LOG OF MEETING
DIRECTORATE FOR ENGINEERING SCIENCES

SUBJECT: Upper Body Equipment

DATE OF MEETING: April 3, 2003

PLACE OF MEETING: CPSC HQ, Bethesda, MD

LOG ENTRY SOURCE: Troy Whitfield

COMMISSION ATTENDEES: Troy Whitfield, Mark Kumagai, Tim Smith, Patricia Hackett, Joyce McDonald, Deborah Tinsworth, Jonathan Midgett

NON-COMMISSION ATTENDEES: John Preston, John Preston Consulting
Candra Thornton, Ph.D., Auburn Univ., Tom Norquist, Gametime/Playcore

SUMMARY OF MEETING:

Tom Norquist and Candra Thornton presented the findings of research commissioned by Gametime to the Commission staff. The research was conducted under the guidance of Joe L. Frost, Ed.D., Consultant and Parker Centennial Professor Emeritus, University of Texas. The desire was to provide information that would be helpful and pertinent in assisting staff in the revision of the Handbook for Public Playground Safety. Several topics were presented; The Relevance of Height for Child Development and Playground Safety, The Developmental Benefits and Use Patterns of Overhead Equipment on Playgrounds, The Nature and Benefits of Children's Climbing Behaviors. A copy of the agenda and presentations is attached.

Attachments (4)

Presentation to the US Consumer Product Safety Commission
April 3, 2003

Statement of Purpose:

To present highlights from independent research funded by GameTime, a PlayCore Company, to the US Consumer Product Safety Commission. We hope the Commission finds this information timely and pertinent as they work towards improving their Handbook for Public Playground Safety.

Why GameTime funded Independent Research?

Research has proven that play is the key to children's cognitive, emotional, physical and social development. A recent societal trend has been to remove playgrounds for liability reduction, risk management and safety concerns. Society needs to better understand how to provide safer play environments for America's children.

Who conducted the independent research for GameTime?

The research being presented was commissioned by GameTime, a PlayCore Company, and conducted under the direction of Joe L. Frost, Ed.D., Consultant and Parker Centennial Professor Emeritus, University of Texas.

Outline of PowerPoint Presentation:

- The Relevance of Height for Child Development and Playground Safety
  (Completed September 2001)
- The Developmental Benefits and Use Patterns of Overhead Equipment on Playgrounds
  (Completed Fall 2001)
- The Nature and Benefits of Children's Climbing Behaviors
  (Completed Fall 2002)
- Open Discussion, Questions/Answers

Presenters:

Tom Norquist, GameTime

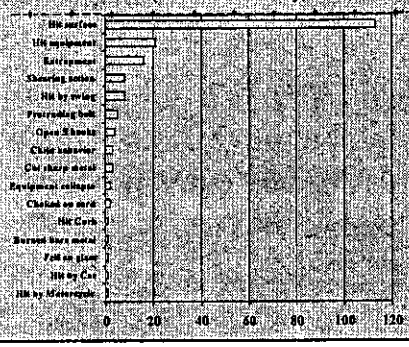
Candra D. Thornton, Ph.D., Auburn University

The Relevance of Height for Playground Safety and Child Development (2001)

Joe L. Frost
John A. Sutterby
Jim A. Therrell
Pei-San Brown
Candra D. Thornton

Cause of injuries: Litigation

(Frost and Sweeney, 1996)



Scope of injuries: NEISS

- National Electronic Surveillance System (NEISS) data for 1999 (205,850 cases) show that falls, primarily to the surface below playground equipment, accounted for approximately 79% of the injuries on public playgrounds and 81% of injuries on home playgrounds. All of the hospitalized injuries (3 percent) resulted from falls (Tinsworth & McDonald, 2001, p.iii)
- "Serious head injuries, such as fractures and concussions, were reported to have occurred from distances of about four and one-half feet or higher" (Tinsworth & Kramer, 1990, p. 8)

Reasons for climbing

- For Arousal
- To increase visual field
- To participate in chase
- To participate in pretend
- For physical sensations
- To challenge self

Expert Opinions on Climbing

- Children, "choose to climb because of the challenge, the sense of danger, and the sense of being able to survey all about them from the 'top of the mountain.'" (Gallahue, 2001)
- "Children love to climb and be high because it is scary and it presents them the feeling of danger and risk." (Heseltine, 2001)
- "All animals climb when they have the ability. This is a basic inherent instinct to rise above the perils of the jungle floor. All animals who can climb do so to observe their terrain, look for enemies, food and new adventurers." (Hogan, 2001)

Development of climbing

- Children are climbing often before they can walk
- By 22 months 90% of children are climbing
- Children seek more and more challenging objects to climb
- Risk taking increases in the middle school years

Children do not always climb as intended

Young children often climb excessive heights

Children climb equipment unintended for climbing

Slide or Climber?

Children can be expected to descend slide chutes in many different positions, rather than always sitting and facing forward as they slide. They will slide down facing backward, on their knees, lying on their backs, head first, and will walk both up and down the chute. Younger children in particular often slide down on their stomachs, either head or feet first. (CPSC, 1997, p. 24)

Adult Concepts of Children's Play

- The assumption that children use equipment in intended ways (CPSC, 1980) "... should be viewed as an inappropriate 'adult' concept of how children play and not at all representative of how we can expect children to behave" (Crawford, 1989, p. 46).

Heights and Fear

- Risk and fear are natural parts of development and are important for children
- Children develop fear based on experiences with heights, moving, and falling
- Some children appear to have an inherent fear of heights
- Some children develop phobias, perhaps due to experience or cerebellar-vestibular dysfunction
- Some children take exceptional risks or have little concern with the consequences of risk taking (e.g. children with ADHD)

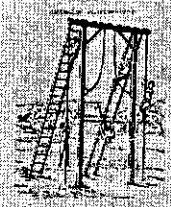
Levels of Fear

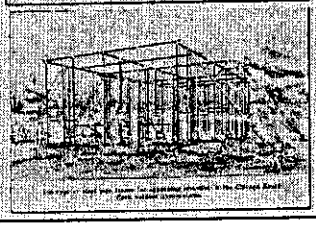
- Both research and experience indicate that there are several levels of fear of heights among children:
  - abnormal fear (phobias)
  - normal fear
  - abnormal lack of fear
- For very young children (e.g., infants) virtual lack of fear may be observed.
- Children with ADD, ADHD, and other disorders may simply be distracted or fail to perceive hazards.

History of Heights on Playgrounds (1900-1950)

- Playgrounds were originally designed with little concern for height
- Injuries were common and professional groups made recommendations to reduce injuries
- Many schools and parks ignored warning and installed hard surfaces

Tall Climbers



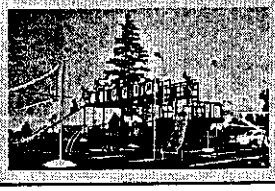


Surfacing and Injuries

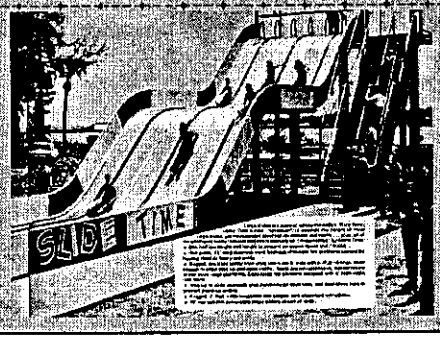
- In 1951, a six-year-old boy fell from a swing onto an asphalt surface of a Los Angeles city school playground and died of head injuries. This was the last of 11 playground deaths in that school system over a twenty year period. (Butwinick, 1974)
- In 1955, the Los Angeles school system purchased rubber surfacing for its playground equipment, and as of 1965 had had no further fatalities. (Butwinick, 1974)

Novelty Period (1950-1970)

- Playground equipment was based on novelty themes like space travel or westerns
- Height was an issue, but excessively high equipment continued to be built

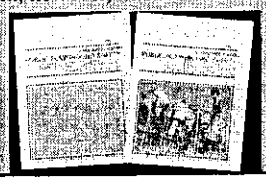


Giant Slides (Circa 1970)



1970's Safety Movement

- In 1974, Elayne Butwinick and Theodora Sweeney petitioned the Consumer Product Safety Commission to develop standards for play equipment safety
- Limiting heights was an issue for the original CPSC document; however, no maximum height was set



Acceleration During Falls

- The key factor in this formula is acceleration; the farther one falls the faster one travels
- Acceleration = 32'/second ^{2}

$$Final\ Velocity = Initial\ Velocity + (Acceleration \times Time)$$

Resilient Surfacing and Critical Heights

- The use of resilient surfacing materials protects children from serious injury from falls; however, "Surfacing materials, even though they may be resilient, will not provide adequate protection unless their impact-absorbing qualities are sufficient for the highest accessible part of the play event. (CFA, 1992, p. 13)
- Critical height of a surfacing material is based on the depth of the material and the distance of the fall.

Differing Opinions on Heights

- Those manufacturing equipment over twelve feet high are "out of their heads." (Hogan, 2001)
- "Height is perception. For example a structure 20 feet high with graduated landscaping might be no more than 4 feet off the ground at any point. (Jambor, 2001)
- Despite these differences in interpretation of the question, none of the responses indicated that children should be exposed to extreme ***fall*** heights.

Summary of Interviews

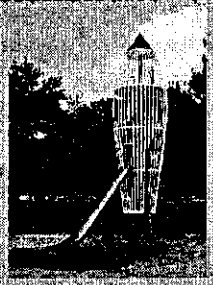
- Children, when given the opportunity, will climb as high as possible.
- Increasing heights increases the potential for serious injury ("the higher you climb, the harder you fall").
- There was no clear agreement among those interviewed on whether the height of manufactured play equipment should be limited.
  - Some suggested that fall heights should be limited, but equipment heights could remain unlimited based on design.
  - Others suggested that equipment heights should be limited.
  - None of the experts stated that ***fall height*** should be unlimited.

Height Study

- Methodology
  - Observations in 4 settings
    - Modern play equipment (Jonesville City Park)
    - Older play equipment (LaPorte City Park)
    - Restaurant play equipment (Beau's Seafood)
    - Water park slide (Baker Municipal Water Park)
  - Coding and Anecdotal notes

Settings

Jonesville City Park



LaPorte City Park

Settings

Baker Municipal Water Park

Beau's Seafood

Results of Observations

- Children frequently misused equipment
- Children accessed unintended parts of the play structure
- Children took risks on playgrounds

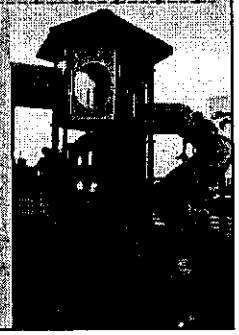
Results of Observations

- Children were frequently unsupervised, but close supervision appeared to be effective
- Children under the age of two often accessed excessive heights
- Children showed different levels of fear on playgrounds

Children misused equipment to increase challenge

Children accessed unintended parts of the play structure

Children were often unsupervised



Developing fear of heights

Risk-taking

Conclusions and Recommendations

The wide range of individual differences in development among children of like chronological age leads to the conclusion that levels of development, not chronological age, should be the determinant for matching children to playground equipment sizes and types. Chronological age is a weak predictor of playground behavior when compared to experience and skill development.

Conclusions and Recommendations

Issues of height, hazards, and injuries are not simple issues of restricting the maximum height of equipment. For example, rotating tire swings must be installed with swivel or beam heights sufficient to avoid injuries from children's heads impacting overhead beams when pushed very vigorously. Decks or platforms need to be sufficiently high to accommodate young children engaging in make-believe or dramatic play underneath the structure in order to enhance play value, conserve space and material, and to provide shade. On the other hand, there appears to be no reasonable rationale for manufacturing and installing slides and climbers that violate national guidelines and standards for heights with respect to protective surfacing.

Conclusions and Recommendations

All the national surveys, guidelines, and standards (AAHPERD, CFA, NPPS, CPSC, and ASTM) reviewed in this document conclude that equipment designed for older groups is anthropomorphically unsuitable for younger children's play. Excessive heights of older children's play equipment means extreme hazards for younger children with undeveloped skills using that equipment. Playground sponsors should ensure that signs are posted regarding the age or developmental ranges for which playgrounds are designed. Educational programs are needed to assist adults in making wise decisions about selecting and supervising playgrounds for children.

Conclusions and Recommendations

Despite recommendations, warnings, and admonitions regarding maximum equipment heights, some manufacturers commonly advertise and sell slides that exceed peak G and HIC values of the protective surfacing that they install or that is installed by consumers. For example some manufacturers market both open and enclosed tube slides that are 10 to 12 feet in vertical height. The commonly used protective surfacing materials are not rated to protect children in falls from this height. The problem is even more serious when taking into account that the overall climbing (fall) height of these slides may exceed 15 feet (that is, when children climb on and fall from the top of protective barriers, support members, or the top of slide chutes).

Conclusions and Recommendations

The CPSC/ASTM recommendations for height of overhead apparatus are appropriate when loose surfacing or a composite surface is installed and maintained per established criteria. However, fall height of apparatus installed over protective surfacing commonly exceeds the designated fall height. This is due to a number of variables, including poor design of equipment, improper initial installation of surfacing, and lack of maintenance following installation.

Conclusions and Recommendations

Height is a critical variable for ensuring fun, challenge and development for children. Innovative design of playground equipment can help ensure these qualities without increasing potential fall heights (not equipment heights) beyond criteria recommended by safety experts, research evidence, and the criteria established by ASTM/CPSC and other national professional organizations concerned with child safety.

Conclusions and Recommendations

Taking all the evidence reviewed into account, the writers recommend the following:

- Maximum fall height (per CPSC/ASTM criteria) of to-fro swing beams should not exceed 8 feet for school age children or 7 feet for preschool children.
- Maximum fall height on overhead apparatus should not exceed 6 1/2 - 7 feet for school-aged or 5 feet for preschool children.
- Maximum height for platforms, decks, slides, and climbers should not exceed 6 - 8 feet for school age children or 4 - 5 feet for preschool children. All equipment with fall heights exceeding these recommendations should be designed to prevent climbing on the outside of the equipment. Height ranges are recommended to allow for innovation in design, diversity of challenges, and different age and developmental levels of children expected to use the equipment.

Conclusions and Recommendations

- Overhead beams of rotating tire swings should not be installed lower than 6 1/2 feet to help avoid contact of children's heads with overhead beams during extreme swinging (Research team experience).
- Manufacturers should take steps to ensure that upon initial installation of their equipment, surfacing meets CPSC/ASTM recommendations for type, HIC, and G rating.

Photo Credits

- Slide 4 - E. Berkeley in Friedberg, P., & Berkeley, E. (1970). Play and interplay. London: The Macmillan Company.
- Slides 6, 7, 23, 24, 27, 28 - J. Sutterby
- Slide 7 - C. Thornton
- Slide 8, 9 - R. Moore in Brett, A., Moore, R. & Provenzo, E. (1993). The complete playground book. Syracuse, NY: Syracuse University Press.
- Slide 13 - E. Unknown in Mero E. (Ed.), American playgrounds: Their construction, equipment, maintenance and utility. Boston, MA: American Gymnasia.
- Slides 14, 15, 17 - J. Frost
- Slides 25, 29, 30 - J. Therrell
- Slides 15, 16 - Gametime Catalog 1970
- Various Photos - T. Norquist

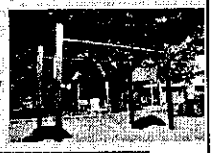
The Developmental Benefits and Use Patterns of Overhead Equipment on Playgrounds

Austin, Texas -- September, 2001

The skill that kids develop on the overhead ladder is called brachiation, and it is one of the very few experiences that are new to children on the playground.

(Hewes & Beckwith, 1975, 123)

Overhead ladders, ring treks, and other types of overhead equipment are commonly found on playgrounds, generally comprising about 10-12% of all playground equipment.



HISTORY OF OVERHEAD EQUIPMENT

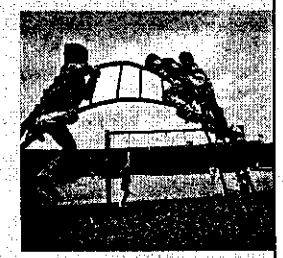
- *Outdoor equipment to promote physical activity traces its roots back to post-Napoleonic Europe to Germany.*
- *This equipment came to the United States around the middle of the 19th century.*
- *Overhead equipment was seen as an important component of playgrounds during this era.*
- *As equipment evolved during the 20th century, new overhead apparatus designs were implemented for playgrounds.*
- *Typical modern overhead apparatus designs include challenge ladders with unevenly spaced rungs, ring treks, C and S shaped overhead ladders (with and without movement), track rides, hanging rings and parallel bars.*

SAFETY & OVERHEAD LADDERS

- *Injuries associated with overhead equipment generally result from falls (Waltzman, Shannon, Bowen & Bailey, 1999). In a study of playground injuries and litigation, Frost & Sweeney (1996) found that 14 out of 190 serious injuries (7%) were associated with falls from overhead ladders.*

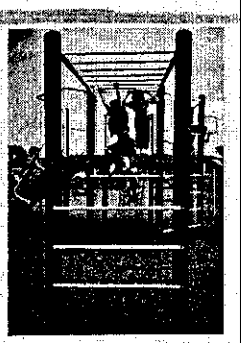
SAFETY & OVERHEAD LADDERS

Injuries associated with overhead apparatus also result from unintended use (such as walking across the top of the ladder along the rungs and sides, and sitting on top of the overhead ladder) (Hewes & Beckwith, 1975; Friedlander & Lohmeyer, 1988) and from children under 5 years of age trying to use equipment designed for older school age children (Frost & Kim, 2000).



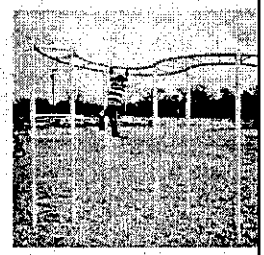
SAFETY & OVERHEAD LADDERS

- To reduce the risk of children falling onto access decks of play structures, it is recommended that the final handhold should be at least 8" from the edge of the deck (Tinsworth, 1996; Ratte', Denham & Johnson, 1990).
- CPSC recommends that upper body devices like overhead ladders not be used by children under 4 years of age.



SAFETY & OVERHEAD LADDERS

- Maximum recommended heights for overhead equipment are 60" for preschoolers and 84" for school-age playgrounds.
- To minimize the risk of falling during attempts to reach the next rung, maximum distances for rungs are not recommended to exceed 14 inches.



FITNESS & UPPERBODY EQUIPMENT

- children's physical fitness is related to upper body equipment because the degree of body strength and body weight influence the ability of the children to use overhead equipment
- experience with upper body equipment increases their skill and ability to use upper body equipment

FITNESS & UPPERBODY EQUIPMENT

- Children need to have reached a point of physical growth and development that allows them to successfully negotiate overhead equipment such as lateral weight shift, eye-hand coordination, and visual perception of distance.
- The support of the body is a combination of three factors: grip strength, upper body strength, and body weight.
- Children develop the grip and upper body strength to support their body weight by at least 3 years (Frost & Kim, 2000) and perhaps by as early as 2 years (Gabbard & Patterson, 1980).

FITNESS & UPPERBODY EQUIPMENT

- Lateral weight shift develops in children as they learn to walk. In order to walk children must be able to shift their weight to one side of their body, so that the other side is free to move (Nelson, 1988). For upper body movement, children must be able to perform a similar task. They must support their body weight on one arm while moving the other to grasp the next rung.

EFFECTS OF OBESITY

- A child with normal grip strength and upper body strength may not be able to use an overhead ladder if he/she is overweight.
- The importance of body weight is found in Frost & Kim (2000) when the only two members of an experimental group of 3- and 4-year-olds who could not complete an overhead ladder were overweight children.
- Lateral weight shift may be affected by obesity as children develop unbalanced locomotion patterns to compensate for carrying extra weight on their joints and muscles (Hills, 1994).

Comments from Experts...

"Are you aware of research or published opinion concluding that suspending from overhead apparatus can injure arms and/or shoulders of 2, 3, and 4 year olds?"

- "Most children at this level, (80% of 4-year-olds) can not suspend (hold) body weight while traversing across...that is, hold with one-arm while reaching for the next rung...we did this in 1980-81." (Carl Gabbard)
- "Very young children do not have the necessary upper body strength or coordination to handle a horizontal ladder 84 inches high and 10 feet long. However, at the age of 5 they don't develop these skills overnight; they must be developed gradually" (Hendy, 1997, 104).

Comments from Experts...

"What should be the general beginning age for using overhead apparatus?"

- "Chronological age is a very poor indicator of readiness. I would prefer to answer in terms of developmental levels. Some children may be ready at age 2 or 3, others not until 5 or 6. It all depends on where the child is developmentally. Furthermore, the nature of the task, the biology of the individual, and the conditions of the learning environment all interact to determine when each individual is ready for any activity. I would say that most children who are not obsese should be ready by age 4 or 5 to begin using overhead apparatus. But some will be ready by age 2 and others not ready until age 7." (David Gallahue)

METHODOLOGY

The overall purpose of this study was to present new data collected from an empirical research study on children's use of overhead equipment.

- ***3 playgrounds: preschool, kindergarten, & school-age***
- ***approximately 35 hours of observation were conducted***
- ***158 children observed using overhead equipment***
- ***1637 use episodes coded***

Findings: Types of Hand Holds

Cup

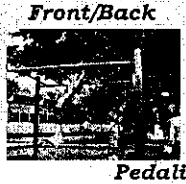
Grip

Oppositional

Combination

Findings: Types of Body Movement

Front/Back



Side/Side

Pedaling Legs

Running Legs

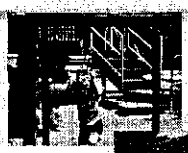
Findings: Types of Travel

Forwards

Backwards

Findings: Types of Exit

Fall



Controlled

Teacher Assisted

Findings: 4 Developmental Stages

- **Fundamental**
- **Practice**
- **Refining**
- **Mastery**

Fundamental Stage

- **emerges approximately between the age of 2-3 years**
- **needs full assistance throughout episode**
- **needs assistance getting to bar**
- **both hands cupped on bar, no consistently preferred leading hand**
- **travels hand-to-hand with assistance**
- **little leg and body movement because held by adult**
- **adult assisted exit or fall**

Practice Stage

- **emerges approximately between the age of 3-4 years**
- **some assistance may be requested**
- **may be tall enough to reach bar without assistance**
- **both hands cupped on bar, no consistently preferred leading hand**
- **hangs on 1st bar; travels hand-to-hand for a few bars with experience**

Practice Stage

- **front/back and side/side body movements; pedaling and running motions with legs**
- **controlled exit when hanging, falls when attempting to travel**

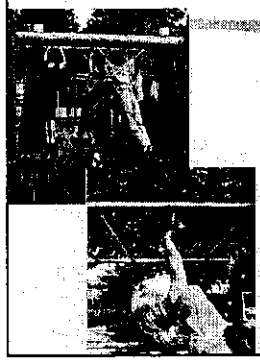
Refining Stage

- **emerges approximately between the age of 4-6 years**
- **no assistance needed**
- **reaches for bar with 2 hands**
- **both hands cupped on bar, some emergence of grip hold, usually on preferred leading hand**
- **travels hand-to-hand; leading had preference emerges; some hand-over-hand travel; some backward travel with more experience**

Refining Stage

- front/back and side/side body movements present, but more controlled; developing rhythmic movement
- minor pedaling; legs used in conjunction with body for momentum
- generally controlled exits; some falls

Mastery Stage



- emerges approximately between the age of 6-9 years
- no assistance needed
- reaches for bar with 1 hand; may jump to 3rd or 4th bar to start
- emergence of grip hold depending on hand size
- travels hand-over-hand; capable of skipping bars, backward and sidebar travel

Mastery Stage

- no extraneous movement; efficient body movement; consistent rhythm
- legs = extension of torso motion
- controlled exit; all bars completed

CONCLUSIONS

- *Appropriate design, use, and surfacing under the equipment minimizes injuries on overhead equipment.*
- *Chronological markers are less useful in determining overhead apparatus performance abilities than children's hand size and their experience with the equipment.*
- *Children progress in their overhead apparatus skills through 4 stages of development: fundamental, practice, refining, and mastery.*

CONCLUSIONS

- *When given appropriate equipment and surfacing, and support from adults, children as young as 2-years of age can begin developing their upper body strength on overhead playground equipment.*

RECOMMENDATIONS

- *Stage of development, not chronological age, should be the major factor in determining when children are ready to use overhead apparatus.*
- *Children should be given regular opportunities to play on overhead apparatus, even as early as age 3.*
- *Educational programs should be expanded to help adults learn to analyze playground safety and to understand the developmental values of play.*

RECOMMENDATIONS

- *Adults should ensure that preschool-age children do not use overhead equipment designed for school-age children.*
- *Adults should observe children carefully to match abilities of children with complexity of equipment and to be alert to fatigue resulting from excessive apparatus usage.*
- *Playground equipment should be designed for flexibility to accommodate the wide range of skill levels present among any chronological age level or grade level.*

RECOMMENDATIONS

- *Overhead rings should be designed to minimize blistering from heavy use (e.g., 1" - 1 1/8" diameter, plastic coated) and be attached to 6" to 12" of chain to allow appropriate swinging.*
- *All overhead apparatus should have "take-off" decks, platforms, or devices constructed from resilient material to protect in falls onto the head and other parts of the body.*
- *Manufacturers should consider providing educational material appropriate for purchasers and users of their equipment to assist in preventing a mismatch between equipment and children's skills.*

RECOMMENDATIONS

- *The recommendations included in this presentation solely reflect the data reviewed for the "Developmental Benefits and Use Patterns of Overhead Equipment on Playgrounds" report and should not be used to circumvent current CPSC or ASTM guidelines and standards.*

The Developmental Benefits and Use Patterns of Overhead Equipment on Playgrounds

Austin, Texas -- September, 2001

The Nature & Benefits of Children's Climbing Behaviors

An empirical study conducted by:

Joe L. Frost, Ed. D.
Pei-San Brown
Candra D. Thornton, Ph. D.
John A. Sutterby, Ph. D.

September, 2002 Austin, Texas

Abstract

The purpose of this study was to…

- Assess the developmental progression of children's climbing abilities;
- Investigate how children's climbing abilities differ across types of climbers;
- Establish criteria for determining which climbers are most beneficial for children.

Motivations for Climbing

- The desire to accomplish a goal.
- The delight, fun, and pleasure achieved through climbing.
- The ability to observe from a place higher than the ground; to increase their visual field.
- Exploration & Engagement.

Climbing Components

Climbing as an activity challenges the climber across several domains.

Depending on the challenge of the climb, the climber must draw on a combination of cognitive skills, and affective factors such as self-confidence and physical skills.

Cognitive Requirements: Memory, Problem Solving, & Imagery/Visualization

Affective Requirements: Motivation, Stress –vs– Relaxation, Fear

Physical Requirements: Perceptual Motor, Motor Fitness, Visual Perception

Climbing Equipment History

Manufactured Apparatus Era

Novelty Era

Modular Equipment Era

METHODOLOGY

Research Questions

1. What is the developmental progression pattern on climbing apparatus?
2. How do children's climbing behaviors differ across types of climbers?
3. What is the difficulty level of each climber?
4. Which climbers are most beneficial?

Methodological Organization

- Participants
- Data Collection Tools
- Setting

Data Analysis

FORMATIVE ANALYSIS

- During each observation
- Between observations within the week
- During interval between data collection weeks

SUMMATIVE ANALYSIS

- Data collapsed into single unit
- Data coding sheet

Validity

The validity of an empirical work is the extent to which the *findings* permit one to draw appropriate, meaningful, and useful inferences.

In this study, validity was established through:

- Triangulation
- Prolonged Engagement
- Peer Debriefing

Reliability

Reliability is the extent to which a measuring *instrument* measures something consistently.

Reliability was established in this study through:

- Inter-rater Reliability

FINDINGS

Developmental progression pattern on climbing apparatus

Three stages of proficiency were developed based upon the findings of this study:

- Beginner
- Intermediate
- Advanced

"Beginner" Proficiency Behaviors

Hand to Hand Movement

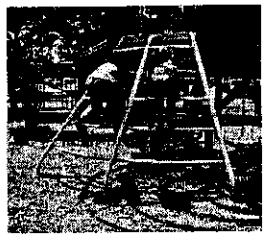
Foot to Foot Movement

Move hands & feet at same time

Cautious & Slow Climbing

Climb up, but not down

Visually focus on hands & feet



"Beginners"

"Intermediate" Proficiency Behaviors

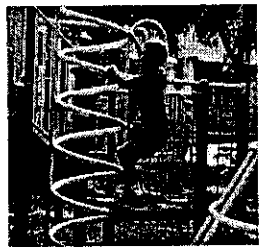
Hand to hand, hand over hand, or alternating pattern; may skip one handhold

Foot to foot, foot over foot, or alternating pattern; may skip 1 step and jump from second step

Same hand to foot relationship, or one at a time when practicing new patterns

Confident with acquired skills but cautious with newly developing skills and with climbing down.

Explores lateral movement



Visual focus is on destination but may be on hands & feet when practicing new climbing skills

"Intermediates"

"Advanced" Proficiency Behaviors

Hand over hand pattern; may skip more than 1 hand hold

Foot over foot pattern; may skip more than 1 step or jump from anywhere on equipment to ground

Opposite hand to foot relationship

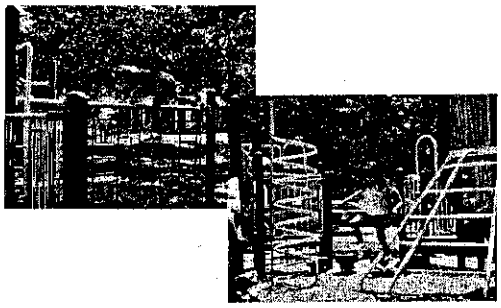
Use other body parts on equipment when exploring new ways to climb

Confidently quick speeds; can go up, down, or laterally with ease

Can face or face away from equipment

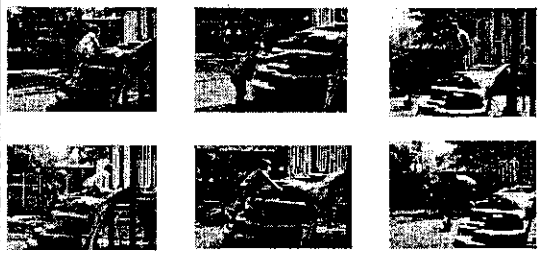
Visual focus is usually on destination or other playmates

"Advanced"



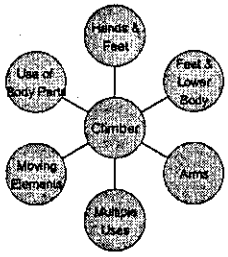
Developmental Progression Comparison

Beginner | Intermediate | Advanced



Differing climbing behaviors with differing climbers

Findings suggest that certain types of playground climbers encourage children to engage in certain types of climbing behaviors.



Hands & Feet Required

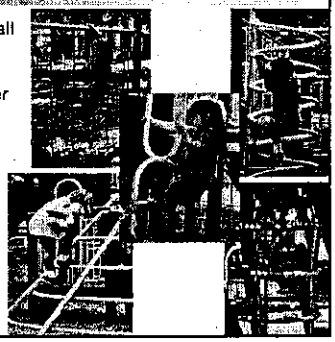
Cargo Net Wall

Chain Link Climber

Corkscrew Climber

Internal Treescape

Trunk Climber



Feet & Lower-body Strength Required

Fat Pipe Climber

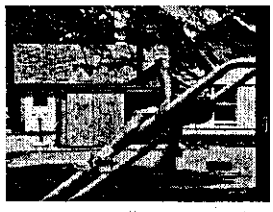
Wave Climber

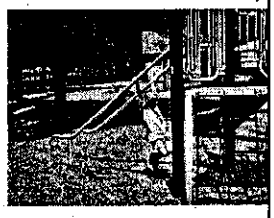
Megarock

Chain Net Climber

Arms & Upper-body Strength Required

Banister Rails

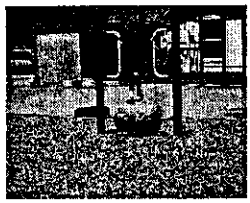




Equipment that promotes multiple uses...

- Banister Rails allow hanging in various ways as well as options for climbing methods (both up and down).
- Cargo Net Wall, Trunk Climber, & Megarock are all wide enough to allow children to move laterally and they accommodate multiple climbers at the same time.
- Internal Treescape Climber & Corkscrew Climber, due to their round shapes, offer the option of climbing on the outside or the inside.
- Wave Climber serves as both a staircase and a slide. It can be accessed with feet and hands, feet only, seats, and sides.

Equipment with moving elements...



Log Roll

Swivel Meister

Climbing events with moving elements elicit balancing behaviors.

Equipment on which children used parts of the body other than their hands & feet...

Banister Rails
Internal Treescape Climber
Trunk Climber
Megarock
Log Roll
Cargo Net Climber
Wave Climber
Corkscrew Climber

Difficulty level of each climber

To assess a climber's difficulty level, each climber's codings were compiled and evaluated.

Those which had more children ranked as "beginner" because of slower, more cautious speeds were deemed more difficult than those climbers which had a majority of "intermediate" and "advanced" children.

The most difficult climber is...

Based upon the findings of this study, the most difficult climber is the Trunk Climber due to its:

- Small round areas on which to place feet
- Large vertical spaces between rungs
- Height
- Steep incline

Why?

For "beginner" climbers, the Trunk Climber presents a high level of difficulty because the *height* and *incline* create a visual intimidation, evoking an initial fear response.

Once on the equipment, the large spaces between the lower rungs are challenging for short legs.

For "intermediate" climbers, the steep *incline* discourages attempts of climbing down.

Most beneficial climber

Considering all the evidence presented in this document and after much deliberation over **THE** most beneficial climbers, it is concluded that there are 3 types of "most beneficial" climbers.

Open-Ended
Challenge
Use

Open-Ended Climbers

Climbers that do not limit the way children can use the equipment are beneficial for promoting creative play.

Space

Location

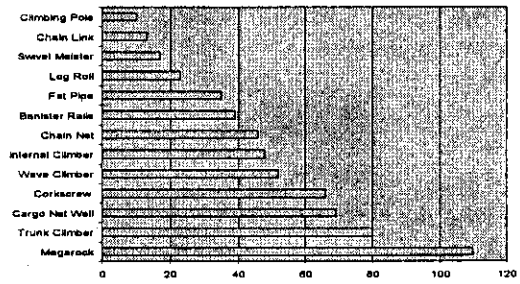
Function

Challenge

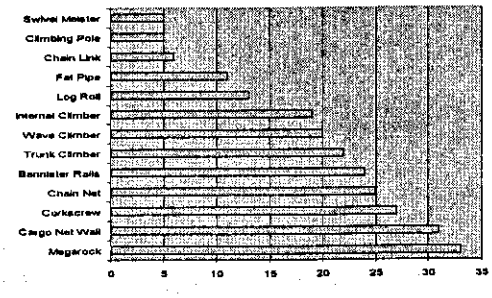
The most beneficial climbers with regard to challenge are those which allow for the progression and development of skill.

Log Roll
Trunk Climber
Climbing Pole
Banister Rails
Cargo Net Wall

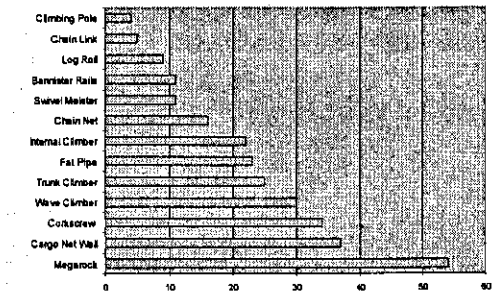
Total Use of Climbers (608 codings)



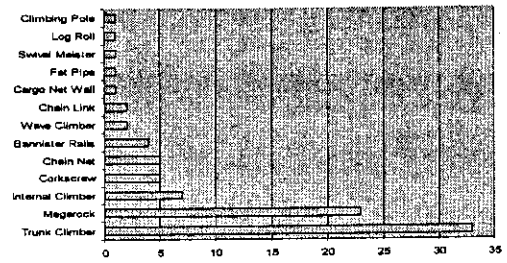
Kindergarten Climber Usage



First Grade Climber Usage



Third Grade Climber Usage



Assessing THE most beneficial climber...

- Desire for open-endedness and creativity in children's play
- Promoting physical development in the children's climbing abilities
- Choosing climbers that are of high interest for children in various age groups

Which climbers are most beneficial? It depends.

DISCUSSION

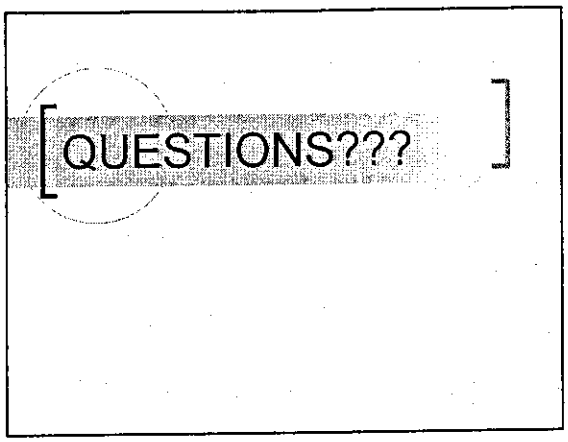
Discussion of Findings

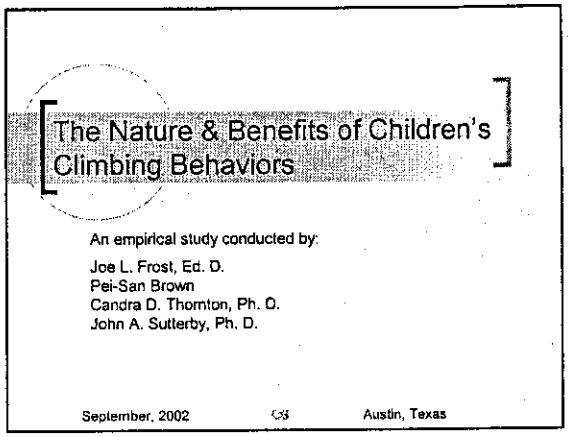
- Stature and ability are mutually dependent
- Stature leads to preferences
  (Rise Height + Skill = Preference)
- Ability (or lack of) leads to preference

RECOMMENDATIONS

Blending HOW children climb with WHY children climb, the following recommendations are made:

- Consider the physical stature of the children who will be using the equipment.
- Evaluate the motivation for deciding which climbers to include in the play structure.
- Address the declining physical fitness level in placement of challenging components.
- Incorporate the need for and enjoyment of social interaction in the climbers.


QUESTIONS???


The Nature & Benefits of Children's Climbing Behaviors
An empirical study conducted by:
Joe L. Frost, Ed. D.
Pei-San Brown
Candra D. Thornton, Ph. D.
John A. Sutterby, Ph. D.
September, 2002
Austin, Texas