The Development of Dreaming in Children

The Maturation of the Neural Network that Supports Dreaming, the Development of Cognitive Skills, and Changes in Dream Content

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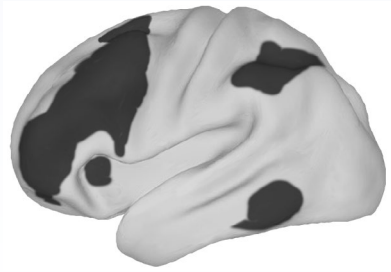
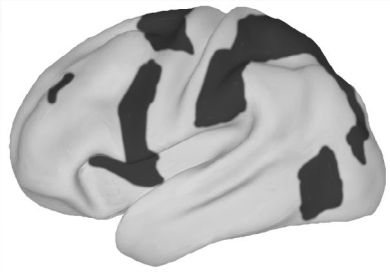
The brain networks involved in perception and cognition

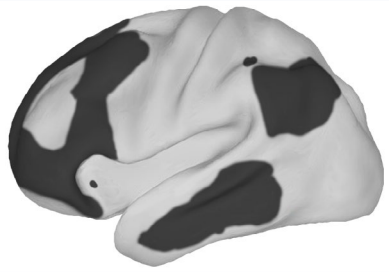
	organizational form	*main functions supported*
Frontoparietal control network (FPCN)	associational, interweaved	top-down control, hierarchical reasoning, executive regulation
Default network	associational, interweaved	internally focused, semantic memory, self-system, imagination
Salience/ventral network	associational, interweaved	attention-shifting, alerting
Dorsal attention network	associational, interweaved	focused thought, task-oriented
Limbic network	associational, interweaved	memory, reward, empathy
Visual Network	hierarchical, linear	processes information on static and moving objects, spatial information
Sensorimotor Network	hierarchical, linear	processes external physical stimuli and internal sensations



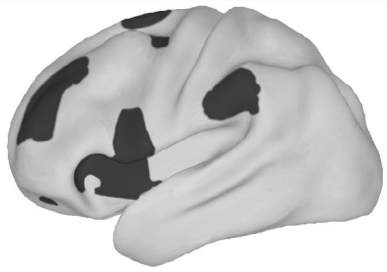
Frontoparietal Control Network



Dorsal Attention Network

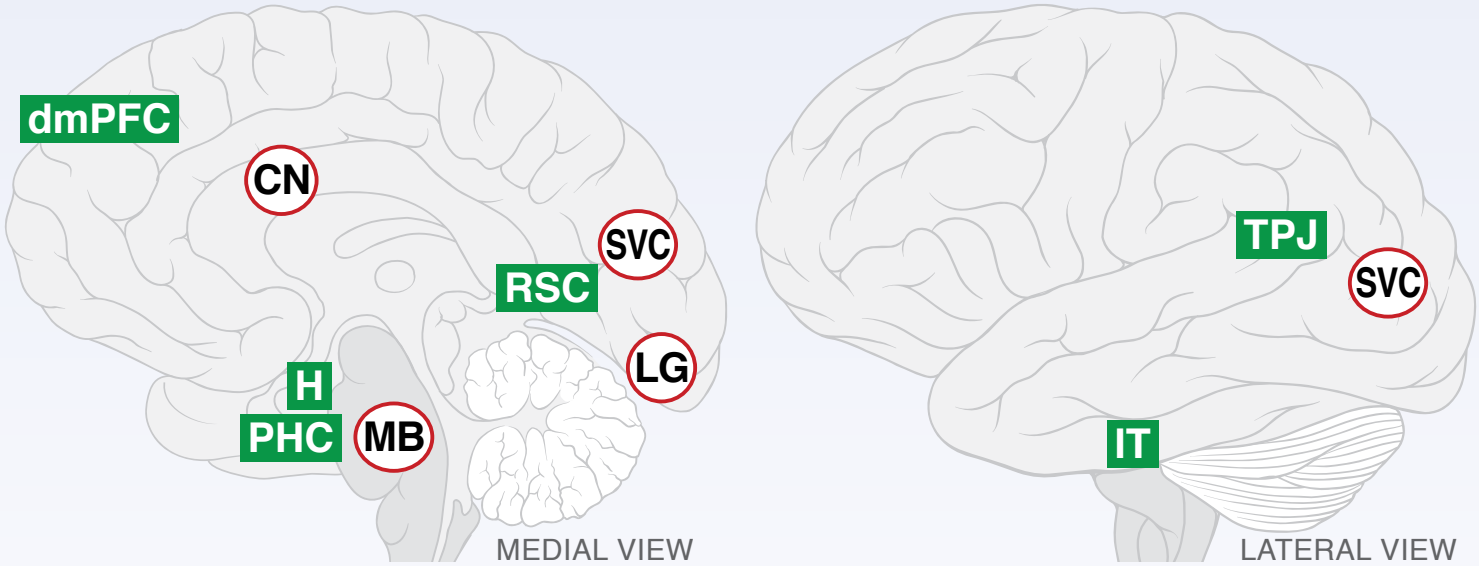


Default Network



Salience/Ventral Network

The neural substrates that support the neurocognitive network underlying dreaming



substrates within the default mode network	dorsomedial prefrontal cortex subsystem	• dorsomedial prefrontal cortex dmPFC • inferior temporal cortex IT • temporoparietal junction TPJ
	medial temporal cortex subsystem	• hippocampus H • parahippocampal cortex PHC • retrosplenial cortex RSC
substrates not in the default mode network	occipital cortex	• secondary visual cortex (V2-V5) SVC • lingual gyrus (visual processing) LG
	subcortical regions	• caudate nucleus (movement) CN • pons/midbrain (arousal, activation) MB

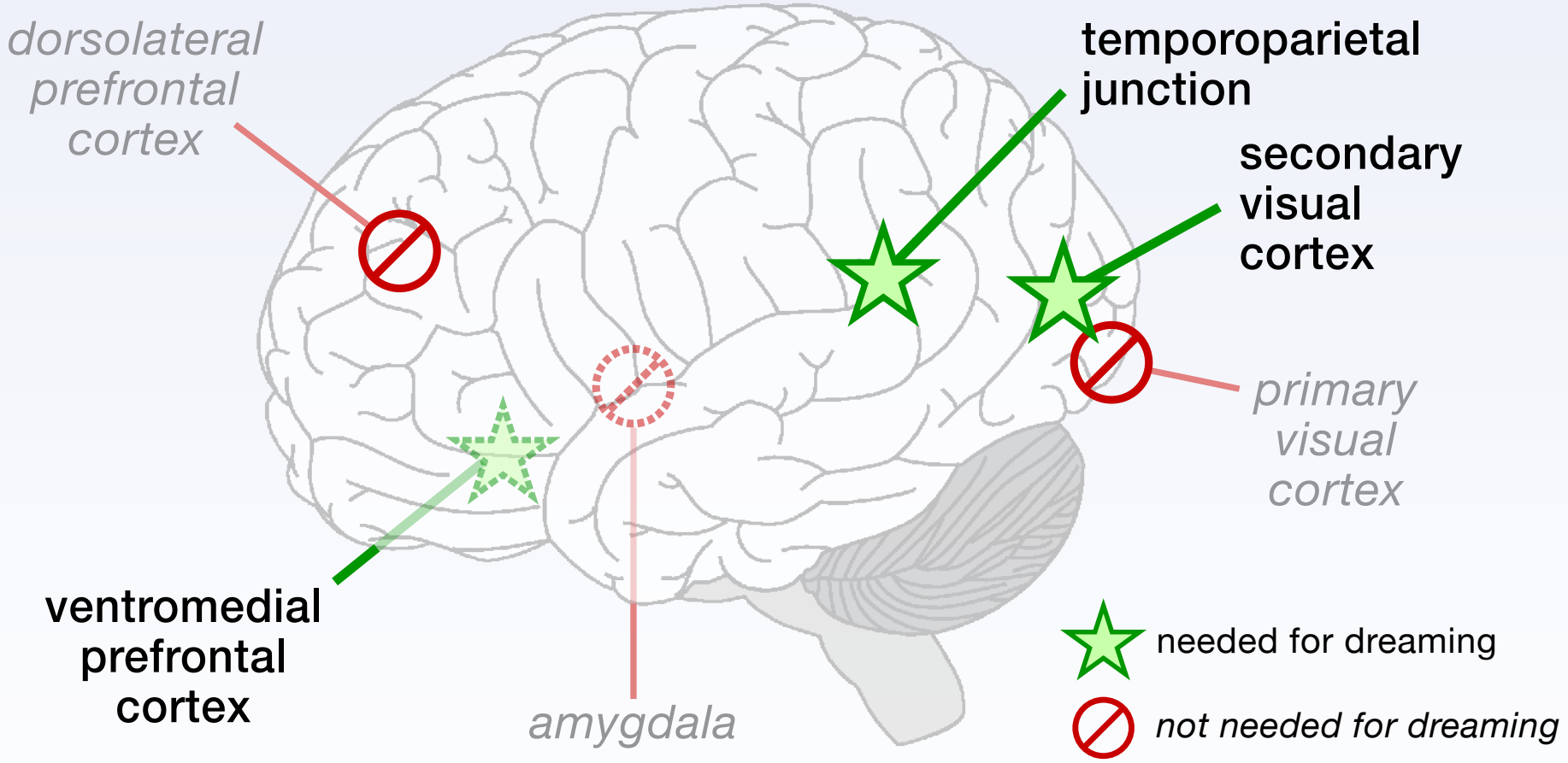
A comparison of the brain regions that subserve waking and dreaming

	Default Network	Neural substrate that supports dreaming
Frontal lobe		
rostrolateral cortex (anterior, frontopolar)	**activated**	relatively deactivated
dorsolateral frontal cortex	**activated**	relatively deactivated
orbitofrontal cortex	**activated**	relatively deactivated
right anterior insula	**activated**	relatively deactivated
rostral anterior cingulate cortex	**activated**	relatively deactivated
dorsal cingulate cortex	**activated**	relatively deactivated
inferior frontal gyrus	**activated**	relatively deactivated
dorsomedial prefrontal cortex	**activated**	**activated**
ventral medial prefrontal cortex	**activated**	**activated**
Parietal lobe		
posterior cingulate cortex (inferior parietal)	**activated**	relatively deactivated
retrosplenial cingulate cortex	**activated**	**activated**
lateral parietal cortex (supramarginal gyrus & temporoparietal junction)	**activated**	**activated**
Temporal lobe		
lateral temporal cortex/temporal pole	**activated**	relatively deactivated
hippocampus (medial temporal cortex)	**activated**	**activated**
parahippocampal cortex (medial temporal cortex)	**activated**	**activated**
entorhinal cortex (medial temporal cortex)	**activated**	**activated**
Occipital lobe (not a part of the default network, but secondary areas are important in dreaming)		
primary visual area (V1)	**activated**	relatively deactivated
extrastriate (V2–5, secondary visual areas)	**activated**	**activated**
lingual gyrus (visual processing)	**activated**	**activated**
Subcortical regions		
caudate nucleus	**activated**	**activated**
pons/midbrain	**activated**	**activated**

A few of the regions of the brain needed and not needed for dreaming — and the effects of lesions in those regions

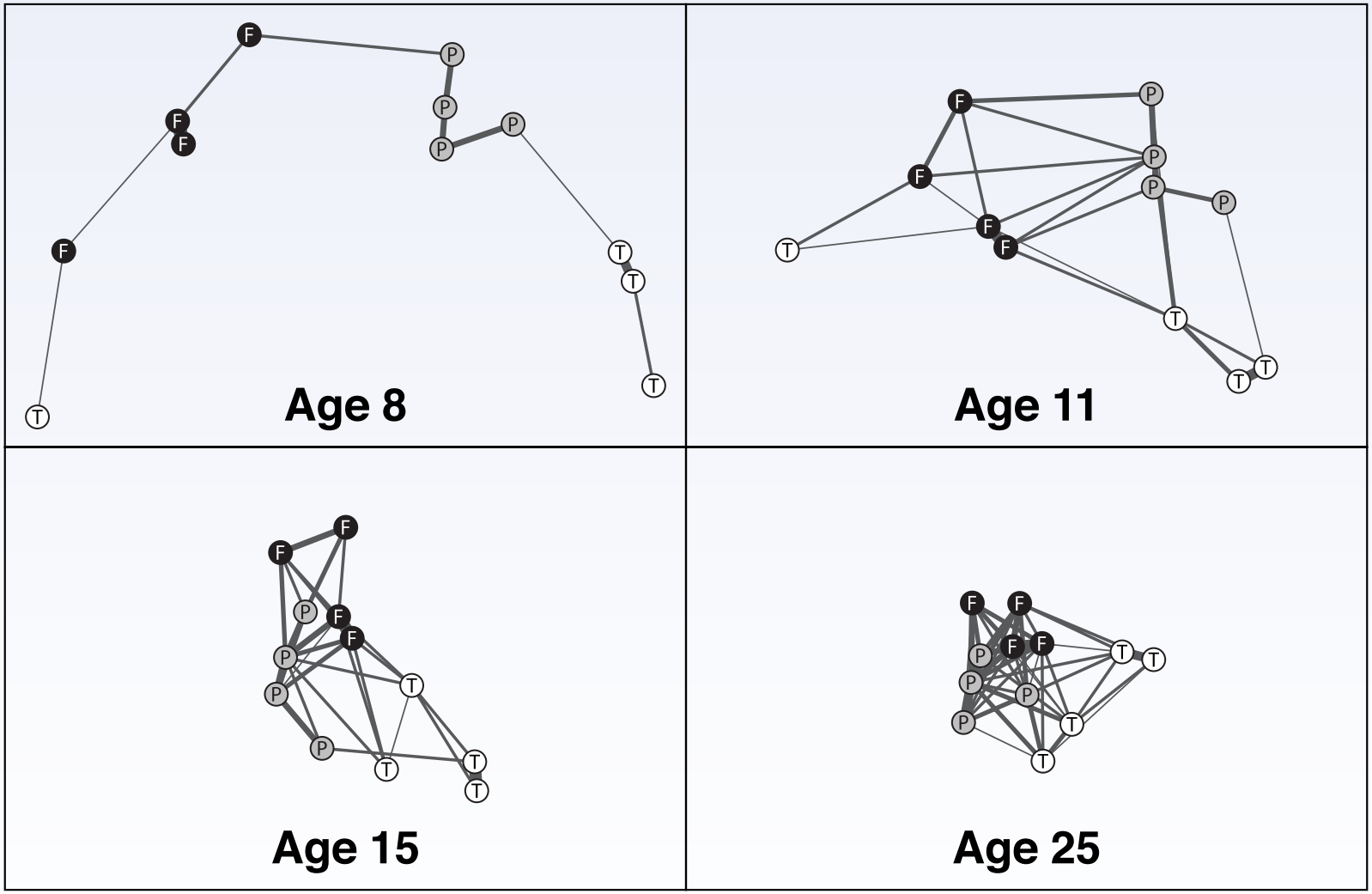
	neurocognitive network	*effect on dreaming of lesions in this area*
Ventromedial prefrontal cortex	Default Network	loss of dreaming
Temporoparietal junction	Default Network	loss of dreaming
Medial occipitotemporal cortex	Sensory Network	distortion or loss of visual imagery
Primary visual cortex	Sensory Network	[no impact]
Dorsolateral prefrontal cortex	Frontoparietal Control Network	[no impact]

Brain regions needed and not needed for dreaming



Note: The dotted lines indicate that the ventromedial PFC and amygdala are located in the medial region of the brain, not on the lateral surface that is shown in this graphic. Five of the six brain areas included in this graphic are also the basis for the previous slide.

The maturation of connectivity in the Default Network



Note: The two bottom panels are "smaller" in a fictive anatomical configuration in order to depict the increasing functional connectivity within the default network. Adapted from Fair et al. (2009).

The development of dreaming

Age	*Dream content*
3–5	Dreaming is very rare if not non-existent; static imagery; very short
5–7	Social interactions occur, but dreamer is often not in the action
7–9	Dreamer more often has a central role in the dream; longer reports
9–11	Dreams adult-like in frequency and complexity
13–15	Dreaming becomes more adult-like in content as well as complexity

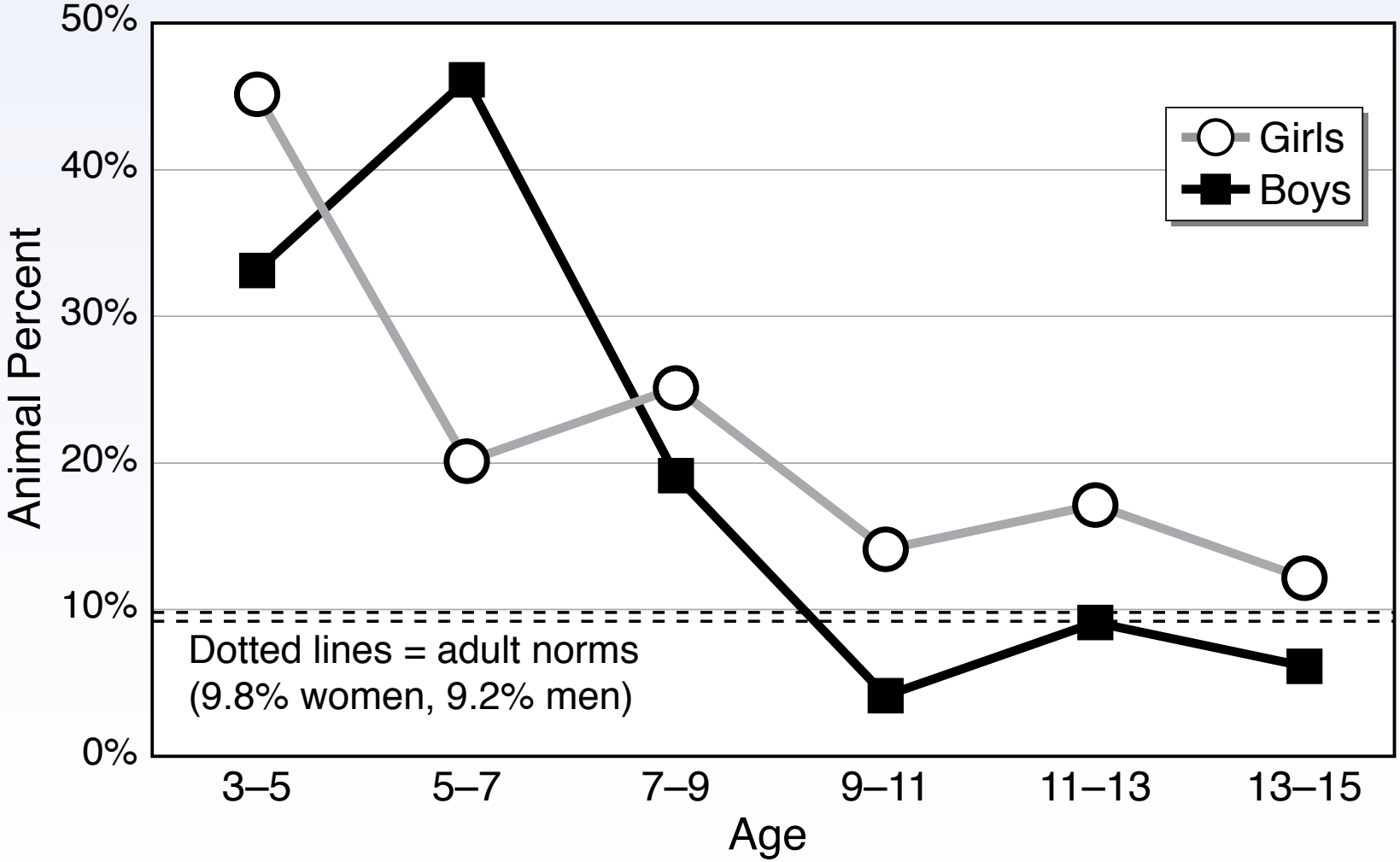
Cognitive skills needed to dream

Dreaming is dependent upon the development of five cognitive processes:

1. The ability to form **concepts**
2. The capacity to generate **mental imagery**
3. The ability to make use of **narrative skills**
4. The development of a **personal memory system** and an **autobiographical Self**
5. The capacity to imagine and then construct a **fully fictional story**

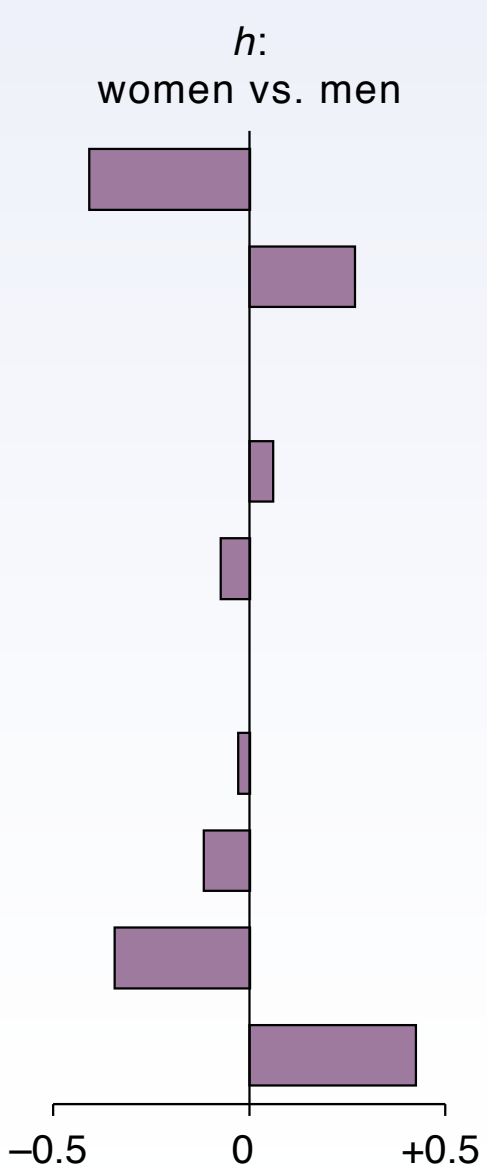
These five cognitive capacities are very likely the basis for the ability to produce mental simulations, which are the general basis for mind-wandering, daydreaming, and dreaming.

Percentage of children's dream reports with at least one animal character



Key differences between men's and women's dreams regarding characters and aggressions

	MALE DREAMERS	FEMALE DREAMERS
Male/Female Percent	67%	48%
Familiarity Percent	45%	58%
F/C Index	.21	.22
A/C Index	.34	.21
Befriender Percent	50%	47%
Aggressor Percent	40%	33%
Physical Aggression Percent	50%	34%
Rejection Percent	18%	36%



Dream reports of 5th- through 8th-grade Bay Area girls, compared to the adult female norms

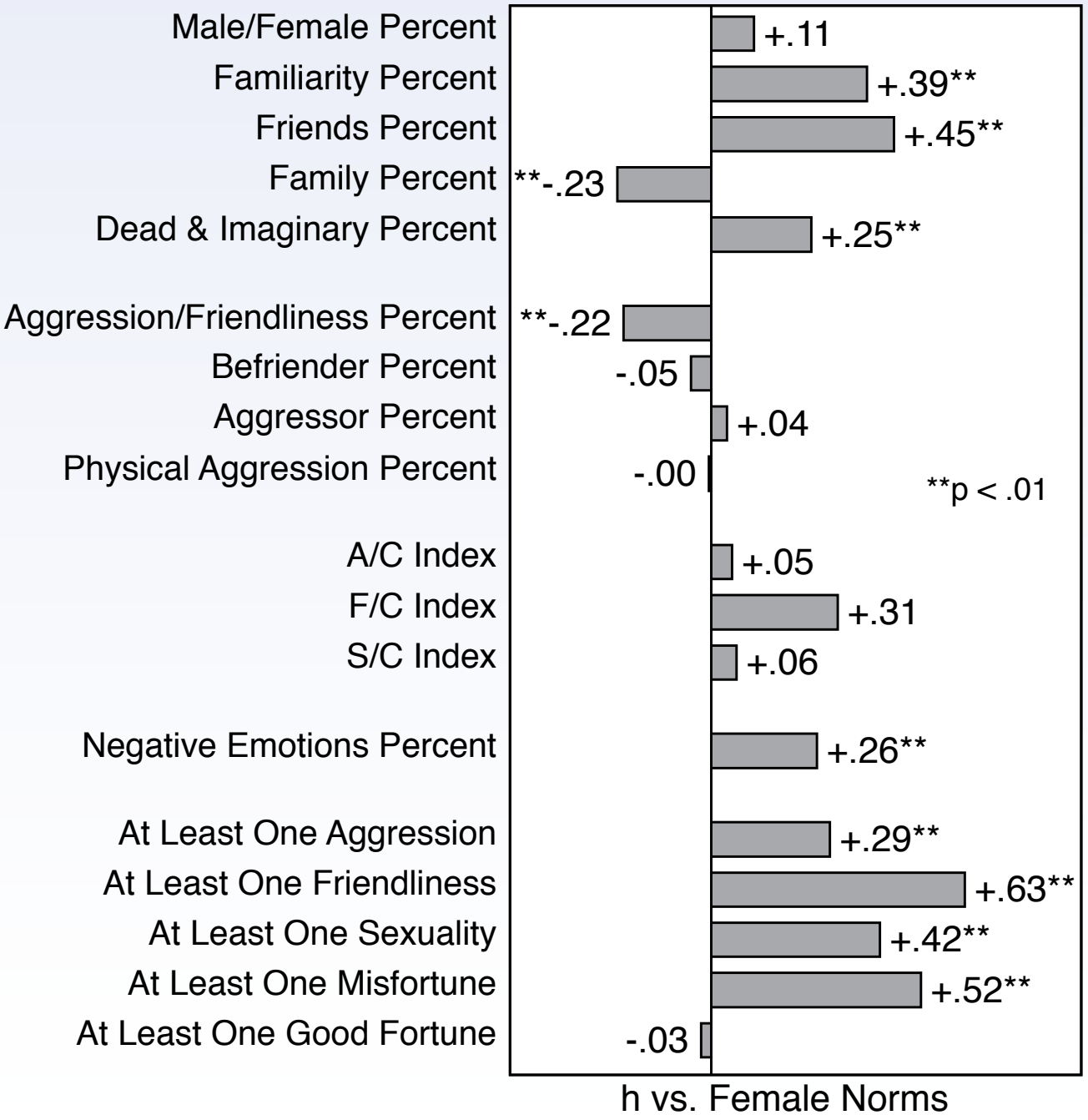
	Grade				Female Norms
	5th	6th	7th	8th	
Characters:					
Male/Female %	38*	48	46	37*	48
Friends %	34	38	35	44	37
Social interactions:					
Aggression/Friendliness %	49	47	52	58	51
Befriender %	39	48	50	40	47
Aggressor %	38	43	25	27	33
Physical Aggression %	57**	67**	56**	47	34
% of dreams with at least one:					
Aggression	33*	31*	37	36	44
Friendliness	31*	37	39	35	42

* $p < 0.05$ ** $p < 0.01$

Dream reports of Greek girls ages 8–12 and 13–18, compared to the adult female norms

	Girls 8–12	Girls 13–18	HVdC Norms
Characters:			
Male/Female %	45%	52%	48%
Friends %	22%	38%	37%
Social Interactions:			
Aggression/Friendliness %	59%	56%	51%
Befriender %	40%	36%	47%
Aggressor %	16%	13%	33%
Physical Aggression %	75%	65%	34%
A/C index	.25	.21	.24
F/C index	.13	.13	.22
Dreams with at least one:			
Aggression	42%	34%	44%
Friendliness	28%	26%	42%

h-profile of "Bea"



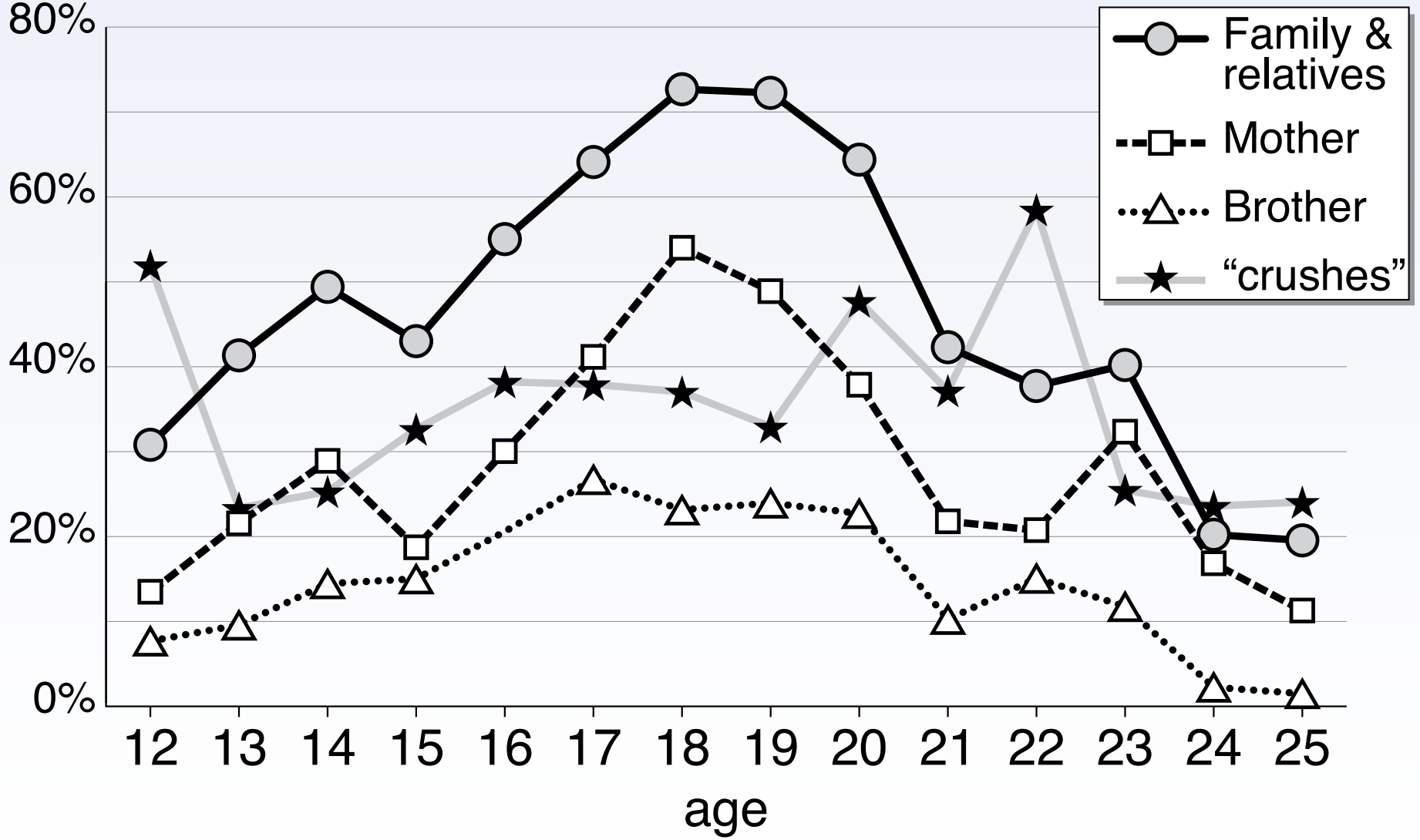
Number of dreams containing various familiar character subclasses in the Female Norms and in the dreams of "Izzy" and "Jasmine"

	Female Norms ($n = 491$)	Izzy ($n = 4329$)		Jasmine ($n = 664$)	
		f	*h*	*f*	*h*
Family	33.6%	56.3%	+.46*	72.7%	+.81*
Mother	12.6%	34.9%	+.54*	55.6%	+.96*
Father	8.8%	19.6%	+.32*	42.3%	+.82*
Parents & siblings	26.3%	53.3%	+.56*	70.8%	+.92*
Relatives	9.2%	15.9%	+.20*	11.9%	+.09
Friends & acquaintances	59.1%	42.4%	–.34*	39.0%	–.40*
Celebrities	3.5%	35.7%	+.91*	12.7%	+.35*
ALL familiar characters	78.2%	86.5%	+.22*	86.9%	+.23*

*$p < 0.001$

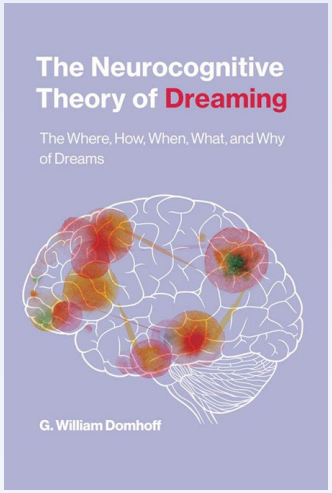
h values are from a comparison of each individual series to the Female Norms.

Percentage of Izzy's dream reports containing family members and "crushes," by age



Four Surprising Observations

1. All of the slides in this presentation are based on descriptive empirical findings that were discovered by a large number of independent researchers who had no preconceptions or hypotheses when they carried out their studies. Moreover, by and large, they did not know of each other's work while they were carrying out their studies. (However, the Most Recent Dream studies in Italy, Spain, and Greece were undertaken to see if there were differences from the earlier Most Recent Dream findings in the United States.)
2. None of the several theorists with an already-existing theory of dreaming has ever attempted to explain the findings presented in this pdf within the context of their theory. One theory group claimed the longitudinal sleep-dream laboratory findings were not accurate, and therefore ignored them, but none of the others have acknowledged any of this work.
3. It is unlikely that any of the rival theorists could explain these findings even if they tried to do so. These findings are not explainable within the context of their various theories.
4. These findings do not fit with any extant hypotheses concerning the adaptive function of dreaming for humans, whether during sleep or in the waking state. All of these various hypotheses assume that children's dreaming is much like that of adults. The fact that there is little or no dreaming until ages 9–11 means that all of the adaptive functions that are attributed to dreaming, whether during sleep or waking, must be carried out independent of dreaming in the first decade of human life. What those with hypotheses about the adaptive function of dreaming need to explain is why all of a sudden dreaming becomes needed during preadolescence to help carry out its alleged functions.



For more information on children and dreaming, see Chapters 6 and 7 of:

The Neurocognitive Theory of Dreaming
(MIT Press, 2022)

Open Access download available:
https://dreamresearch.net/NCTD/

For detailed information on carrying out good quantitative and statistically sophisticated studies of dream reports — and a link to this presentation:
https://dreamresearch.net/

For 27,000+ dream reports and several tools for studying them, including information on how to create word strings for salient aspects of representative sample of dream reports, or lengthy dream series consisting of dreams from an individual: **https://dreambank.net/**

For a 16-slide presentation on how to collect the fastest, largest, and most accurate samples of dream reports for studies of people from ages 8-9 to old age: **https://dreamresearch.net/Library/domhoff_2016.pdf**

For any questions on dreams or on collecting dream reports, please feel free to contact G. William Domhoff at **domhoff@ucsc.edu**.