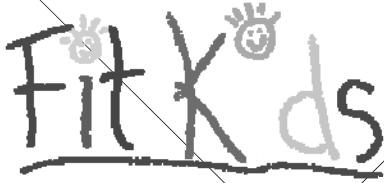


Children and Trainability; Participation in Sport



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Children and sport: the debate

- Early specialization advocates the link btw quantity of training with skill proficiency
- Early diversification advocates multilateral development and fundamental skill mastery

Eg. Baker, High Ability Studies, 2003

Early Specialization

- “deliberate practice” – effortful practice that lacks inherent enjoyment with the sole purpose of improving current levels of performance – required at a young age

Ericsson et al., Psychological Review, 1993

- 10 year rule (Simon & Chase, 1973)
- Power Law of Practice (Newell & Rosenbloom, 1981)

Cornerstones of Early Specialization

Power Law of Practice

- Learning occurs at a rapid rate after the onset of practice, but decreases over time as practice continues

The 10-year Rule

- It takes a minimum of 10 years and 10,000 hours of training for a talented athlete to reach elite levels.

Consequences of Early Specialization

- Limit overall motor skill development
- Stifle sociological and psychological development
- Training without adequate recovery leads to staleness and/or burn out
- May lead to drop out

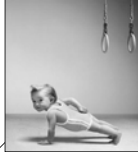
Learning from Experience

Olympic Excellence:

- Olympians had their first exposure to the sport at 11.5 - 12.0 yrs of age
- Took 12 to 13 years for talent development
- Average age >24 yrs
- Medallists received motor skill development and training at an earlier age
- Difference was years of training after 18yrs of age (Baker et al., J Appl Sport Psych, 2003)

“Olympic victors were those who did not squander their powers by early training”

Aristotle, 300 BC



Early Diversification

- Early sport involvement in play-like environments
- “cross training” effect with cross-over of skills (spatial awareness, decision making...)
- Transferable elements in movement, perceptual and conceptual elements

Baker et al., J Appl Sport Psych, 2003

Transferable elements

- Movement
 - Throw a baseball, volleyball spike
- Perceptual
 - Hockey, soccer etc interpret actions of opponents to inform decisions
- Conceptual
 - Strategies (offense, defence), tactics (1 on 1, 2 on 1), guidelines and rules

Maturation: A *Wild Card*

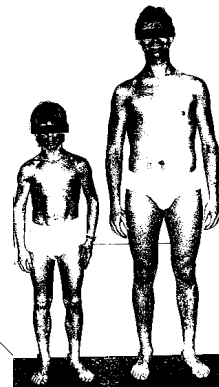
- Significant changes during puberty make the prediction of adult performance difficult
- Performance is influenced by maturation of the body systems

“The range of variability between individuals of the same chronological age in somatic and biological growth is large and especially accentuated around the adolescent growth spurt.”

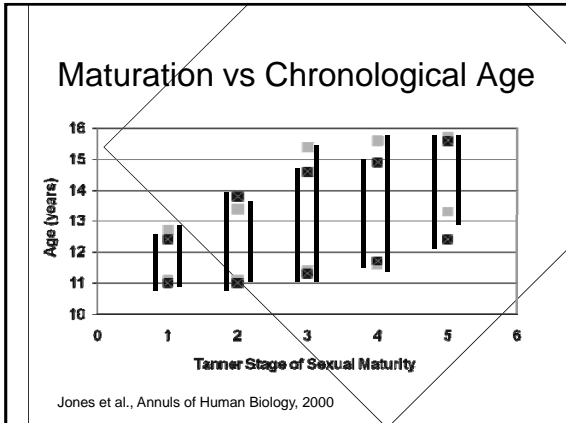
Mirwald et al., 2002

Maturation Varies

	Small	Large
• Age	12 yr	12 yr
• Wt	37 kg	74 kg
• Ht	147 cm	179 cm
• Grip	53 kg	110 kg
• Speed	7.6 m/s	8.3 m/s
• Impact	1010 N	1722 N



Roy et al., Physician and Sports Med, 1989

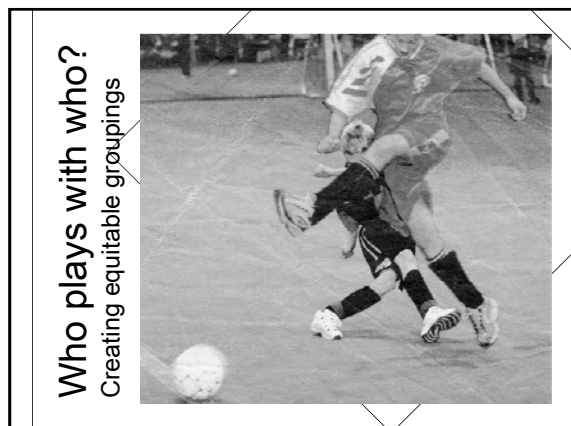
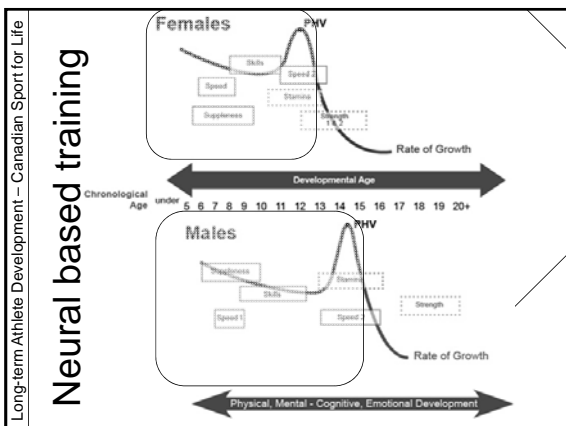
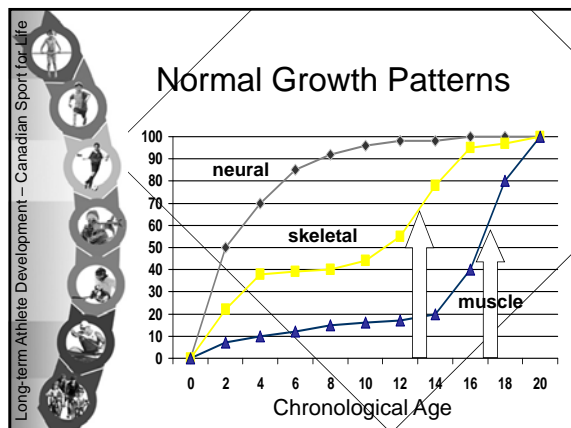


Effect of puberty on physical and physiological parameters

	Effect	Increase	Age	Trainable	Hormone Mediated
Ht	Increase	17-18%	13	no	yes
Wt	Increase total mass	40%	14	yes	yes
Muscle Mass	Increase muscle mass	20%	14	yes	yes
Body Fat	Increase in total fat	50%	steady	yes	yes
VO2 L/min	Steady increase (FFM)	70%	>12	yes	yes
VO2 ml/kg/min	Steady or small decrease (FM)	gender	<12	yes	no
Anaerobic Power	Rapid increase during puberty	50%	14-16	yes	yes
Anaerobic Capacity	Steady through adolescence	200%	16+ ?	yes	yes
Strength	Dramatic increase with mass	150%	14-16	yes	yes
Agility	Increase in adolescence	20%	?	yes	partially
Skill	Related to practice (best during adolescence)	?	?	yes	partially

Trainability of Children

- **Adaptation:** refers to changes in the body as a result of a stimulus that induces functional and/or morphological changes in the organism.
- **Trainability:** refers the responsiveness of developing individuals to the training stimulus at different stages of growth and maturation.
- **Critical Period:** refers to the point in the development of a specific capacity when training has an optimal effect; where the stimulus is timed to achieve optimum adaptation.

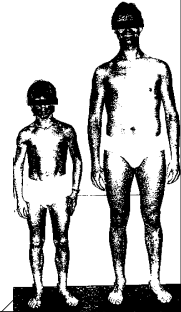


The Purpose of Sport Classification Systems

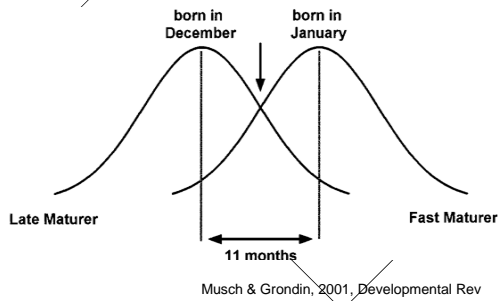
- Equitable competitive groupings
- Increase satisfaction
- Great chance for success
- Decrease drop-out
- Decrease injuries related to competition

Categories Based on Chronological Age

- Assumes biological maturation proceeds along a standard time course or chronology
- Little variance in maturation across a span of two chronological years

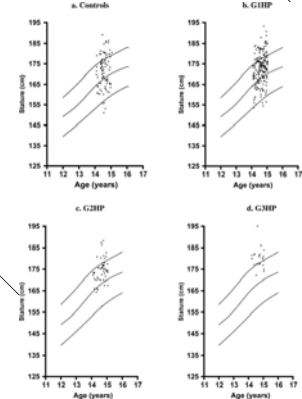


RAE and Maturation

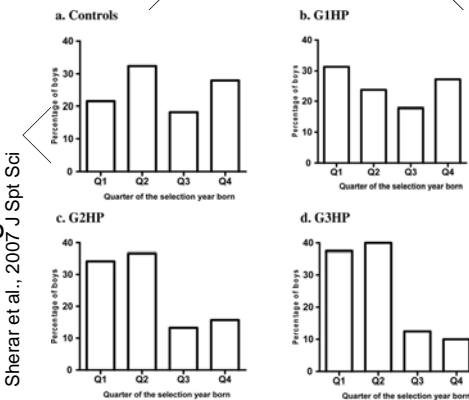


RAE Hockey

- Stature of players on various teams
- G1HP Bronze
- G2HP Silver
- G3HP Gold



Relative age on teams



Relative Age Effects

- Relatively older children within an annual age grouping are more likely selected for competitive and/or school sports teams

- Malina et al., 2005, J Spt Sci
- Musch & Grondin, 2001, Developmental Rev
- Giacomini, Percept and Motor Skills, 1999
- Baxter-Jones & Helms, 1996

- Persist into professional sports
- Nolan & Howell, Int Rev Social Sport, 2010
- Dudink, 1994



RAE "Rep (AAA)" Hockey

	Ages	Q1	Q2	Q3	Q4
Minor Novice	8	123	103	68	30
Novice	9	125	105	45	49
Minor Atom	10	142	139	57	40
Atom	11	145	121	83	34
Minor Peewee	12	154	104	71	57
Peewee	13	129	124	87	32
Minor Bantam	14	162	124	78	29
Bantam	15	150	130	74	44
Midget	16, 17	130	138	97	64
Totals		1260	1088	660	379
		37%	32%	19%	11%

70%

Hurley, 2009, Eur J Operational Res

RAE "House" Hockey

	Ages	Q1	Q2	Q3	Q4
Novice	8, 9	3108	3598	3573	3158
Atom	10, 11	2990	3423	3463	3270
Peewee	12, 13	2333	2836	2763	2683
Bantam	14, 15	1582	1862	1925	1879
Midget	16, 17	640	835	906	842
Totals		10,653	12,554	12,630	11,832

48%

Hurley, 2009, Eur J Operational Res

NHL Players

	1982	1996	2000	Total	Percent
Born Jan - June	442	664	711	1817	61.5 %
Born Jul - Dec	273	427	442	1142	38.5 %

60 – 70% of the players were born between January and July, depending on the year you examine

- ### Static Birthdate Enrolment
- Chronological age discriminates against individuals born late in the age category
 - 60% of junior ranked tennis players were born in the first 3 months (Dudink, 1984)
 - 50% of elite soccer and tennis players born in first 3 months; 70% in the first 6 months (Baxter-Jones & Helms, 1996)

- ### Why Used?
- Easy – look at birth certificate
 - Easier – using December 31st as a cut-off as year of birth is all that is required
 - Expertise – none required
 - Expense – little to none
 - School – relates to grades in school
 - Historical – its always been done this way
- None of which address the purpose of classification systems*

Chronological age based categorization of children for sport and competition is one of the longest standing, scientifically unsound practices used in sport today

Other options for classification



Weight

- Competitors lose 5-10% of their body weight to compete in a lighter class

Problems associated with severe weight loss in growing children:

- Reduced blood testosterone (Strauss et al., 1985)
- Growth hormone resistance (McMurray et al., 1991)
- Reduced protein nutrition (Horswill et al., 1990)

Maturational Age

- Crampton (1908) advocated the use of “physiological” or maturational age
- Examines secondary sex characteristics
 - pubic hair/breast development (Tanner, 1962)
- Related to gonadal steroid concentrations and muscle mass

Maturational Age

- Haffner et al. (1975) matched participants based on Tanner stages
 - 2% of matched incurred significant injury
 - 50% unmatched had significant injury
- Physiological function more related to maturation than chronological age

Skeletal Age

- Chronological age and skeletal age rarely progress at the same rates (Katzmarzyk et al., 1997)
- Rotch (1909) advocated “anatomic age”
- Related to hormones and performance
 - Body size has a significant effect
 - Physical work capacity, strength and functional strength, tissue development and physique
 - Mixed findings in regard to motor performance because of “learning effect” and hence time

Multiple Regression Models

- Height and weight are related to skeletal and maturational age
- Methods have used this association
 - Reilly (1917) age, grade, Ht, Wt and gender
 - McCloy (1920) age, height and weight
- Mirwald et al. (2002) height, sitting height, weight and age
 - Proposed equalize competition, enhance chances of success and potentially reduce injuries

Impulse Potential

- Using factors the child can not manipulate
 - No weight
- Independent of motivation
- Using simple, easily obtained measures
 - Ht, age, forearm girth and calf girth
- Represents the child's gross ability to generate force

Anderson & Ward, 2002

“...classification into age maturity categories instead of classification into mere chronological age categories will lead to fairer competition in youth sports.”

Beunen et al., 1981

Birthdate Rotation

- Rotate the cut-off age by 3 months each year
- Every four years a child's birthdate would put them in the “oldest” 25%
- Does not address early/late maturation
- Not as easy (birth year can not be used)

Hurley, 2009, Eur J Operational Res

“Equitable classification of participants in youth sport remains an important but unresolved issue.”

Mirwald et al., 2002

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