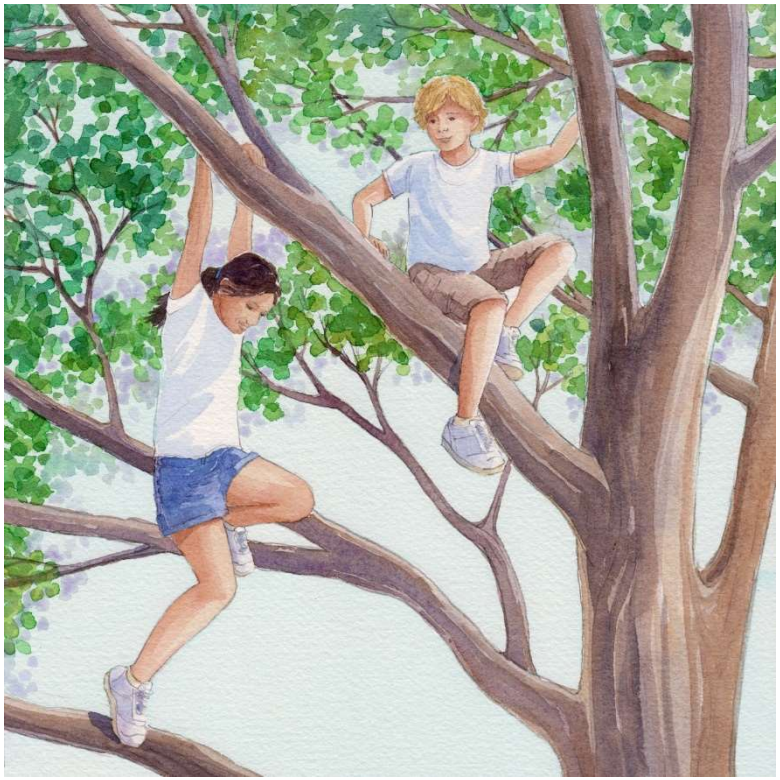
PLAYTrack Research Project:

Using visual Q-methodology to explore children's perceptions of outdoor play environments

February 25, 2019
Christine Hempel

AARHUS UNIVERSITET

The LEGO Foundation



Key Findings

Suitability of Method

- Visual Q-methodology is highly suited to play research
- Promising method for exploring cultural differences
- Suitable for wide age range of participants
- Q-Method technique is efficient and provides robust data

Understandings of Children's Perceptions of Play

- Results suggest gender differences in play preferences
- Children with different cultural backgrounds differ in play preferences
- Older children are more likely to dislike activities if they have experienced incompetence
- Play environment is highly important for some groups of children (*where*), while the activity (*what*) is most important for others
- "Contemplative play" may represent a 6th play type

Research Problem

"Little is known about how environmental influences interact with individual perceptions; in the past decades few studies have been conducted that examine person-environment fit or congruence for young people"

(Horelli 2007)

Purpose

To develop a technique that allows children to express their knowledge and preferences about outdoor play activities and environments

Method: Visual Q-methodology

Step by Step Process

- Semi-structured approach to theory using key models (Addams 2000)
- Five play types (Whitebread and Neale et al., 2007)
- Skill Development in play (Zosh et al., 2017)
- Spatial types and environmental perception models (Meinig 1979, Kaplan and Kaplan 1989, Appleton 1975, Kellert and Wilson 1993)

Play types

Physical play
Play with objects
Symbolic play
Pretend play
Games with rules
Contemplation

Skill Development

Emotional skills
Cognitive skills
Physical skills
Social skills
Creative skills

Environmental Types

Urban Amenities
Natural Amenities
Biophilia – love of living organisms
Information Processing
Prospect-refuge
Restorative environments
Fascination

Step 1: Review of Opinion Domain

- Sentiments expressed in books, movies, public art, advertisements
- Field observations

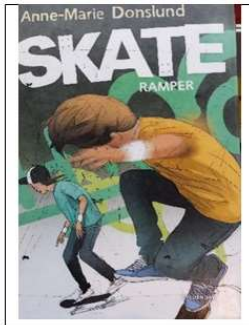
Development of Concourse

- images are collected into a catalogue with sources noted
- Catalogue is subdivided by themes and keywords

H.C. Andersen, The Snow Queen (Snedronningen). Ill. by Svend Otto S.
Keywords: ***high speed movement, biophilia (animals), sublime, natural open landscape, winter***

Kelly Hart: http://www.skateboardstory.com/interviews/kelly-hart/
- *Skateboarding, flying, climbing*
- *High speed, high risk*
- *Urban landscape*

The Lords of Dogtown
- *High speed, high risk*
- *Driving, motorcycle*
- *Urban landscape*



- *Skateboarding,*
- *High speed, high risk*
- *jumping*
- *Urban landscape*

The Lords of Dogtown
- *Skateboarding, flying, High speed, high risk, jumping*
- *Urban landscape*

Bart Simpson – "professional skater"
- *Skateboarding, high speed, high risk, jumping*
- *Urban landscape*

Rise of the Guardians
- *Sledding, flying, fantasy*
- *High speed, high risk*
- *Small town landscape*
- *winter*

The Secret Life of Walter Mitty
- *Skateboarding, high speed, high risk*
- *Open landscape, natural landscape with road*

Julian Neel
Lou! Laser-Ninja
- *Skiing*
- *Winter*
- *High speed*
- *High risk*

Soren & Morten Ellemose
- *Fantasy (flying)*
- *High speed*
- *High risk*
- *skateboarding*

Harry Potter and the Chamber of Secrets
- *Games with rules*
- *High speed, high risk,*
- *Flying*
- *Open sports field landscape*

- *Fantasy (flying)*
- *High speed*
- *High risk*
- *Driving a car*
- *Urban (road) setting*

- *High speed*
- *High risk*
- *Riding an animal (wild)*
- *Biophilia (animals)*
- *Sublime landscape, natural open landscape*

Movement: High Speed, high risk

Development of Concourse

Sub-category:
Physical Play-Movement:

- high speed
- high risk

Step 2: Creation of Q-Set

Play types	Skill Development	Environmental types
Physical play • High risk (flying) • High speed – vehicles • High speed – running • Low speed (hiking/walking) • climbing • Rough play • Throwing • Swimming • jumping Play with objects • Play with weapons • Construction tools • Trading cards • Musical instruments • Art objects • Fishing rods • Play with pets • Flying kits • Play equipment - swings Symbolic play • Drawing/painting • Music performance • Music (alone) • Story-telling • Dramatic performance • dance Pretend play • domestic tasks (cooking) • shopping (market) • hunting/fishing • Nurturing plants/animals • Nurturing people (friendship/partnering) • Fighting/war • Detective play Games with rules Physical games (soccer, baseball, basketball Board games Solo puzzles (rubic's cube) Solo physical games (hopscotch) Trading games Contemplation Star gazing Immersion in nature Groups (campfires) Wonder exploration	Emotional skills • Empathy • Attention • Bravery • Patience Cognitive skills • Puzzles/games • Physical games/strategy • Reading • Investigation • Exploration (urban) • Exploration (natural) • Trading • Music (listening, playing) • Watching people Physical skills • Balance • strength • Speed • Fighting skills • Fine motor skills (artwork) • Musical skills • Stillness • Co-ordination Social skills • Friendship/loyalty • Dancing • Group building projects • Games with rules • sportsmanship Creative skills • Street art • Music performance • Costumes/drama • Imagination/fantasy • Tinkering (small scale) • Building (larger scale) • collecting Contemplative skills • Alone in nature • isolation • wonder with others • meditation	Urban • City roads/highways • View over city • Bustle/business Tame • Country roads/paths • Park-like environments Natural • View over nature • Forests (dangerous) • Forests (benign) • seascapes Sublime • Urban (night scenes) • Weather/atmosphere • Wild forests • Wild animals • storms Biophilia • Love/care of plants • Immersion in forest/trees • Bonds with tame animals • Bonds with wild animals Affordances • Water • Food (found in nature) • Food (urban market) • Shelter from elements Enclosed (shelter) • Built spaces (forts) • Natural enclosures • Urban rooms Open (prospect) • View from above (flying • Open meadow • View from hill/cliff • View of road Wayfinding • Roads and paths (forests) • City roads Complexity/mystery • Natural (tangled garden) • Urban complexity • Investigation • fascination Comprehension/Legibility • Open field • Open roadways • paths

Saturation of concourse:

- 340 images (including duplicates)
- No new themes emerging
- Analysis of concourse
- Creation of Balanced Block Matrix (Addams 2000)

Step 2: Creation of Q-Set

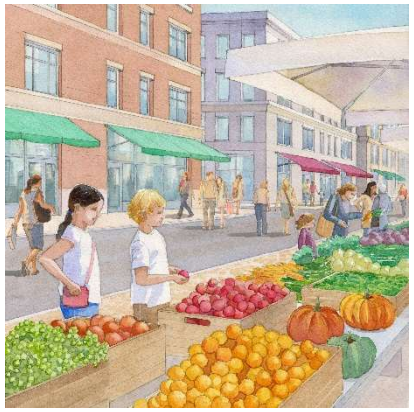
Play types	Skill Development	Environmental types
Physical play • High risk (flying) • High speed – vehicles • High speed – running • Low speed (hiking/walking) • climbing • Rough play • Throwing • Swimming • jumping Play with objects • Play with weapons • Construction tools • Trading cards • Musical instruments • Art objects • Fishing rods • Play with pets • Flying kits • Play equipment - swings Symbolic play • Drawing/painting • Music performance • Music (alone) • Story-telling • Dramatic performance • dance Pretend play • domestic tasks (cooking) • shopping (market) • hunting/fishing • Nurturing plants/animals • Nurturing people (friendship/partnering) • Fighting/war • Detective play Games with rules Physical games (soccer, baseball, basketball Board games Solo puzzles (rubic's cube) Solo physical games (hopscotch) Trading games Contemplation Star gazing Immersion in nature Groups (campfires) Wonder exploration	Emotional skills • Empathy • Attention • Bravery • Patience Cognitive skills • Puzzles/games • Physical games/strategy • Reading • Investigation • Exploration (urban) • Exploration (natural) • Trading • Music (listening, playing) • Watching people Physical skills • Balance • strength • Speed • Fighting skills • Fine motor skills (artwork) • Musical skills • Stillness • Co-ordination Social skills • Friendship/loyalty • Dancing • Group building projects • Games with rules • sportsmanship Creative skills • Street art • Music performance • Costumes/drama • Imagination/fantasy • Tinkering (small scale) • Building (larger scale) • collecting Contemplative skills • Alone in nature • isolation • wonder with others • meditation	Urban • City roads/highways • View over city • Bustle/business Tame • Country roads/paths • Park-like environments Natural • View over nature • Forests (dangerous) • Forests (benign) • seascapes Sublime • Urban (night scenes) • Weather/atmosphere • Wild forests • Wild animals • storms Biophilia • Love/care of plants • Immersion in forest/trees • Bonds with tame animals • Bonds with wild animals Affordances • Water • Food (found in nature) • Food (urban market) • Shelter from elements Enclosed (shelter) • Built spaces (forts) • Natural enclosures • Urban rooms Open (prospect) • View from above (flying • Open meadow • View from hill/cliff • View of road Wayfinding • Roads and paths (forests) • City roads Complexity/mystery • Natural (tangled garden) • Urban complexity • Investigation • fascination Comprehension/Legibility • Open field • Open roadways • paths

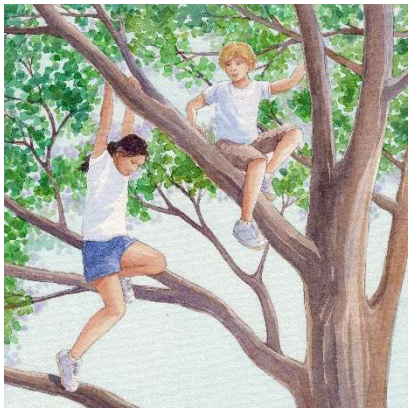
Items in Q-set: "Carpet Tiles" (Watts and Stenner, 2012) to represent the opinion domain

Step 2: Creation of Q-Set

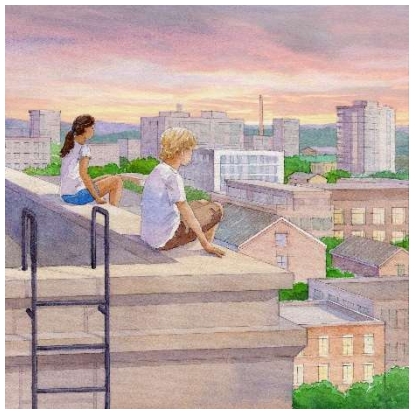
Play types	Skill Development	Environmental types
Physical play • High risk (flying) • High speed – vehicles • High speed – running • Low speed (hiking/walking) • climbing • Rough play • Throwing • Swimming • jumping Play with objects • Play with weapons • Construction tools • Trading cards • Musical instruments • Art objects • Fishing rods • Play with pets • Flying kits • Play equipment - swings Symbolic play • Drawing/painting • Music performance • Music (alone) • Story-telling • Dramatic performance • dance Pretend play • domestic tasks (cooking) • shopping (market) • hunting/fishing • Nurturing plants/animals • Nurturing people (friendship/partnering) • Fighting/war • Detective play Games with rules • Physical games (soccer, baseball, basketball • Board games • Solo puzzles (rubic's cube) • Solo physical games (hopscotch) • Trading games Contemplation • Star gazing • Immersion in nature • Groups (campfires) • Wonder • exploration •	Emotional skills • Empathy • Attention • Bravery • Patience Cognitive skills • Puzzles/games • Physical games/strategy • Reading • Investigation • Exploration (urban) • Exploration (natural) • Trading • Music (listening, playing) • Watching people Physical skills • Balance • strength • Speed • Fighting skills • Fine motor skills (artwork) • Musical skills • Stillness • Co-ordination Social skills • Friendship/loyalty • Dancing • Group building projects • Games with rules • sportsmanship Creative skills • Street art • Music performance • Costumes/drama • Imagination/fantasy • Tinkering (small scale) • Building (larger scale) • collecting Contemplative skills • Alone in nature • isolation • wonder with others • meditation	Urban • City roads/highways • View over city • Bustle/business Tame • Country roads/paths • Park-like environments Natural • View over nature • Forests (dangerous) • Forests (benign) • seascapes Sublime • Urban (night scenes) • Weather/atmosphere • Wild forests • Wild animals • storms Biophilia • Love/care of plants • Immersion in forest/trees • Bonds with tame animals • Bonds with wild animals Affordances • Water • Food (found in nature) • Food (urban market) • Shelter from elements Enclosed (shelter) • Built spaces (forts) • Natural enclosures • Urban rooms Open (prospect) • View from above (flying • Open meadow • View from hill/cliff • View of road Wayfinding • Roads and paths (forests) • City roads Complexity/mystery • Natural (tangled garden) • Urban complexity • Investigation • fascination Comprehension/Legibility • Open field • Open roadways • paths





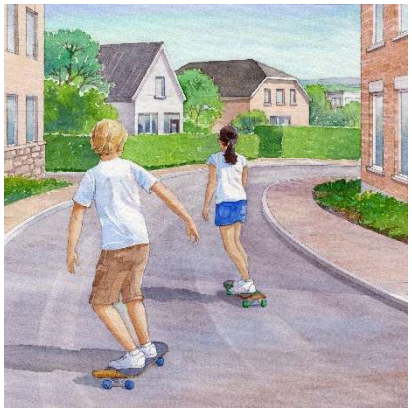


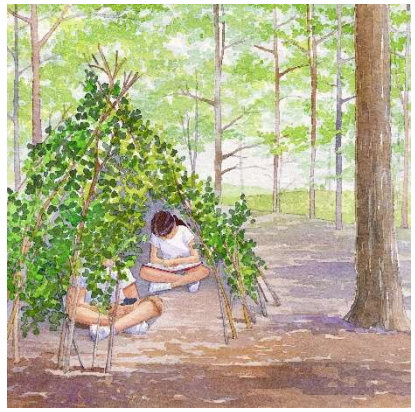
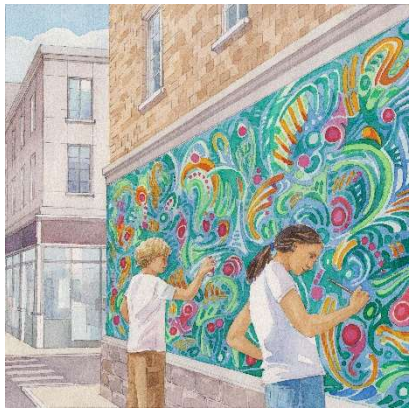
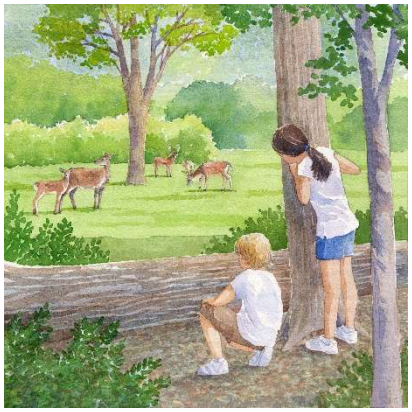






Step 3: Administration of Q-Sort

Interview process:

- Child reviews book of printed images
- They sort the deck of smaller images into 3 piles (like most, least, medium)
- They sort these onto the Q-sort board in order of preference
- Takes approx. 15 minutes
- Children enjoyed the interviews and were happy to participate.
- Some received a thank-you gift, but others (at schools) did not.

Sample

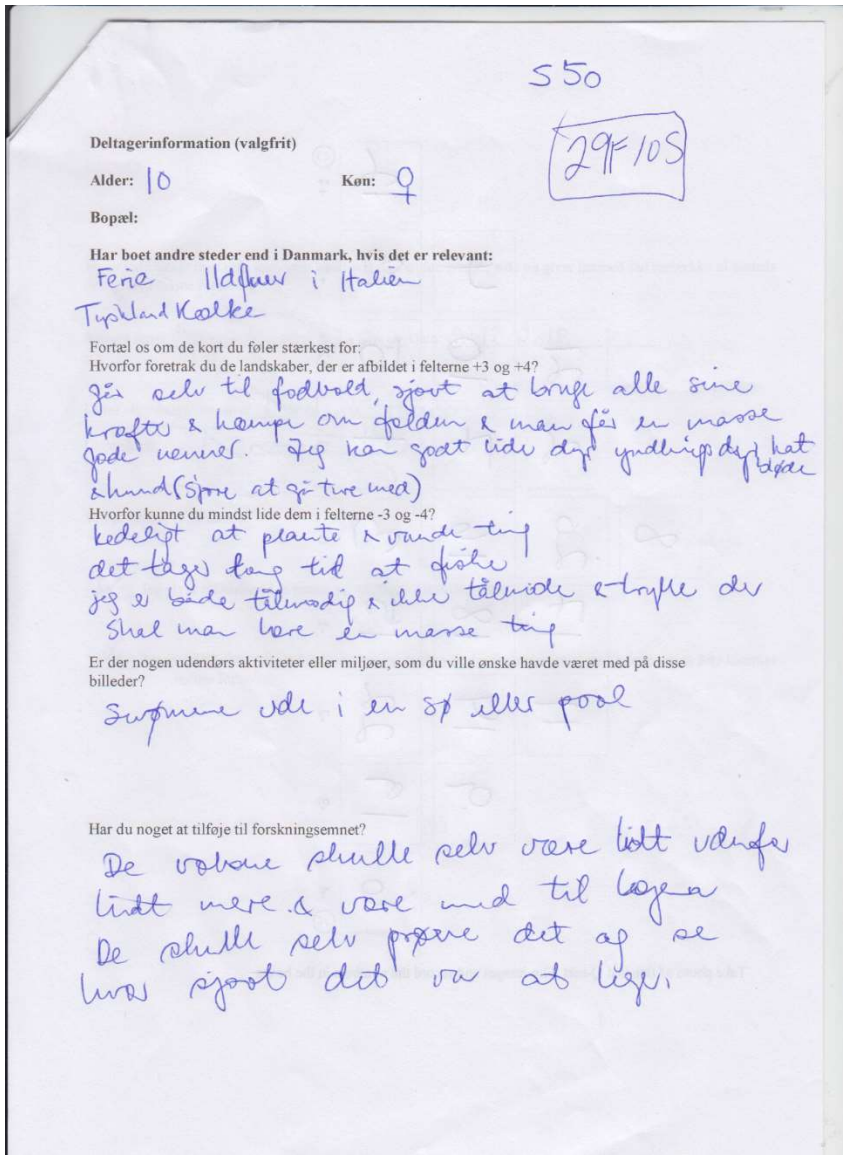
- 49 children (24 boys, 25 girls)
- Residents of Vejle/Billund area
- 13 children have non-Danish parents and were born outside of Denmark
- 10 children have one non-Danish parent

Recruitment

- International School (Billund) -after hours program
- Vejle Bibliotek – drop-in
- Internationals dinner in Vejle
- Vejle School – after hours program
- Misc: children of colleagues, local shop owners, other contacts

Age breakdown:

5 years (1)
6 years (8)
7 years (7)
8 years (6)
9 years (14)
10 years (5)
11 years (5)
12 years (2)
13 years (1)



S50

29F 10S

Deltagerinformation (valgfrit)

Alder: 10 **Køn:** ♀

Bopæl:

Har boet andre steder end i Danmark, hvis det er relevant:

Ferie Ildfluer i Italien

Tyskland Kalkø

Fortæl os om de kort du føler stærkest for:

Hvorfor foretrak du de landskaber, der er afbildet i felterne +3 og +4?

gå selv til fodbold, sjovt at bruge alle sine kræfter & kæmpe om bolden & man får en masse gode venner. Jeg kan godt lide dyr ynderligt dyr hat hund (sjove at gå tur med)

Hvorfor kunne du mindst lide dem i felterne -3 og -4?

kedeligt at plante & vande ting

det tager lang tid at gøre

jeg er både tålmodig & ikke tålmodig afhængig af

Skal man lave en masse ting

Er der nogen udendørs aktiviteter eller miljøer, som du ville ønske havde været med på disse billeder?

Svømme ude i en sø eller pool

Har du noget at tilføje til forskningsemnet?

De voksne skulle selv være lidt udenfor

lidt mere & være med til legen

De skulle selv prøve det af se

hvor sjovt det er at lege.

Questionnaire

- Age, Gender, Place of Residence
- Other places of residence
- “Why did you prefer the images in the +3 and +4 boxes?”
- “Why did you least prefer those in the -3 and -4 boxes?”
- Are there any play activities you wish were included in these pictures
- Additional comments about the topic (usually asked as “is there anything you think the researchers should know about playing outside”)

“Adults should not work so much but play more with us”

playtrac 4 centroid.lis.txt - Notepad

File Edit Format View Help

PQMethod2.35 Visual Q Study of Children's Outdoor Play Preferences
Path and Project Name: C:\PQMethod\projects/playtrac

Factor Matrix with an X Indicating a Defining Sort

		Loadings			
QSORT		1	2	3	4
1	01M9J	0.0363	0.1653	0.2550	0.7956X
2	02F11A	-0.1797	-0.0896	0.6648X	0.2499
3	03M11S	0.2085	-0.0495	-0.2258	0.8807X
4	04F6A	-0.2321	0.6170X	-0.0565	0.3872
5	05M8D	0.0416	0.4860X	-0.1406	-0.3791
6	06F12I	0.2989	0.3580	0.0508	0.2446
7	07M13S	-0.2395	0.2866	-0.4890X	0.0618
8	08F10S	0.6073X	0.1634	-0.2693	0.3373
9	09F9E	0.4288X	-0.0115	0.2315	-0.0013
10	10M6M	-0.0701	-0.1129	-0.1180	0.4474X
11	11F5E	-0.1512	0.5339X	0.2527	0.2013
12	12M7J	-0.0294	0.1097	0.4377X	-0.0963
13	13M9B	0.1849	0.1796	-0.1511	0.5695X
14	14M7L	0.3843	-0.0913	0.0362	0.2574
15	15F6J	0.5117	-0.4251	0.0405	0.6778X
16	16M9M	0.0553	-0.3019	-0.0395	0.1481
17	17F9C	0.5665X	0.1422	0.1669	0.2822
18	18F9E	0.8212X	0.0381	0.2637	0.1927
19	19M9A	0.4441	-0.1880	-0.0558	0.4585
20	20M8I	-0.0806	0.3982	-0.0061	-0.0696
21	21F9K	0.3707	-0.0238	-0.1770	0.3974
22	22M8S7	-0.0025	0.0137	-0.5297X	-0.0006
23	23F7C	0.5390X	-0.1861	-0.2829	0.0117
24	24F9C	0.3069	0.1907	-0.1887	0.1099
25	25F6R	0.6493X	-0.1716	0.1945	-0.3388
26	26F7L	0.4714	0.3047	0.1491	0.4393
27	27M10A	-0.1685	0.7593X	-0.0442	-0.4400
28	28F6S	0.4003	-0.0166	0.4883X	0.2518
29	29F10S	0.2220	0.6027X	-0.0928	0.1583
30	30M7N	-0.2662	0.2884	-0.0112	0.3144
31	31M6R	-0.2724	0.1315	-0.1665	0.6610X
32	32M7N	0.0026	0.4537	-0.3921	0.2845
33	33M6V	-0.5777X	0.0104	0.2282	0.1732
34	34M12M	0.1863	0.1006	0.6834X	0.4695
35	35F7A	0.1278	-0.4680X	0.2702	0.0617
36	36F11A	0.7049X	0.1717	0.0115	0.0219
37	37M8M	0.3277	-0.1031	0.3816	0.0728
38	38M9S	0.1744	0.0522	0.2748	0.4302X
39	39F8M	0.1758	-0.0344	-0.1969	0.2659
40	40F8E	0.5662X	-0.2272	0.1521	-0.1760
41	419Mt	0.1513	0.3188	0.2073	0.0770
42	42F9C	0.1077	0.0003	-0.4154	0.1607
43	43M6V	0.2236	0.6848X	-0.0726	0.2086
44	44F9E	0.1804	0.4069	0.2313	0.7194X
45	45M11W	-0.1505	0.5360X	0.2061	0.3031
46	46F10A	0.1145	-0.0115	-0.6971X	0.3390
47	47F9L	0.5488X	-0.0520	-0.2940	0.0319
48	48M10S	0.0565	0.3062	0.3229	-0.1212
49	49F11J	0.6857X	-0.0836	0.0143	0.1937
% expl.Var.		13	9	8	13

Step 4: Data Analysis

- PQ method software (Schmolk 2012)
- Plots correlation matrix
- Finds 8 factors initially
- Humphrey's rule performed
- Eigenvalues (8.8, 5.3, 4.0, 3.7) plotted with Scree test
- 4 defining factors
- Centroid analysis and Varimax rotation
- Defining sorts automatically flagged

Displaying Factor Arrays

- Factor arrays provided using text to represent images

			Factor Arrays			
No.	Statement	No.	1	2	3	4
1	biking through woods	1	2	3	-3	1
2	lying in meadow	2	0	0	-2	-3
3	shopping at market	3	0	-2	1	-3
4	playing frisbee with dog	4	3	1	-2	2
5	climbing in tree	5	2	3	2	4
6	urban garden	6	0	-4	-1	-2
7	playfighting	7	-4	1	3	-1
8	running through woods	8	-2	-2	-2	2
9	magic show	9	-1	0	0	-1
10	rooftop view	10	1	-1	-1	-2
11	picking raspberries	11	1	-1	0	0
12	playing soccer	12	-3	4	-4	0
13	petting a cat	13	4	1	2	2
14	looking at butterflies	14	1	0	0	0
15	playing guitar	15	-1	2	1	-2
16	playing with drones	16	-3	2	3	1
17	sitting around a campfire	17	-1	-3	0	3
18	skateboarding	18	-2	2	-1	-4
19	exploring by creek	19	-2	-2	-3	1
20	playing inside fort	20	0	-1	2	3
21	street art	21	3	0	4	-1
22	looking at deer	22	2	-3	1	0

Displaying Factor Arrays

- Program designed to convert arrays to images (courtesy Ralph Hempel)

Step 5: Interpretation of Factors

Group 1 – The Nurturers

- Preference for contemplative, creative, tactile and gentle activities
- Value sentimentality and friendship, display caring and empathy
- Role playing (nurturing adult)
- All are female (7 Danish, 3 non-Danish, born outside Denmark)
- Age range 6-11, average age 8.9

Likes

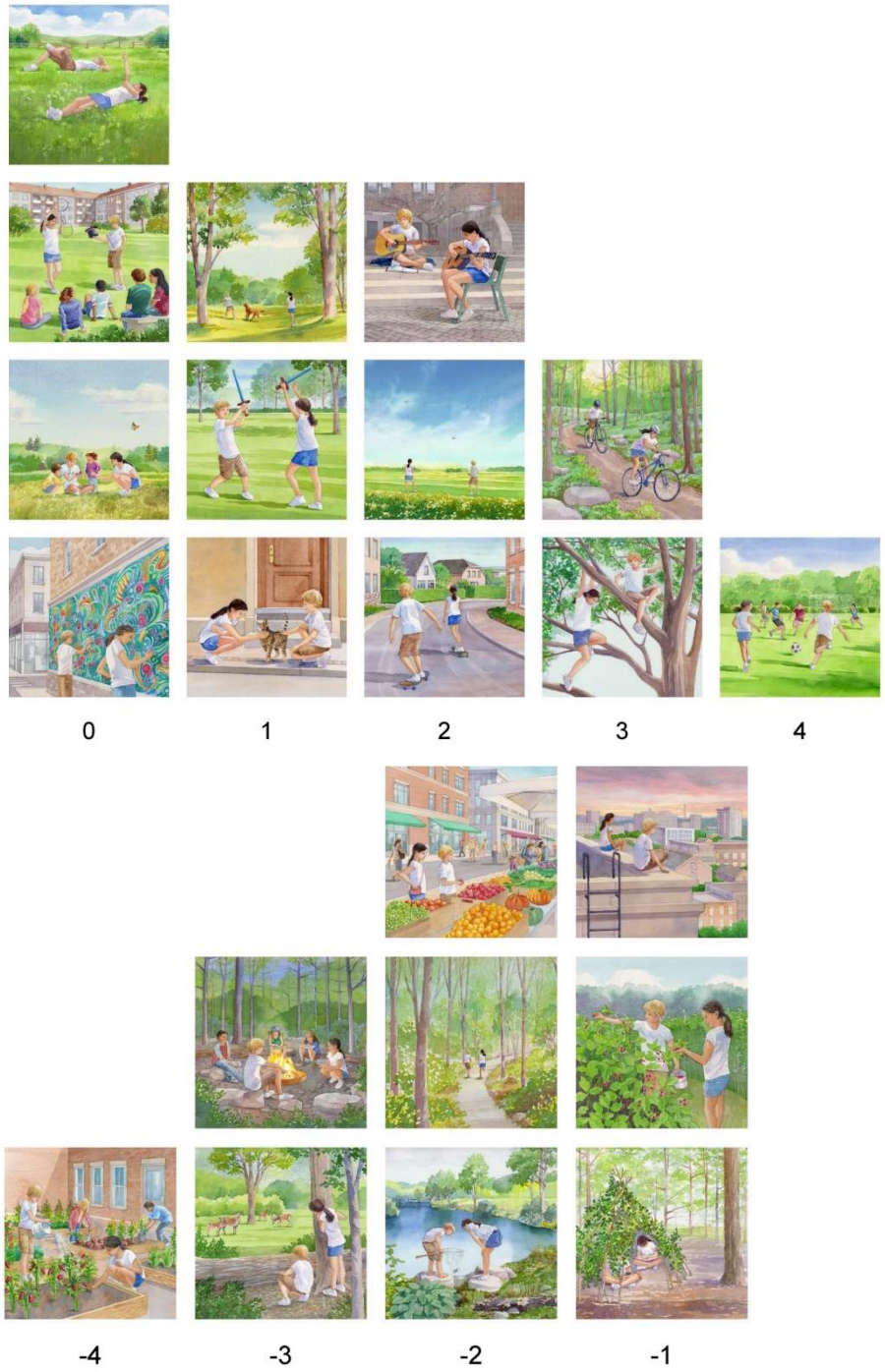
- Animals (watching or studying) “I have cats at home and I love to pet them”
- Picking berries, growing plants, growing food, shopping at market, examining butterflies with young children - more highly valued than other groups
- Where friendships were perceived in the images, they were more preferred (e.g. rooftop view)
- Likes climbing trees and “touching them”

Dislikes

- Activities that appear competitive or harmful
- Where danger is perceived, the image is less preferred (e.g. campfire: “I am afraid of fire”

Group 2 – The Active Children

- Active children like to move, and play that involves “doing things”
- 6 boys and 3 girls (5 Danish children, 4 immigrant children) All 3 boys from Middle east align with this factor
- Age range 5-11, average age 8.25



Likes

- Climbing, cycling, skateboarding, playing with drones
- Higher risk/ higher speed
- Playing with Objects

Dislikes

- Activities that perceived as dull
- “It’s boring to shop…I don’t like flowers”
- Forest landscapes as less preferred than for other groups
- “plants are a bit boring”
- “I have tried fishing twice and it is really boring and you just waste your time”

Group 3 – The Creators

- Children are imaginative, creative and enjoy fantasy play
- They are visual, and enjoy activities that foster artistic expression
- 2 boys and 2 girls (3 Danish children, 1 Polish child)
- Age range 6-12, average age 9

Likes

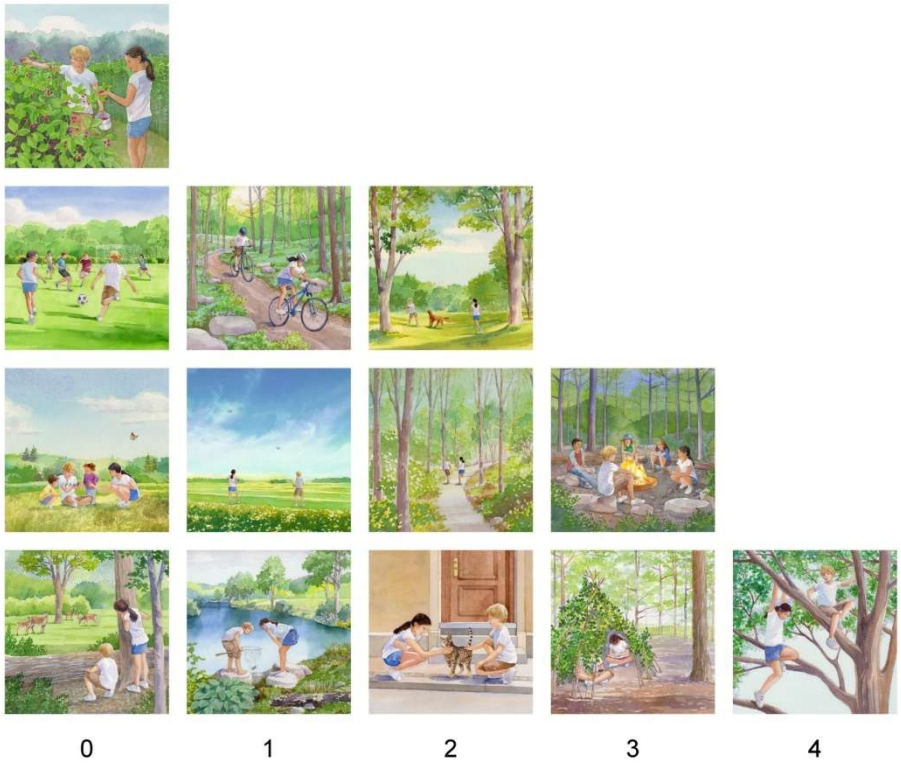
- Role Playing
- Play fighting – it's fun to imagine you are a warrior and play with weapons"
- Flying drones: "It's fun to see the world from the sky"
- "I like to draw things and I wish there were more placed to paint like this"

Dislikes

- Competitive sports: "I really hate football"
- Disliked running/biking scenes where they are perceived as racing

Group 4 – The Forest Children

- Children's perceptions are highly influenced by environment
- They enjoy woodlands, natural landscapes, and animals
- 6 boys and 2 girls (6 Danish children, 2 with a Norwegian parent)
- 4 of the children attend Steiner School
- Age range 6-11, average age 8.12



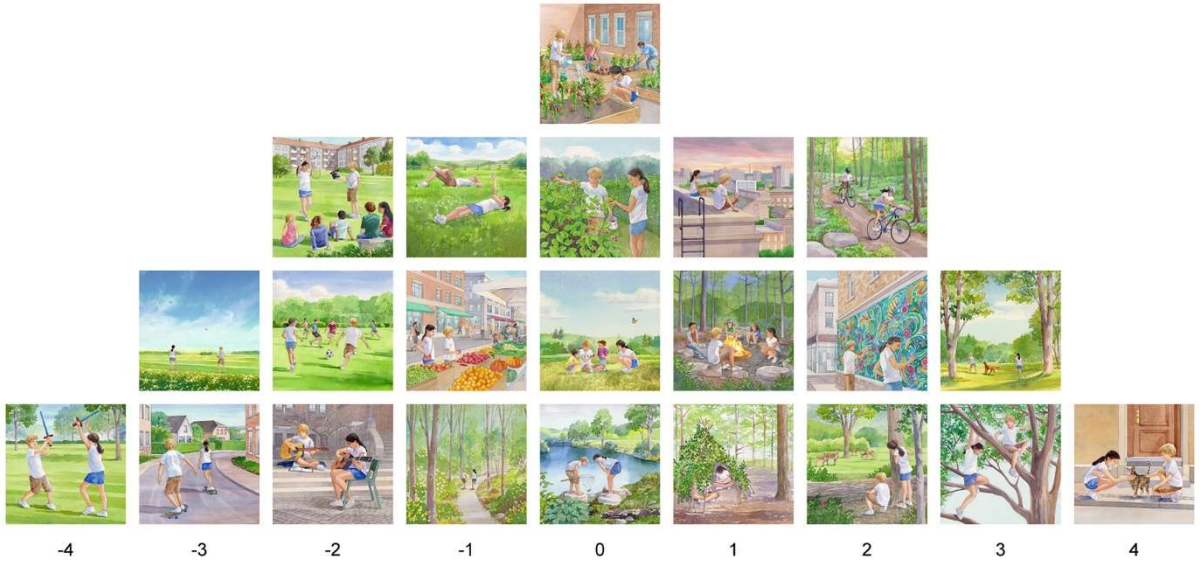
Likes

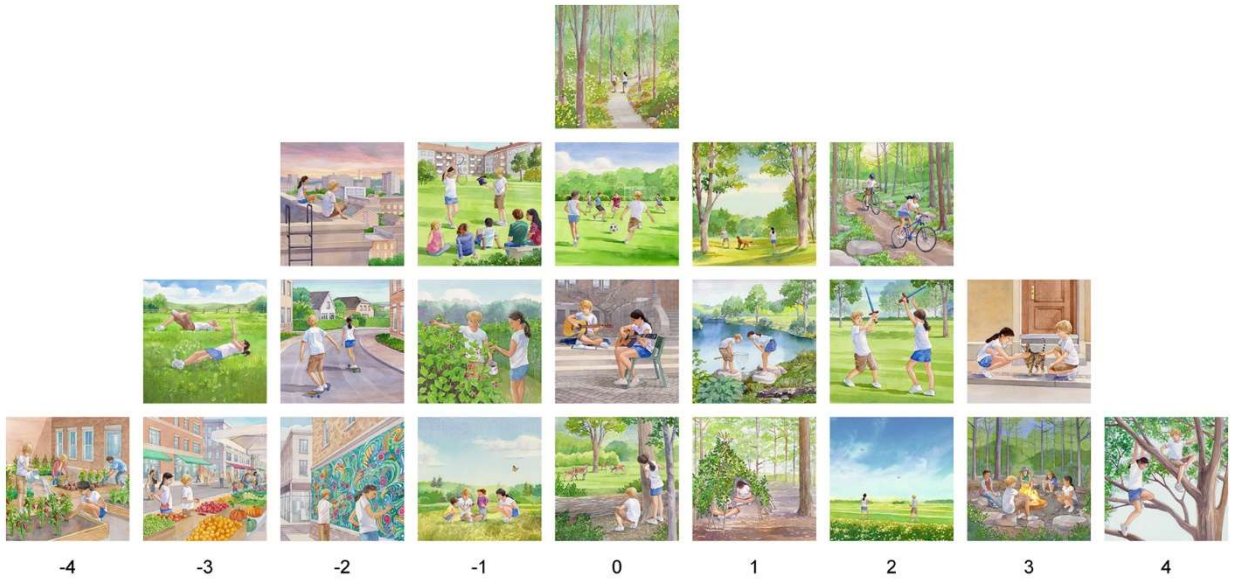
- Being in the woods: “I love camping”
- Animals “I love the cat which is so solf – I am the best friend with all of the cats here”
- The forest: “It is really awful that somebody here has cut down the trees where I live”

Dislikes

- “I don’t like skateboarding. I have tried it and it hurt a lot”
- Rooftop view – “you can fall down and hurt yourself a lot”
- Urban environments: “I don’t really like shopping

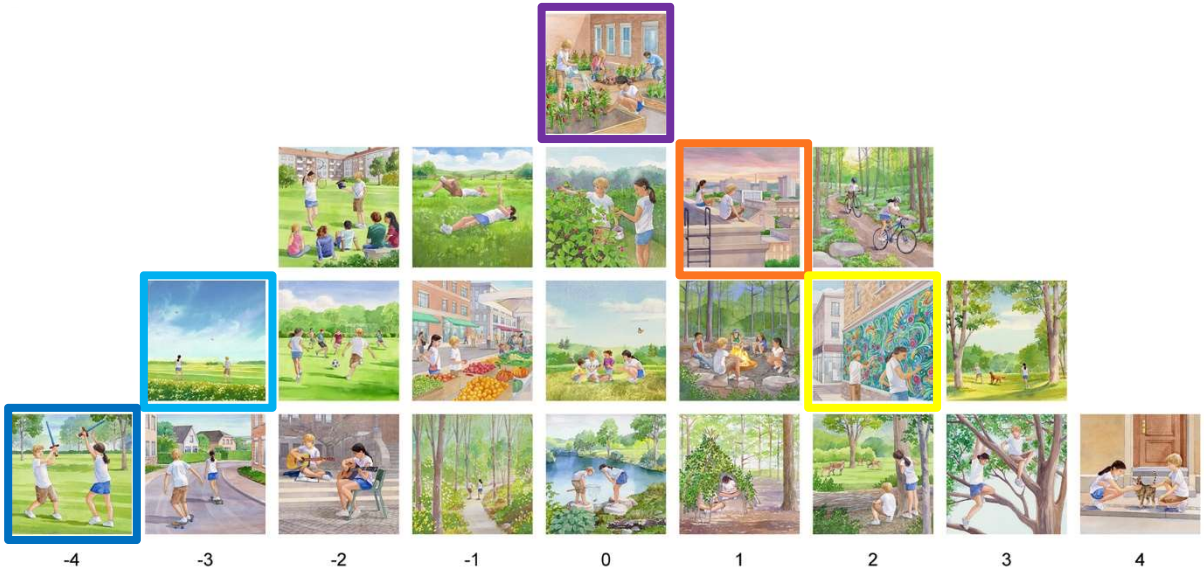
Additional Studies from data set

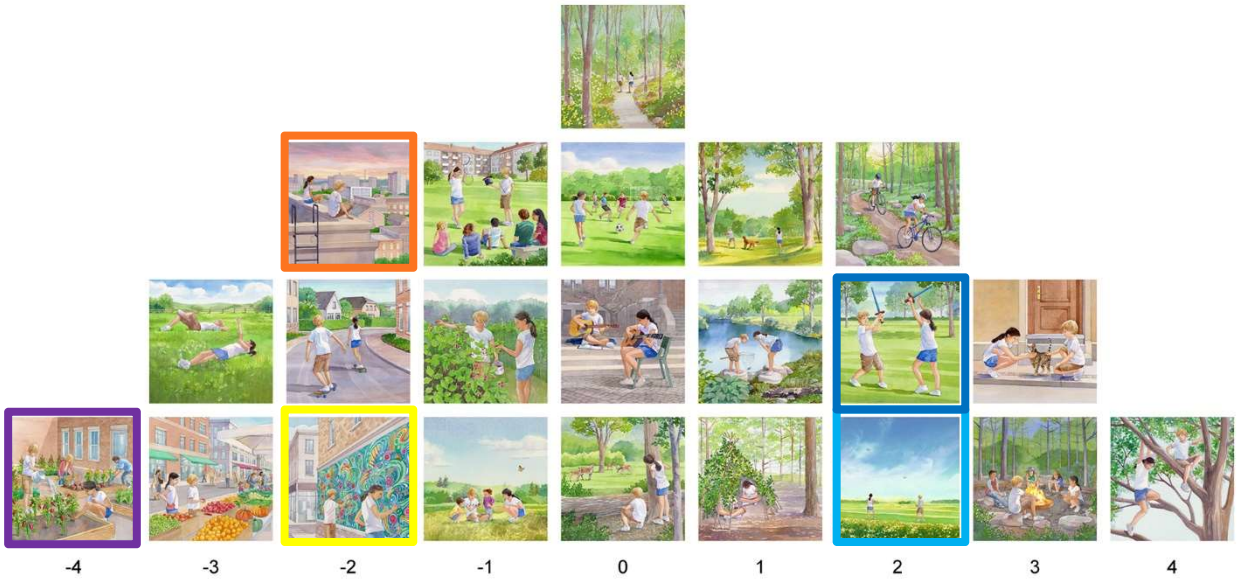




Example:
single factor
comparing
boys with girls

Additional results from same data set





Example:
single factor
comparing
boys with girls

Conclusions

"The adults should themselves be outside a little bit more and participate in the game. They should try it and see how fun it is to play!"

- Visual Q-methodology is highly suited to play research. Children enjoyed the process, the data collection process was efficient, and the results appear robust even with a small sample
- Age did not influence alignment with factors: Each group had a wide range of ages and similar average age
- Cultural differences appear strongly in two of four factors
- Gender differences appear in individual responses, and between
- Play landscape (urban vs. rural) is relevant for 2 factors
- For younger children, preferences may be based on future projections of enjoyment.
- For older children, play preferences are largely based on known experiences, and self-evaluations of competence

Further research

How do cultural influences affect play preferences?

- Children living in other countries
- Children living in Denmark with play experience in other countries
- Children living in Denmark with parents or older siblings who lived/played in other countries

How does gender influence play preference?

- Some play preferences are aligned with gender, and perceptions of the same play experience depending on gender.
- Do very young children display gender-based responses?

How does perception of competence affect children's enjoyment of activities?

- How can play experiences support perceptions of competence?
- How does perception of competence affect other aspects of learning, and at what age?

Toolkit: What practical lessons or guidelines can aid teachers, parents, community developers, or designers of play experiences?

References

Addams, H. (2000). Q-Methodology. In: Addams, H. and Proops, J. (Eds). (2000) *Social Discourse and Environmental Policy: An Application of Q Methodology*. Elward Elgar Publishing, UK.

Appleton, J. (1975)**.** *The Experience of Landscape*. New York: Wiley & Sons Ltd.

Horelli, L. (2007). Constructing a theoretical framework for environmental child-friendliness. Children, Youth and Environments 17 (4).

Kaplan, R. & Kaplan, S. (1989) *The Experience of Nature: a psychological perspective.* Cambridge University Press, Cambridge, UK.

Kellert, S. and Wilson, E.(1993). *The Biophilia Hypothesis*. Washington, DC: Island Press.

Meinig, D. (1979) The beholding eye, ten versions of the same scene. In: Jackson, J. and Meinig, D. (eds) (1979) *The Interpretation of Ordinary Landscapes.* New York: Oxford University Press

Watts, S. and Stenner, P. (2012) *Doing Q Methodological Research: Theory, Method and Interpretation.* Thousand Oaks, California: Sage Publications.

Whitebread, D., Neale, D., Jensen, H., Liu, C., Solis, S. L., Hopkins, E., Hirsh-Pasek, K., Zosh, J. M. (2017). *The role of play in children's development: a review of the evidence* (research summary). The LEGO Foundation, DK.

Zosh, J. M., Hopkins, E., Jensen, H., Liu, C., Neale, D., Hirsh-Pasek, K., Solis, S. L., and Whitebread, D. (2017). *Learning through play: a review of the evidence* (white paper). The LEGO Foundation, DK.

Thank you

AARHUS UNIVERSITET

The LEGO Foundation


08F10S
-4 -3 -2 -1 0 1 2 3 4


09F9E
-4 -3 -2 -1 0 1 2 3 4


17F9C
-4 -3 -2 -1 0 1 2 3 4


18F9E
-4 -3 -2 -1 0 1 2 3 4


23F7C
-4 -3 -2 -1 0 1 2 3 4


25F6R
-4 -3 -2 -1 0 1 2 3 4


36F11A
-4 -3 -2 -1 0 1 2 3 4


40F8E
-4 -3 -2 -1 0 1 2 3 4


47F9L
-4 -3 -2 -1 0 1 2 3 4


49F11J
-4 -3 -2 -1 0 1 2 3 4

Factor 1


04F6A
-4 -3 -2 -1 0 1 2 3 4


05M8D
-4 -3 -2 -1 0 1 2 3 4


11F5E
-4 -3 -2 -1 0 1 2 3 4


27M10A
-4 -3 -2 -1 0 1 2 3 4


29F10S
-4 -3 -2 -1 0 1 2 3 4


43M6V
-4 -3 -2 -1 0 1 2 3 4


45M11W
-4 -3 -2 -1 0 1 2 3 4


48M10S
-4 -3 -2 -1 0 1 2 3 4

Factor 2


02F11A
-4
-3
-2
-1
0
1
2
3
4


12M7J
-4
-3
-2
-1
0
1
2
3
4


28F6S
-4
-3
-2
-1
0
1
2
3
4


34M12M
-4
-3
-2
-1
0
1
2
3
4

Factor 3


01M9J
-4 -3 -2 -1 0 1 2 3 4


03M11S
-4 -3 -2 -1 0 1 2 3 4

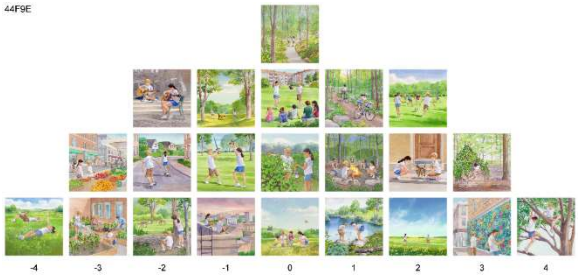

10M6M
-4 -3 -2 -1 0 1 2 3 4


13M9B
-4 -3 -2 -1 0 1 2 3 4


15F6J
-4 -3 -2 -1 0 1 2 3 4


31M6R
-4 -3 -2 -1 0 1 2 3 4


38M9S
-4 -3 -2 -1 0 1 2 3 4


44F9E
-4 -3 -2 -1 0 1 2 3 4

Factor 4