventions prove most effective for children with low versus high wellbeing?
- Do factors that enhance wellbeing differ depending on baseline wellbeing level?

These questions address a fundamental challenge in wellbeing research: distinguishing what helps people thrive from what helps people recover. The pathways may differ substantially.

Practical Applications

Answers to these questions would enable designing precise, effective interventions tailored to specific children's characteristics and wellbeing states, along with individually optimized play recommendations. This represents highly practical guidance for product development and support programs.

Rather than generic advice that play is good for children, we could offer nuanced recommendations: For children exhibiting X wellbeing profile, Y types of play appear most beneficial, while children with Z profile benefit more from different

activities. This precision transforms research findings into actionable insights that genuinely serve diverse children's needs.

6.Part 2:Play Styles and Psychological Characteristics

6.1.Purpose of the Analysis

This section examines the relationship between children's play styles and their psychological characteristics—both cognitive and emotional traits.

For clarity, we've organized the presentation as follows: first, we present overall findings to give you the big picture; next, we dive into detailed results; and finally, we explain how these results were derived.

6.2.Key Findings

Manual play (solitary reflective activities and creative projects) and physical play (running, jumping, and active group activities) both show important associations with children's psychological characteristics, though they work through distinct pathways.

- **Manual play** fosters emotional development, helping children express feelings and understand emotions—both their own and others'. Through activities like drawing, building, or imaginative solo play, children develop the interior emotional landscape that supports psychological wellbeing.
- **Physical play**, in contrast, cultivates social competence (ability to interact with others), physical capabilities, and cooperativeness (skill at collaborating successfully). Active play with peers creates natural laboratories for navigating social dynamics, negotiating conflicts, and coordinating actions.

Importantly, these two play types do not exist in a trade-off relationship where choosing one sacrifices the other. Rather, incorporating both in balanced measure enriches children's multifaceted development more fully than emphasizing either alone.

The implication is clear: optimal development requires diverse play experiences. A child who only engages in quiet, solitary creative activities may develop rich emotional awareness but limited social skills. Conversely, a child who

only participates in active group play may build strong peer relationships but miss opportunities for the introspection and self-expression that manual play provides. Balance matters.

6.3.Detailed Results

Now we'll examine the overall patterns described above in greater depth. These findings appear consistently across both Group 1b and Group 1a (our survey population segments).

Manual Play and Emotional Involvement/Playful Humor

Manual play—solitary reflective activities where children think deeply or engage with their own feelings—influenced how emotionally engaged children become (emotional involvement).

Unlike vigorous physical activities, manual play involves quiet contemplation and immersion in interior worlds. This inward-facing quality promotes not merely experiencing emotions, but thoughtfully processing and understanding them—a metacognitive dimension that deepens emotional engagement.

Research by Vrolijk (2021) and Thomsen (2023) supports this pattern, showing that children who spend substantial time in manual play activities demonstrate higher emotional recognition—the ability to perceive and understand both their own and others' feelings. However, studies directly examining the relationship between emotional recognition and emotional involvement remain scarce, making our findings a potentially valuable new clue for exploring this connection.

Furthermore, as discussed in Section 4.1.4, strong humor correlates with high social competence. Therefore, our finding that manual play also influences humor suggests that such activities not only cultivate children's interior emotional worlds but also play important roles in social skill development through this process.

The pathway appears to work as follows: manual play → enhanced emotional processing and self-awareness → greater capacity for humor and social nuance → stronger social competence. What begins as solitary, reflective activity ultimately supports sophisticated social engagement—demonstrating how interior development

and social development intertwine rather than competing for children's time and attention.

Physical Play and Social Development

As expected, physical play is strongly associated with children's social competence, physical capabilities, playful humor, and cooperativeness. These findings confirm that active, movement-based play plays a crucial role in developing children's ability to engage with others.

The mechanism is straightforward: physical play, especially with peers, creates constant social challenges—taking turns, negotiating rules, reading others' intentions, managing conflicts, celebrating victories, handling defeats. These experiences build social and emotional competencies that transfer far beyond the playground.

Environmental Facilitators (How Surroundings Influence Play)

- **Impact of toys:**
  Toy availability directly enhanced children's emotional expressiveness and manual play engagement. Through toys, children express more feelings and engage more readily in self-reflective play activities. Toys serve as tools for emotional exploration—dolls become vehicles for working through social scenarios, building blocks enable expressing spatial ideas, art materials allow externalizing interior visions.
- **Impact of time with parents:** Time spent with caregivers positively influenced children's manual play. This reveals an important truth: children's play stems not solely from individual preferences or characteristics, but is actively supported through relationships with surrounding adults. Parents who engage attentively with children's creative activities validate and encourage this form of play.
  Conversely, parental time showed negative associations with digital play, suggesting a potential trade-off relationship—when children spend time with parents, they engage less with screens.
  However, this relationship requires cautious interpretation. Our study did not capture how time with parents was spent. Parents and children

might very well engage in digital activities together—playing video games or watching videos. Therefore, parental time doesn't necessarily reduce digital play; rather, the nature of parent-child interaction matters more than quantity alone.

Future research distinguishing co-play from parallel presence, and digital engagement from screen time, would clarify these dynamics.

Digital Play Results (Group 1b Only)

Children who engage extensively in digital play showed lower motor-social competence (ability to interact through physical activities) but higher cooperativeness (ability to get along with others harmoniously).

This nuanced pattern suggests that digital play doesn't simply reduce sociability, but rather transforms how and in what ways children interact with others. The finding makes intuitive sense: digital play occurs in sedentary contexts with limited physical interaction, naturally providing fewer opportunities to develop the motor-social skills honed through running, climbing, and physically coordinated group activities. Yet these same children show elevated cooperativeness—suggesting they may be developing social skills through different channels.

6.4.How Results Were Derived

This section explains the analytical methods used to produce the findings presented above.

Methodological Shift: From Quantile Regression to DirectLiNGAM

In Part 1, we employed quantile regression—a technique that reveals relationships between variables at specific levels while accounting for variation across the entire data distribution.

However, our current analytical target involves complex causal structures: play styles influence psychological characteristics, which in turn influence wellbeing (mental health and happiness). Single regression equations cannot adequately capture this multifaceted reality, requiring methods capable of estimating causal relationships more directly.

Adopting DirectLiNGAM

We therefore employed DirectLiNGAM (Direct Linear Non-Gaussian Acyclic Model)—a causal inference framework that intuitively answers: Which variables causally influence which other variables? by extracting this structure from data patterns.

This model enables us to clarify the causal architecture connecting play styles, psychological characteristics, and wellbeing variables.

DirectLiNGAM Coefficients vs. Regression Coefficients

Coefficients from DirectLiNGAM resemble those from Part 1's regression analysis but carry fundamentally different meanings.

Regression coefficients indicate association: Holding other conditions constant, when variable X changes by one unit, outcome Y changes by this amount. They describe correlational patterns without claiming directionality.

DirectLiNGAM coefficients estimate causation: If we intervene to change variable X by one unit, other variables will causally change by these amounts. They describe what happens when we actively manipulate variables.

For example, if physical play has a coefficient of 0.3, this means: An intervention increasing physical play by one unit would causally raise wellbeing by 0.3 units—including indirect effects where physical play influences wellbeing through psychological characteristics as mediators.

This captures the entire causal cascade, not just direct effects. When physical play enhances motor-social competence, which in turn boosts wellbeing, DirectLiNGAM's coefficient reflects the complete pathway.

Important interpretive note: Both Part 1 and Part 2 models use normalized variables, making coefficient magnitudes numerically comparable. However, their conceptual meanings differ—regression coefficients describe patterns observed in data, while DirectLiNGAM coefficients describe predicted effects of interventions. This distinction matters critically for practical applications.

Consistency Across Analytical Parts

To maintain structural consistency between Parts 1 and 2, we estimated DirectLiNGAM models using only the VSS factors extracted in Part 1 for both analyses. This ensures that different methodological approaches are applied to the same underlying construct space, facilitating meaningful comparison of insights across analytical sections.

Key Assumptions and Limitations

DirectLiNGAM relies on several prerequisite assumptions, the most critical being no hidden confounders.

Confounders are factors that genuinely influence the variables we're analyzing but aren't included in our model. For instance, if some unmeasured psychological characteristic affects both play style and cognitive ability, this influence becomes invisible within the model—creating spurious apparent relationships or masking true ones.

This assumption is stringent, and in practice, measuring every possible factor proves impossible. We addressed this challenge by narrowing our analysis to 15 key variables: three wellbeing indicators, four play styles, and other psychological characteristics. This focused scope reduces—though cannot eliminate—the risk of hidden confounders distorting results.

Despite this limitation, our analysis revealed meaningful relationships among play styles, psychological characteristics, and wellbeing, while also identifying noteworthy patterns deserving further investigation. The consistency of findings across different analytical approaches (Part 1's quantile regression and Part 2's DirectLiNGAM) strengthens confidence that observed patterns reflect genuine phenomena rather than methodological artifacts.

Model Framework

DirectLiNGAM allows imposing rules (constraints) about which variables can influence which others. These constraints encode common-sense principles—for example, the future cannot influence the past or outcomes cannot cause their own predictors.

In our context, we structured the model recognizing temporal and logical precedence: childhood play styles precede psychological characteristic development, which in turn precedes current wellbeing states. While all these relationships may involve bidirectional influences over time (wellbeing affects future play choices, for instance), our cross-sectional data captures a snapshot where directional constraints help identify the most plausible causal structure.

These constraints prevent the model from proposing nonsensical relationships (like current wellbeing causing childhood play patterns) while allowing it to discover the network of influences among contemporaneous variables.

Temporal Constraints

Temporal constraints are rules enforcing causality along time's arrow—ensuring our model respects the fundamental principle that causes precede effects.

For example:

- How a child played before age 3 can influence later introspective play patterns
- But play styles in elementary school cannot influence what happened before age 3

Only past → future flows are permitted.

Constraints for Group 1b

For adults reflecting on their own childhoods, we imposed these constraints:

- Play under age 3 receives no influences from other variables because it represents historical memory—already fixed in the past, immune to present circumstances.
- Play styles, children's knowledge and emotions, and lifestyle patterns cannot be influenced by current wellbeing because these all derive from childhood memories. Current wellbeing might color how adults remember or interpret childhood experiences, but within our analytical framework, we treat childhood characteristics as antecedent factors that shaped present wellbeing, not consequences of it.

This assumption has limitations—memory is reconstructive, and current psychological states do influence recall. However, allowing bidirectional influences would make causal identification impossible with cross-sectional data.

Constraints for Group 1a

For Group 1a (parental reports), the analytical context differs because parents are observing their children now, not recalling distant history.

We imposed only one temporal constraint: Play under age 3 cannot be influenced by other variables. This reflects that this early period is definitively past, while current observations of play styles, psychological characteristics, and wellbeing all reflect the child's present state.

The more permissive structure for Group 1a acknowledges that parents' assessments occur in real time, where current wellbeing might genuinely influence play choices, and play experiences might immediately affect psychological states—creating contemporary mutual influences that our model can potentially disentangle from the directional patterns in the data.

Causal Networks and Visualization

DirectLiNGAM's most powerful output is a coefficient matrix revealing causal relationships among our 15 key variables—quantifying who influences whom, and by how much.

To make these complex relationships accessible, we created network diagrams (visual maps of causality):

- **Blue lines**: Positive influences (one factor enhances another)
- **Red lines:** Negative influences (one factor reduces another)
- **Line thickness:** Magnitude of influence

These network diagrams provided the foundation for the Key Findings presented earlier, allowing us to trace causal pathways visually before examining numerical details.

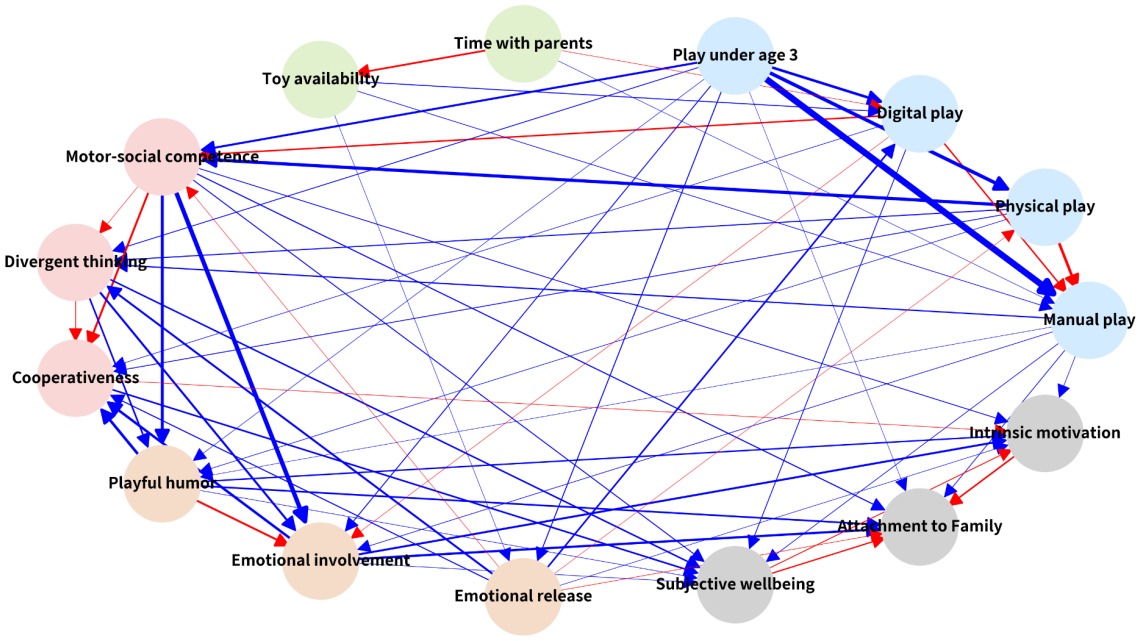
Alongside the network diagrams, we present DirectLiNGAM coefficient matrices. These matrices contain identical information to the network graphs but display precise numerical values rather than visual representations.

Reading DirectLiNGAM Coefficient Matrices

Understanding how rows and columns work is essential for interpretation:

- **Reading by row (left to right):**Each value represents how the row variable (left side) influences the column variable (bottom). For example, scanning across the manual play row shows how manual play causally affects each variable listed in the columns.
- **Reading by column (top to bottom):**Each value represents how the column variable (bottom) receives influence from the row variable (left side). For example, examining the subjective wellbeing column shows how wellbeing is causally affected by each variable listed in the rows.

Figure 5: DirectLiNGAM Results for Group 1b



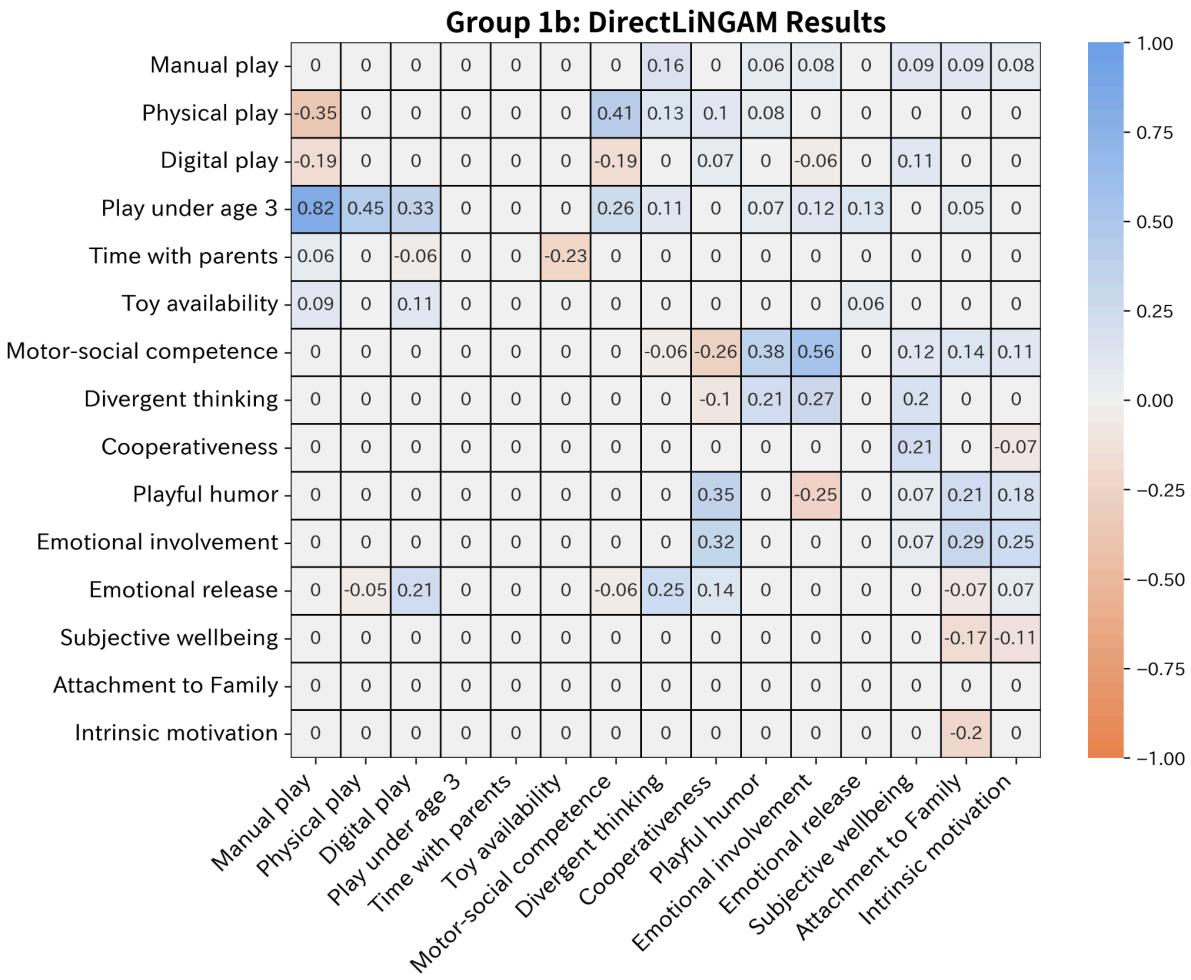
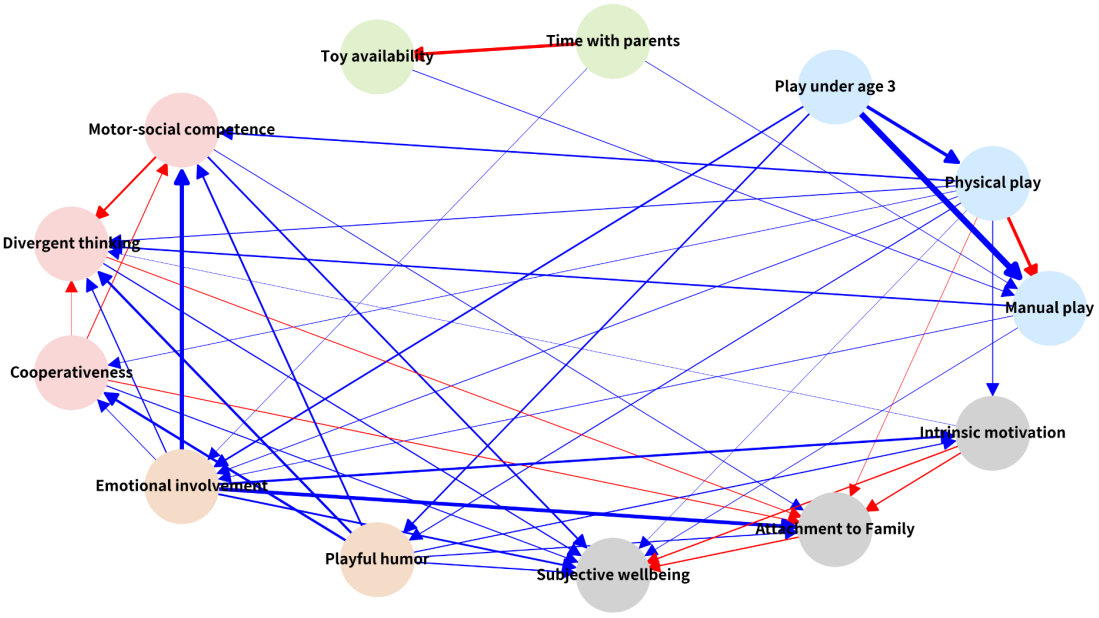
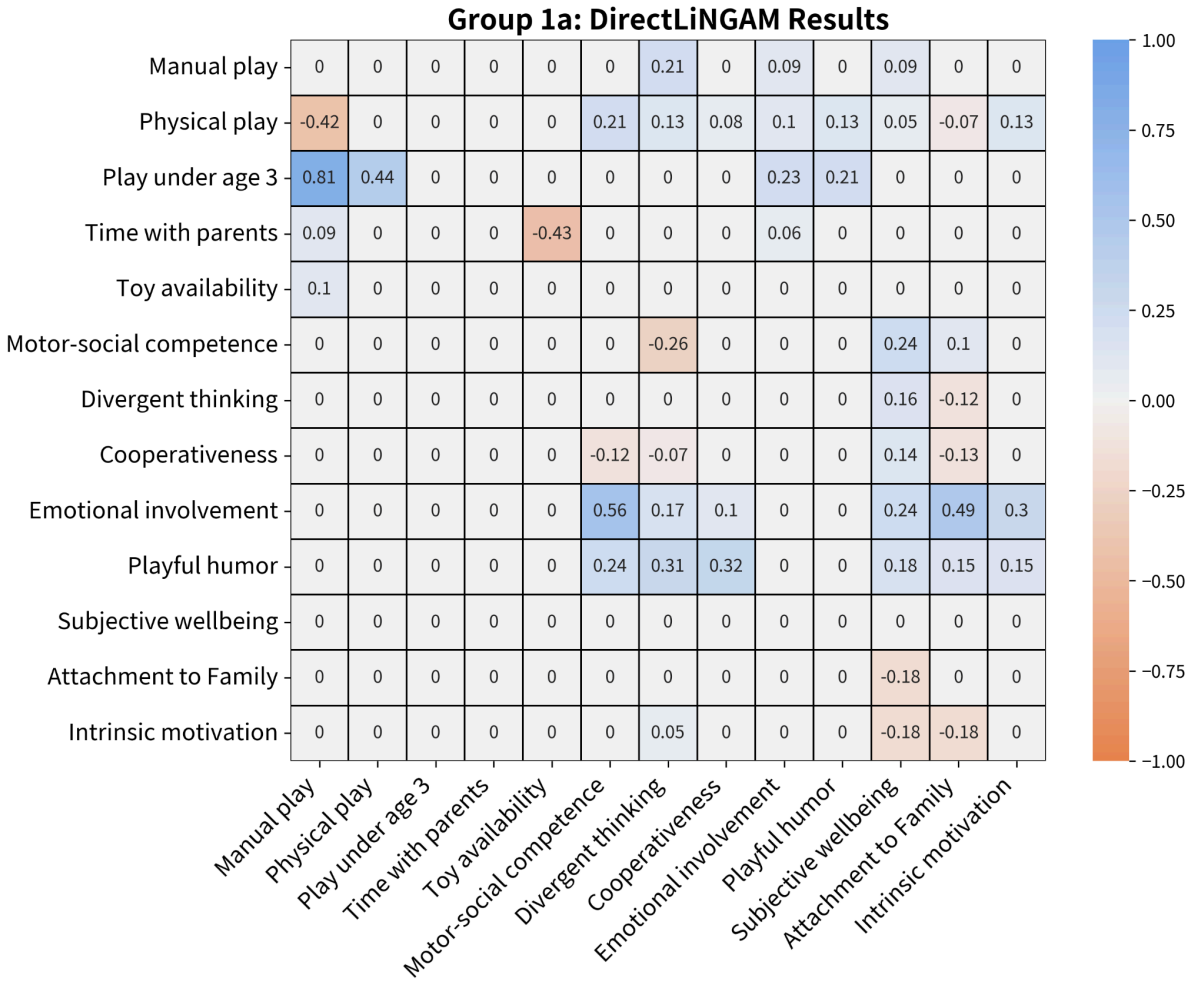

Group 1b: DirectLiNGAM Results
Manual play 0 0 0 0 0 0 0 0.16 0 0.06 0.08 0 0.09 0.09 0.08
Physical play -0.35 0 0 0 0 0 0.41 0.13 0.1 0.08 0 0 0 0 0
Digital play -0.19 0 0 0 0 0 -0.19 0 0.07 0 -0.06 0 0.11 0 0
Play under age 3 0.82 0.45 0.33 0 0 0 0.26 0.11 0 0.07 0.12 0.13 0 0.05 0
Time with parents 0.06 0 -0.06 0 0 -0.23 0 0 0 0 0 0 0 0 0
Toy availability 0.09 0 0.11 0 0 0 0 0 0 0 0 0.06 0 0 0
Motor-social competence 0 0 0 0 0 0 0 -0.06 -0.26 0.38 0.56 0 0.12 0.14 0.11
Divergent thinking 0 0 0 0 0 0 0 0 -0.1 0.21 0.27 0 0.2 0 0
Cooperativeness 0 0 0 0 0 0 0 0 0 0 0 0 0.21 0 -0.07
Playful humor 0 0 0 0 0 0 0 0 0.35 0 -0.25 0 0.07 0.21 0.18
Emotional involvement 0 0 0 0 0 0 0 0 0.32 0 0 0 0.07 0.29 0.25
Emotional release 0 -0.05 0.21 0 0 0 -0.06 0.25 0.14 0 0 0 0 -0.07 0.07
Subjective wellbeing 0 0 0 0 0 0 0 0 0 0 0 0 0 -0.17 -0.11
Attachment to Family 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Intrinsic motivation 0 0 0 0 0 0 0 0 0 0 0 0 0 -0.2 0
Manual play
Physical play
Digital play
Play under age 3
Time with parents
Toy availability
Motor-social competence
Divergent thinking
Cooperativeness
Playful humor
Emotional involvement
Emotional release
Subjective wellbeing
Attachment to Family
Intrinsic motivation
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00

Figure 6: DirectLiNGAM Results for Group 1a





Column:Climate Change and Child Development

This section examines how climate change—particularly global warming—may affect children's play and development, building on the analytical findings presented throughout this report.

As we've demonstrated, both physical play and manual play (quiet, self-reflective activities) are essential for children's development, though they serve distinct roles. Neither play type alone suffices for healthy development—children need both.

From this perspective, we gain crucial insight into how climate change—especially rising global temperatures—may impact children's developmental trajectories.

The Challenge of Rising Temperature

According to Japan Meteorological Agency data, summer 2024 (June-August) was 1.76°C warmer than the 30-year average. This means significantly increased health risks—particularly heat stroke—when children play outdoors.

A critical question emerges: **In this extreme heat, where and how can children engage in physical play?**

Summer traditionally coincides with extended school breaks—the season when children play freely outdoors and socialize extensively with peers. However, when rising temperatures restrict opportunities for safe outdoor play, they may impede the social and emotional development that naturally occurs during this period.

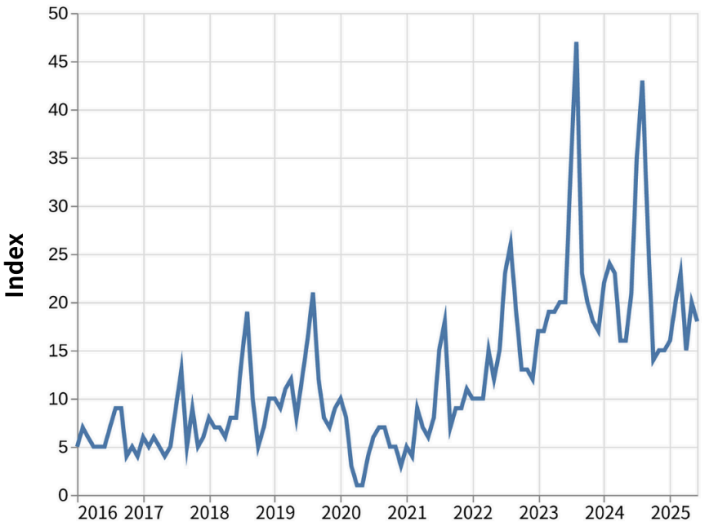
Our analysis demonstrated that physical play critically develops children's social and emotional capacities. This means global warming poses genuine developmental risks—not merely discomfort, but potential disruption to fundamental growth processes.

Market Response: The Indoor Play Revolution

Interest in indoor play spaces has surged as families seek safe play environments despite extreme heat. Google Trends data reveals a striking pattern: searches for indoor playground children (室内 遊び場 子供, as the search term was

made in Japanese) increased approximately fivefold from summer 2016 to summer 2024.

Figure 7: Google Trends for indoor playground children



Note: The data is related to the search term in Japanese (室内 遊び場 子供)

The Expansion of Indoor Play Facilities

Indeed, shopping malls nationwide are increasingly incorporating indoor playgrounds. These developments represent a societal adaptation to outdoor play becoming increasingly difficult due to extreme heat—indoor play environments are normalizing as safety alternatives.

Equity and Access Concerns

However, indoor playgrounds do not constitute a universal solution. Most facilities charge admission fees and require time investments that strain families already struggling economically or temporally. Consequently, children from financially constrained households may experience reduced physical play opportunities.

In other words, if only affluent families can access safe play environments, we risk creating developmental inequality—where children's healthy growth depends on their parents' economic resources rather than being universally available.

Climate change thereby transforms from an environmental issue into a social justice issue, exacerbating existing disparities through a new mechanism.

Implications for Society

These changes present both risks and opportunities. What matters societally is ensuring all children can equally access the play experiences essential for development—regardless of family income or circumstance.

Our analysis illuminates emerging connections between global warming and child development challenges. This relationship represents a critical theme demanding serious consideration in future policy-making and urban planning.

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