NEUROSCIENCE OF PLAY

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Eva de Gosztonyi, co-ordinator
Centre of Excellence for Behaviour Management
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"Building the Capacity of the English School Boards of Quebec"

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KEY CONCEPT # 1

THE BRAIN TAKES TIME TO DEVELOP

- Many parts of the brain need to create connections to work together
- We must create the conditions for growth of all the parts of the brain

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BRAIN DEVELOPMENT

HOW LONG DOES IT TAKE TO "GROW" A FULLY FUNCTIONING HUMAN BRAIN?

AT LEAST
25 YEARS – IF ALL GOES WELL

MUCH LONGER, ESPECIALLY IF EXPERIENCING STRESS AND TRAUMA

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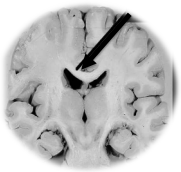
INTEGRATIVE -PROBLEM SOLVING BRAIN

PREFRONTAL CORTEX	CORPUS CALLOSUM (THE BRIDGE)	LEFT & RIGHT HEMISPHERE



TWO THOUGHTS AT A TIME	CONNECTS THE LEFT AND RIGHT PARTS OF THE BRAIN	THE FACTS & THE WHOLE

only starts to engage at the age of 5 years-old

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BRAIN DEVELOPMENT

Birds and animals all have divided brains,

- **one hemisphere for the narrow attention that enables them to lock onto whatever it is they need to get**. e.g. seed amongst pebbles
- **one hemisphere for vigilant attention** to **the world at large**, **so as to make sense of it**, on the look-out for whatever else may exist – e.g. in order to avoid getting eaten

Humans:

- we use our LEFT HEMISPHERE **to grasp & manipulate**
- the RIGHT HEMISPHERE to understand the world at large and how things within it **relate to one another**, as well as our relationship with **it as a whole**.

The Master and His Emissary: Iain McGilchrist 5

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BRAIN DEVELOPMENT

The **left hemisphere's** raison d'être is to **narrow things down to a certainty,**

The **right hemisphere's** is to **open them up into possibility**.

In life we need both.

The **right hemisphere appreciates that all things change and flow, and are never**

fixed and static as the left hemisphere sees them.

Nor are they isolated and atomistic (left hemisphere),

but **reciprocally interconnected** (right hemisphere).

There is evidence that those of highest intelligence, whatever their discipline, may rely more on the right hemisphere.

The Master and His Emissary: Iain McGilchrist 6

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BRAIN DEVELOPMENT

The right hemisphere:

- **sees more**
- is more in touch with reality
- is more intellectually sophisticated.

The **left hemisphere:**

- **does not understand things**, so much **as process them**.

It is the **right hemisphere** that is the basis of understanding.

I believe there has been until very recently a blindness among neuroscientists to the contributions made by the right hemisphere. (p. 129)

The Master and His Emissary: Iain McGilchrist

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LEFT HEMISPHERE	RIGHT HEMISPHERE
• learns facts • de-contextualized • focus is on details and rules • abstract • wants THE answer	• looks at the whole picture • makes sense of the details • considers context • seeks understanding

RIGHT HEMISPHERE IS IN RAPID DEVELOPMENT DURING EARLY CHILDHOOD

RIGHT HEMISPHERE REQUIRES EXPERIENCES NOT INFORMATION TO DEVELOP

AND THUS, THE NEED FOR PLAY- LOTS OF PLAY

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BRAIN DEVELOPMENT

BRAIN HEMISPHERES AND DEVELOPMENT

Between **1 and 3 years of age**, the blood flow shows a **right hemispheric predominance**, mainly due to the activity in the posterior associative area.

Asymmetry **shifts to the left after 3 years**. The subsequent time course of changes appear to follow the emergence of functions localized initially on the right, but later on the left hemisphere (i.e. visuospatial and later language abilities).

These findings support the hypothesis that, in man, the **right hemisphere develops its functions earlier than the left.**

C Chiron I Jambaque R Nabbout R Lounes A Syrota O Dulac *Brain*, Volume 120, Issue 6, 1 June 1997, Pages 1057–1065, https://doi.org/10.1093/brain/120.6.1057

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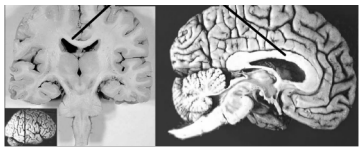
BRAIN DEVELOPMENT

CORPUS CALLOSUM DEVELOPMENT



- undergoes a growth spurt between ages 3 and 6,
- results in improved coordination between right and left hemisphere tasks.

For example, in comparison to other individuals, children younger than 6 demonstrate difficulty coordinating an Etch-A-Sketch toy because their corpus callosum is not developed enough to integrate the movements of both hands (Kalat, 2016).

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KEY CONCEPT # 2

PLAY PROVIDES THE IDEAL CONDITIONS FOR BRAIN DEVELOPMENT

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PLAY AND THE BRAIN

WHAT IS PLAY?

Play is characterized by a sense of FREEDOM and ENGAGEMENT

Dictionary - "to move or operate freely in a bounded space"

"I need to see you and you need to see me."
Teacher, Forest Kindergarten

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PLAY AND THE BRAIN

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PLAY AND THE BRAIN

	PLAY	WORK
the focus	the ACTIVITY	the OUTCOME
what engages	the ACTIVITY	the OUTCOME
where the fun is	the ACTIVITY	the OUTCOME

Activities more likely to be Work or be made into Work

- Craft activities requiring a specific outcome
- Singing a song to learn the words for a reason
- Where the outcome will be praised or rated
- Most screen time (computer, iPad, tablets etc.)

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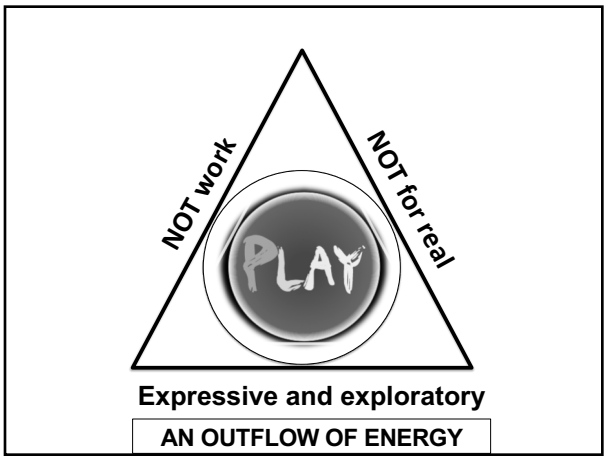

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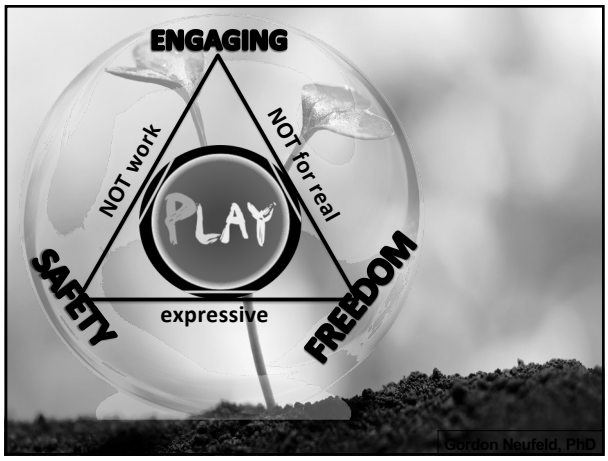

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PLAY AND THE BRAIN

PREFRONTAL CORTEX (PFC) – Executive Functions

Sustained engagement in an activity demands the ability to stay selectively focused on the situation at present, tune out distractions, and hold the information in our heads (Diamond, 2013).

We can observe **the effects of active engagement** on **executive function skills** (EFs) in a study comparing children assigned to Montessori and non-Montessori schools, which discovered that the Montessori children, **who had fewer interruptions during their learning activities**, performed better at **EF tasks** than the other group (Lillard & Else-Quest, 2006, as cited in Carlson, Zelazo, & Faja, 2013)

Liu – Neuroscience and Learning p. 15 18

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PLAY AND THE BRAIN

PREFRONTAL CORTEX (PFC) – Executive Functions

"One function of play is to **take you to the edge of your emotional knowled**ge, so you can learn what you can and cannot do to others."

Jaak Panksepp: Brain World

Behavioural neurobiologists have found that **ROUGH AND TUMBLE PLAY**, which can ride the edge of ambiguity and requires continual reassurances, generates the neural circuits that enable **animals to ACCURATELY READ AMBIGUOUS SOCIAL SIGNALS**, thus building their social intelligence and capacity for relationship. Panksepp,2004; Pellis, 2010

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PLAY AND THE BRAIN

PREFRONTAL CORTEX (PFC) – Executive Functions

Social interactions in **rodents** characterised as **ROUGH-AND-TUMBLE PLAY** appear to shape the **PFC (Prefrontal Cortex) and have an impact on self regulation and planning**

Bell, Pellis, & Kolb 2010; for reviews also see Pellis & Pellis, 2007; Pellis, Pellis, & Himmler, 2014

In addition, in **humans** play **facilitates the maturation of the frontal lobe inhibitory skills** that enable a child to **reflect, look, listen, and feel** before acting on primary-process emotional urges. This promotes **empathy, imagination, and creative play.**

Panksepp 2007

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PLAY AND THE BRAIN

PLAY CUES

The defense response to a mortal threat and the excitement of play share their roots in the **same branch of the autonomic nervous system** Porges & Buczynski, 2011

What, then, keeps play from turning violent?

Porges tells us that **play relies on the sense of safety** When not afraid, mammals are able to engage socially and **down-regulate defensive reactions using the "vagal brake"** which caps the older defensive system and makes social engagement possible. Culp,20l0

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PLAY AND THE BRAIN

PLAY CUES

The primary signals for communicating safety and employing the "vagal brake" are in **the face and voice**.

During play bouts **animals continually reassure other that they're still playing** Spinka, Newberry, & Beckoff; 2001

- the **"PLAY FACE"** (aka, **smiling**) and
- **PLAY VOCALIZATIONS** (**laughter**).

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PLAY AND THE BRAIN

According to complexity science, this **dynamic process of integration** occurs at the **edge of chaos**, with **enough order t**o provide stability but **enough dynamism** for the system to continually adapt and grow.

Such an integrated slate enables a system to move toward "**maximizing complexity**," a state that represents the system's optimal functioning.

According to Siegel, optimal functioning systems are **"flexible," "adaptive," "coherent," "energized," and stable"** Siegel, 2001,which he identifies through the acronym FACES.

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PLAY AND THE BRAIN

PLAY AND ADHD

At present, reasonable predictions are that:

- **psychostimulants** will **REDUCE** the natural play urges of human children
- a regular diet of **physical play**, each and every day during childhood, should alleviate ADHD-type symptoms in many children and diminish numbers of kids on the "clinical" track;
- **play** will have long-term pro-social benefits for children's brains and minds, that are not obtained with psycho-stimulants;
- psycho-stimulants may sensitize young brains and intensify internally experienced materialistic and drug desires that may be manifested, if socio-environmental opportunities are available, as elevated drug use (perhaps only in adulthood when parental constraints loosen)

Panksepp – ADHD p. 63 24

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PLAY AND THE BRAIN

PLAY AND ADHD

- if relevant genetic studies can ever be conducted in human children, we anticipate that the **profiles of gene-activation resulting from abundant play and chronic psychostimulants will be vastly different within the brain**.
- If so, we may have sufficient cause to worry and TO DEVELOP SOCIAL POLICIES that **encourage abundant early physical play to promote pro-social brain/mind development**.

Our recent broad-scale brain gene expression analysis has indicated that activity of about of a third of the 1,200 brain genes we evaluated in **frontal and posterior cortical regions are significantly modified by play within an hour of a 30 min play session** Kroes, Burgdorf Panksepp and Moskal, 2006, Unpublished observations from Falk Center for Molecular Therapeutics, Northwestern University.

Panksepp – ADHD p. 63 25

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PLAY AND THE BRAIN

PLAY AND ADHD

Have ADHD children received less social play in childhood? This has never been documented. ***But what if it turned out that a substantial percentage of ADHD kids currently receiving psychostimulants are simply normal kids who have excessive, unsatisfied desires to play, and ADHD symptoms would diminish with play supplementation***?

In our informal efforts to evaluate this, we (at the Memorial Foundation for Lost Children in Bowling Green, Ohio) **routinely counseled fathers in families with young ADHD children** to expend special effort to have **daily periods of happy rough-and-tumble play** with their children. Their feedback was consistently that **such daily activities were beneficial**.

Panksepp – ADHD p. 63 26

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PLAY AND THE BRAIN

- Self-regulation skills were better in those children who were allowed to play without interruption.
- When children are engaged in a play activity they stay selectively focused on the situation at present, tune out distractions, and hold the information in their heads.
- This then allows children to develop the capacity to: **reflect, look, listen, and feel** before acting on primary emotional urges.
- Rough and tumble play – where children "play fight" builds the capacity to read social signals and manage one's behaviour and urges.
- ADHD seems to be related to a deficit in play time. 27

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KEY CONCEPT # 3

A LACK OF PLAY TIME IN THE EARLY YEARS SEEMS TO AFFECTS MENTAL HEALTH, BEHAVIOURAL AND ACADEMIC OUTCOMES

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LOSING THE SPACE TO PLAY

David Elkind in the *Power of Play*

- over the past two decades, children have lost twelve hours of free time a week, including eight hours of unstructured play and outdoor activities.
- free unstructured play, spontaneous pickup games, and self-initiated dramatic play, are replaced by digital devices

Stuart Brown on the *Status of Play* (Encyclopedia of Play Science)

- outdoor play has decreased by 71% in one generation in both the US and the UK.

ESCALATING DIAGNOSES OF CHILDHOOD ANXIETY, DEPRESSION AND ADHD HAS PARALLELED THE LOSS OF PLAY - Peter Gray, 2011

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PLAY and EMOTIONAL WELL-BEING

When children are “stirred up” emotionally, their PLAY can reflect themes they are struggling with.

PLAY is how they naturally make sense of all the emotions they are experiencing.

In PLAY, pictures are drawn, structures are made, and games are engaged in to ALLOW EMOTIONS TO COME OUT in a way that feels “safer”.

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LOSING THE SPACE TO PLAY

Effects of a statewide pre-kindergarten program on children's achievement and behavior through sixth grade

Data through sixth grade from state education records showed that the children randomly assigned to attend pre-K:

- had lower state achievement test scores in third through sixth grades than control children, with the strongest negative effects in sixth grade.
- a negative effect was also found for disciplinary infractions, attendance, and receipt of special education services, with null effects on retention. Durkin, K et al., 2022

Research comparing early versus late readers found later readers

- catch up to comparable levels later on
- slightly surpassing the early readers in comprehension abilities. Suggate, S, 2012

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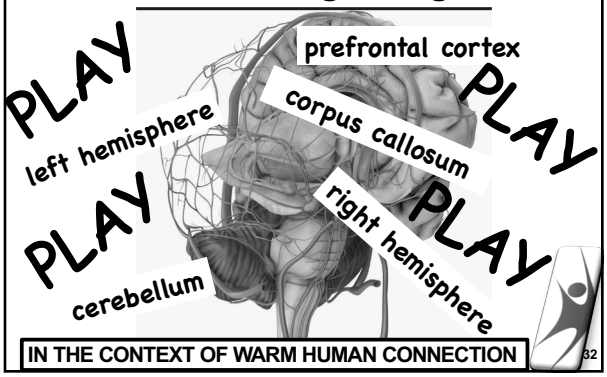
What does it take to build all the connections in a growing brain?



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LET THE CHILDREN PLAY

PLAY
SING
DANCE
EMOTE
COMFORT
REST
PROVIDE GENEROUSLY
FORGIVE EASILY
FEEL YOUR SADNESS
HAVE FAITH IN NATURE'S PLAN

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