





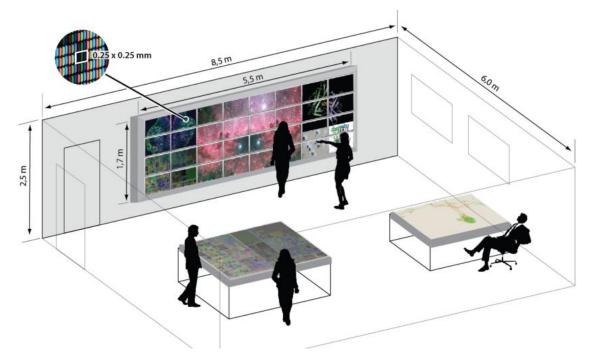


Hybrid-Image Visualization for Large Viewing Environments

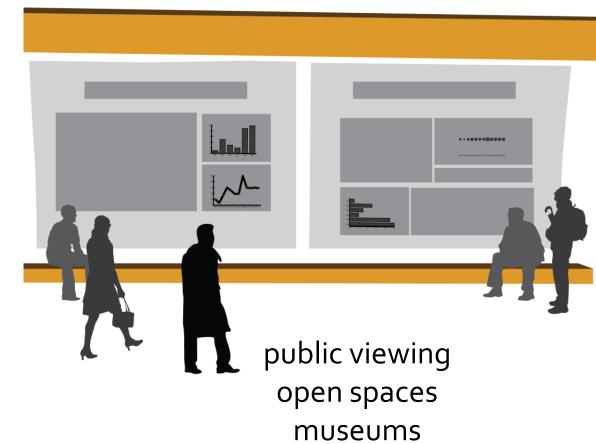
Petra Isenberg, Pierre Dragicevic,

Wesley Willett, Anastasia Bezerianos, Jean-Daniel Fekete

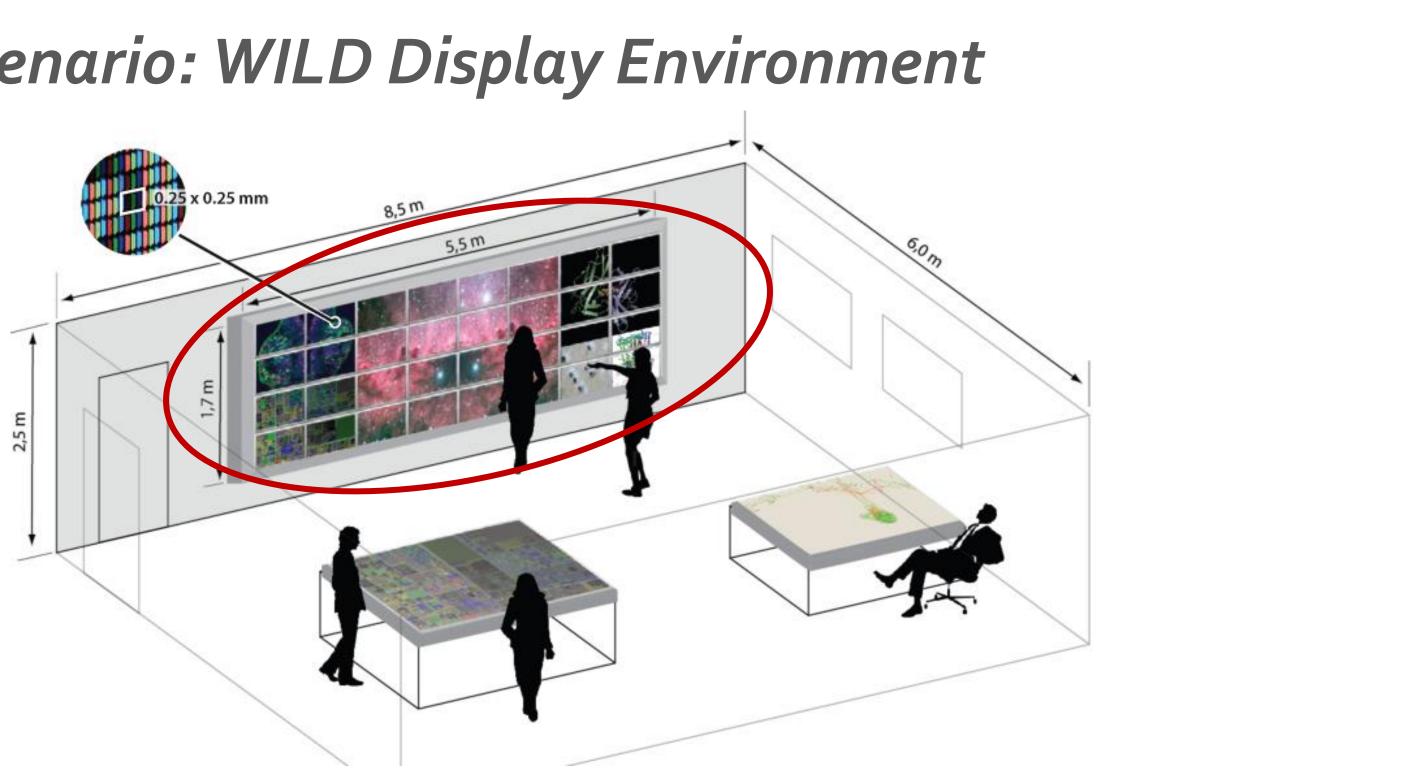
Large Viewing Environments



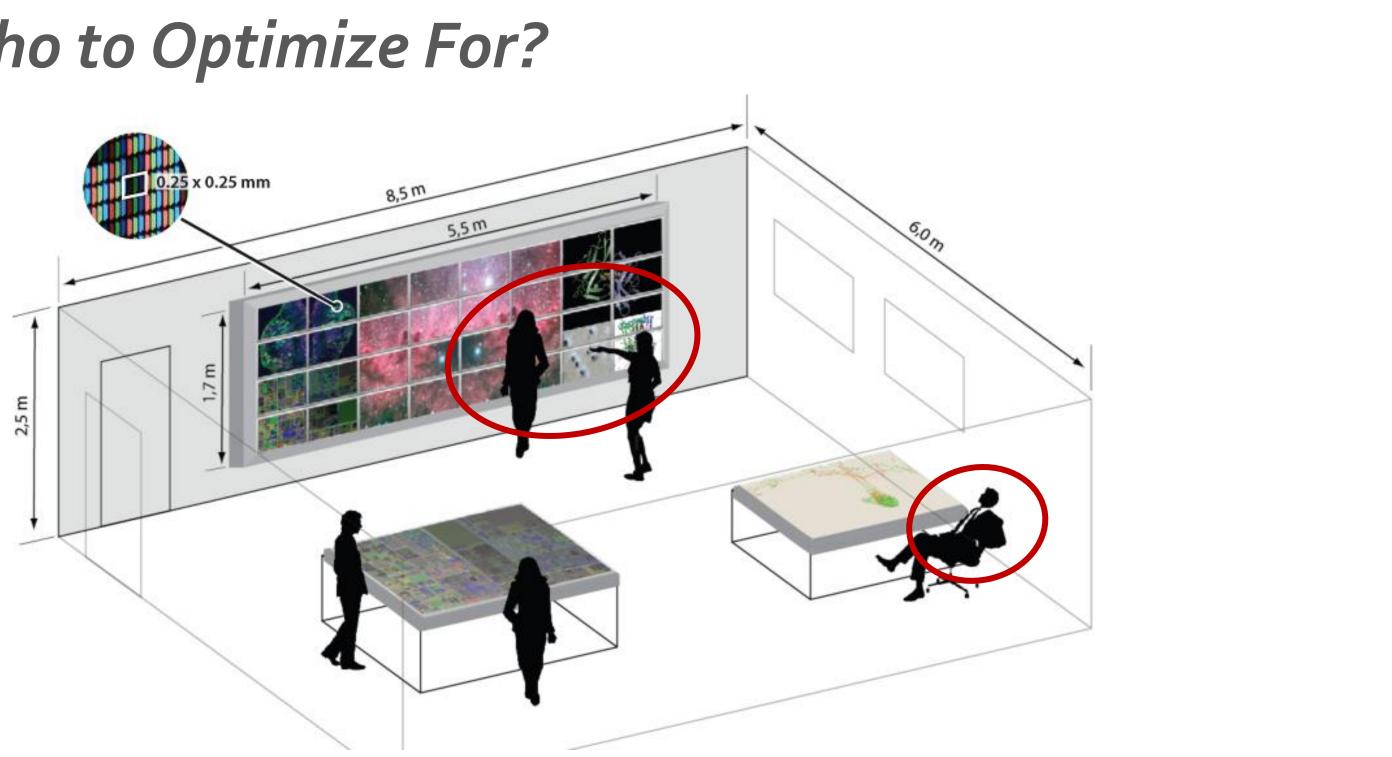
large displays meeting rooms / war rooms emergency response rooms



Scenario: WILD Display Environment



Who to Optimize For?



Example Data

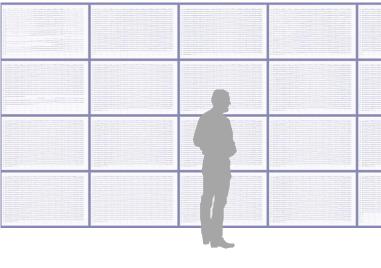
23 years of daily temperatures for 32 cities

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RLIN-DAHLEM,	GERMANY,	41,	133 , 1990	-01-04,	-12,	0									
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RLIN-DAHLEM,	GERMANY,	41,	133 , 1990	-01-10,	44,	0									
RLIN-DAHLEM,	GERMANY,	41,	133 , 1990	-01-11,	48,	0									
RLIN-DAHLEM,	GERMANY,	41,	133,1990	-01-12,	60,	0									
RLIN-DAHLEM,	GERMANY,	41,	133 , 1990	-01-13,	22,	0									
RLIN-DAHLEM,	GERMANY,	41,	133 , 1990	-01-14,	30,	0									
RLIN-DAHLEM,	GERMANY,	41,	133 , 1990	-01-15,	42,	0									

Naïve Approach

Optimize for one specific viewing distance

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	MANC NAME	LUXENBOURG ARPORT	PARIS-14E FARC MONTSOURIS				
	21.7% M A M J J A S O N D						
APLONA LAS PAI SPAIN	ALMAS DE GRAN CANARIA/GANDO SPAIN	NIMES FRANCE	GENEVE COINTRIN SWITZERLAND	MILAN ITALY	ROMA CIAMPINO ITALY	SARAJEVO BOSNIA AND HERZEGOVINA	JERU
		NINES FRANCE	SWITZERLAND		ITALY		JERU



detail from close

Problem: detailed information lost

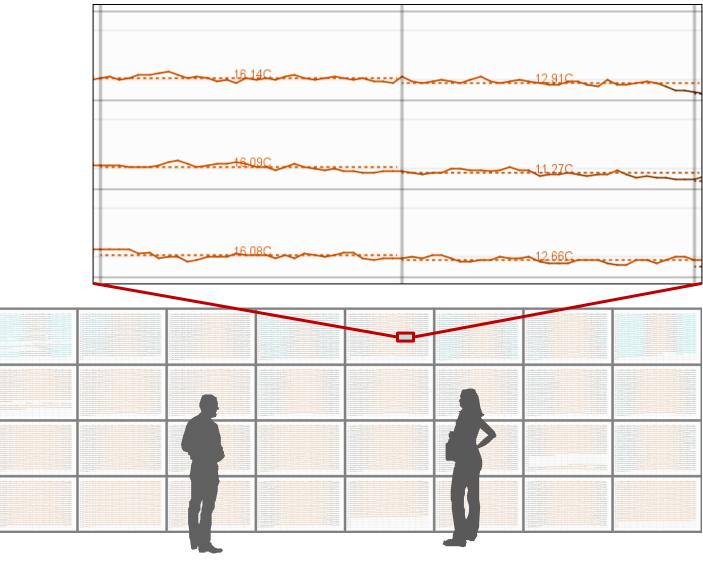
Problem: mental aggregation, comparison

6

Naïve Approach

Optimize for one specific viewing distance

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detail from close

Problem: detailed information lost

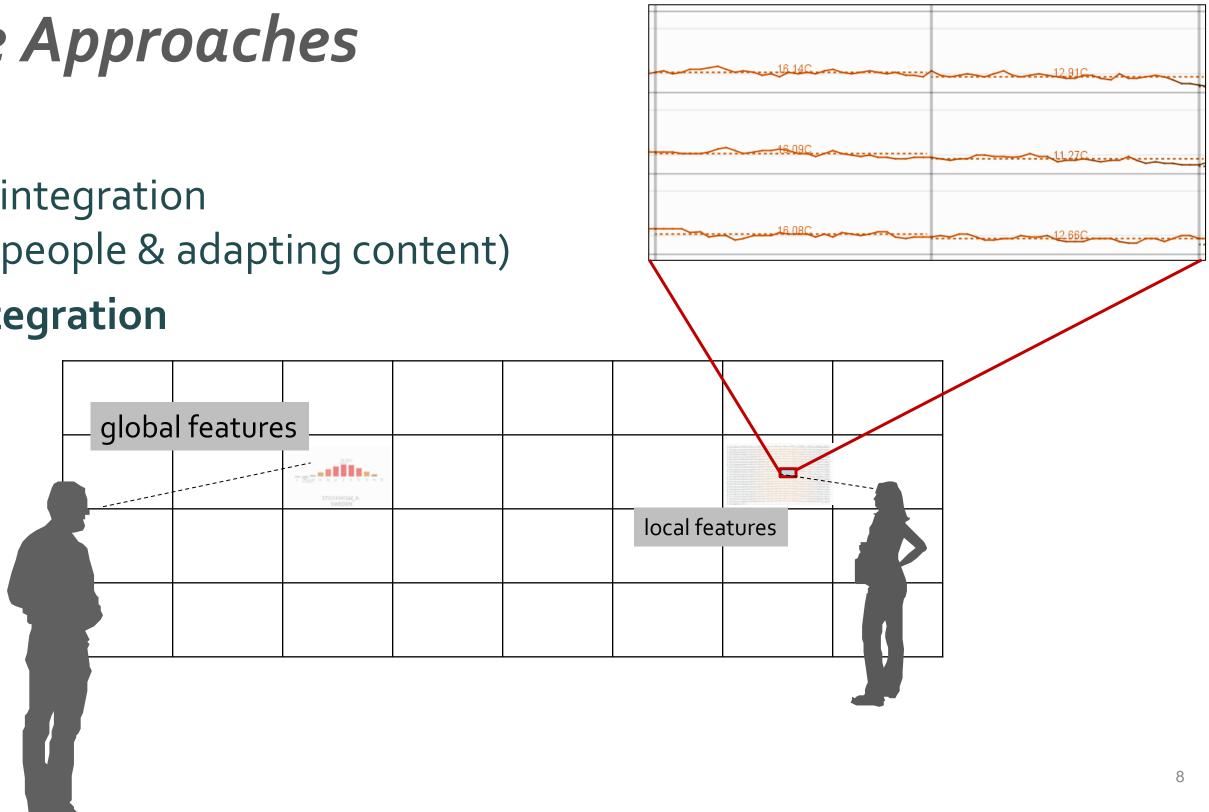
Problem: mental aggregation, comparison

7

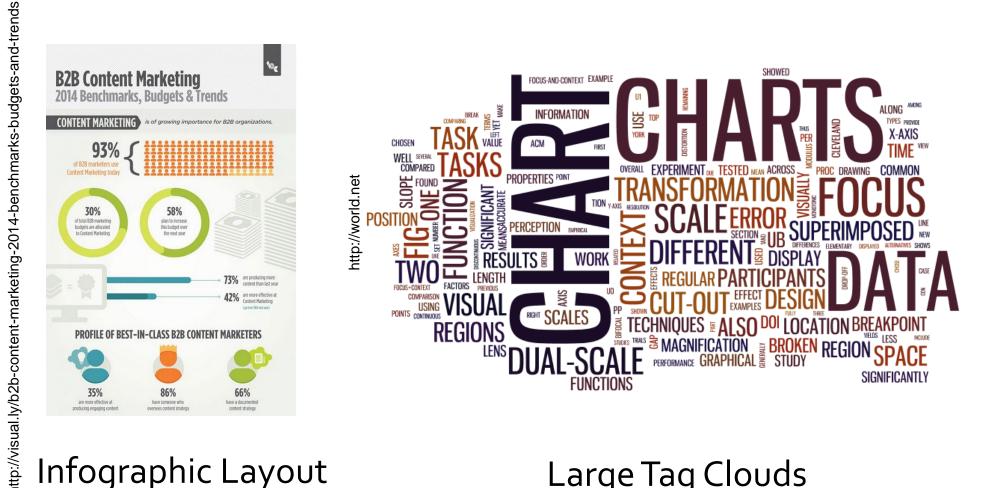
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Possible Approaches

- Dynamic integration (tracking people & adapting content)
- Static integration



Juxtaposition: global & local features next to each other

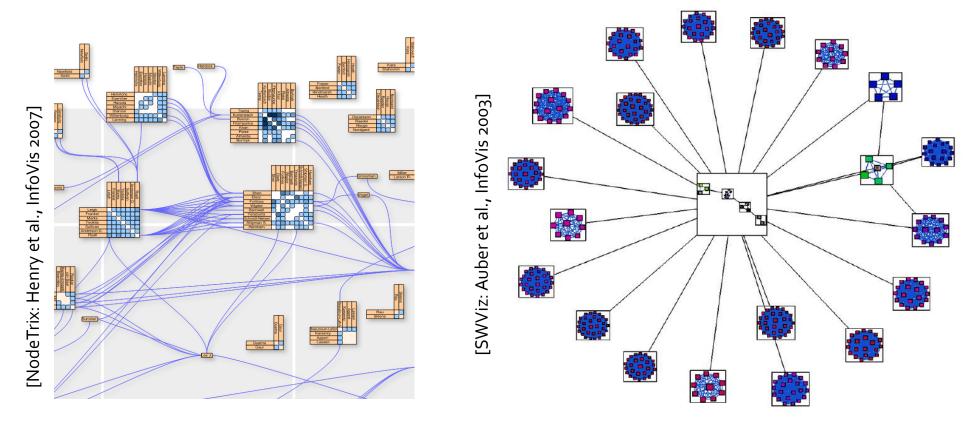


Infographic Layout

Large Tag Clouds

9

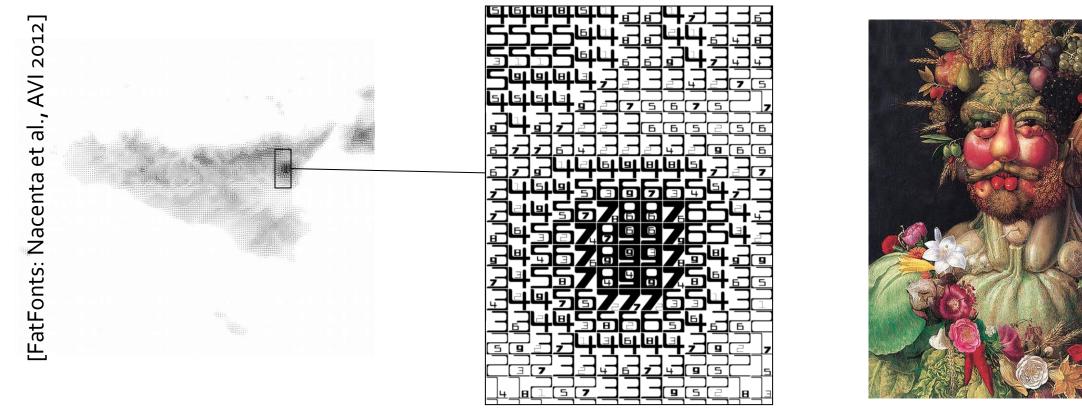
Nesting: local inside global features



NodeTrix

SWViz

Visual aggregation: local form global features



FatFonts

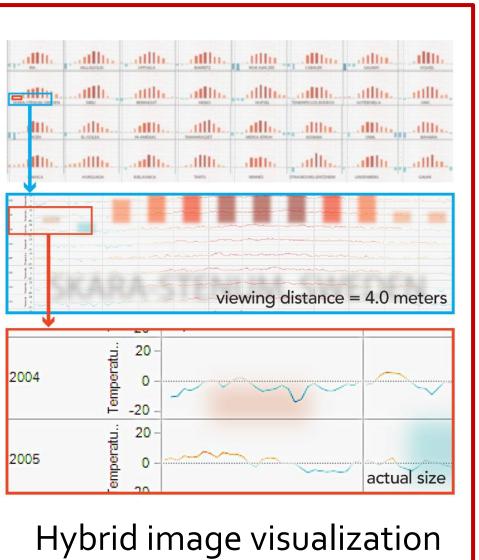
Arcimboldo Paintings, Calligrams

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Blending: local & global features overlap



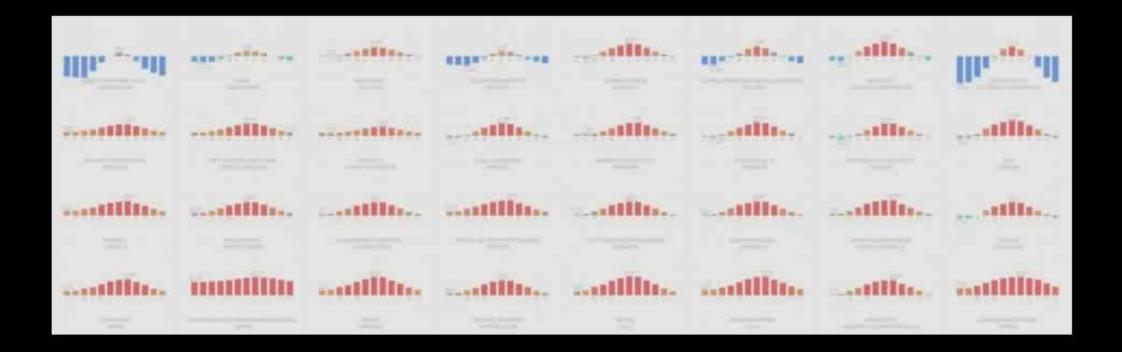
1037	n Science all news videos images	0111	
	Sense About Gravity	Jakub Narębski 1,144 • 1 • 10	Jason Heine
674	Ames's Window Optical Illusion Will	Joel Coehoorn 39.9k • 6 • 71 • 1	FreeMemory
014	Blow Your Mind	Jason Heine 2,996 • 7 • 30	Mitch Wheat
552	A Harvard Psychiatrist Explains Zombie	James Hopkin 3,861 • 3 • 17	Michael Kohr
202	Neurobiology	Matthew Vines 1,373 • 1 • 10	Mehrdad 29
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455	World's Dirtiest Rivers and Lakes (Slideshow)	741 • 1 • 7	David Yance
		Tadmas 620 • 2 • 10	Mendelt 10.3
438	Is Aging Optional?	Visage 2,551 • 1 • 12	akappa 1,09
		Brian Agnew 8,576 • 3 • 16	jrockway 4,9



Map regions over map detail

Label detail over bar chart

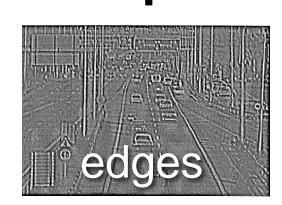
www.fraps.com



Hybrid Images

• Schyns & Oliva, 1994



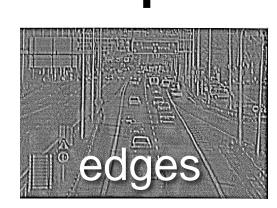




Hybrid Images

• Oliva, Torralba & Schyns, 2006





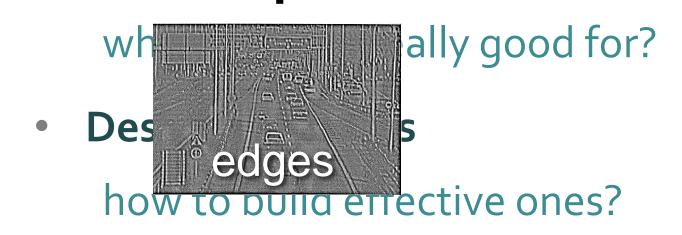
Our Contributions

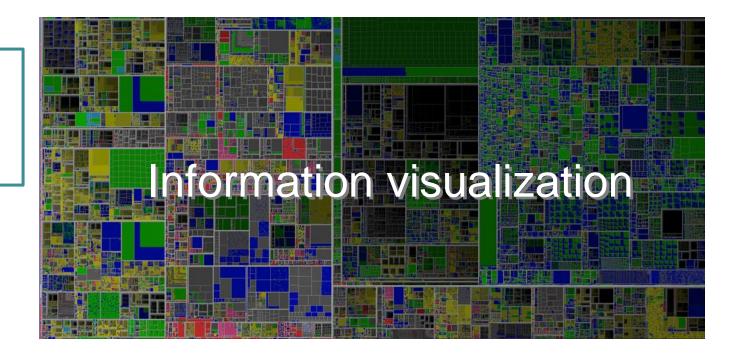
 Theoretical grounding why & when use hybrid images?

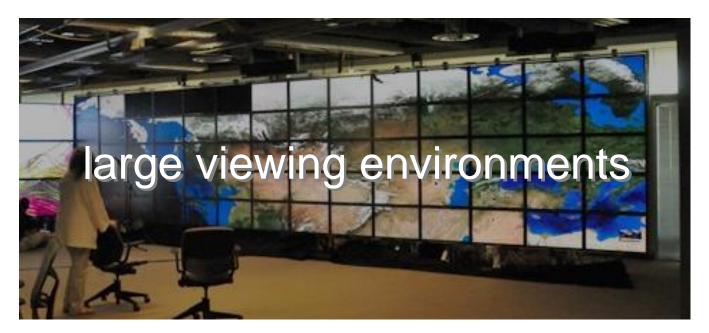
their creation?

Toc ho blurred

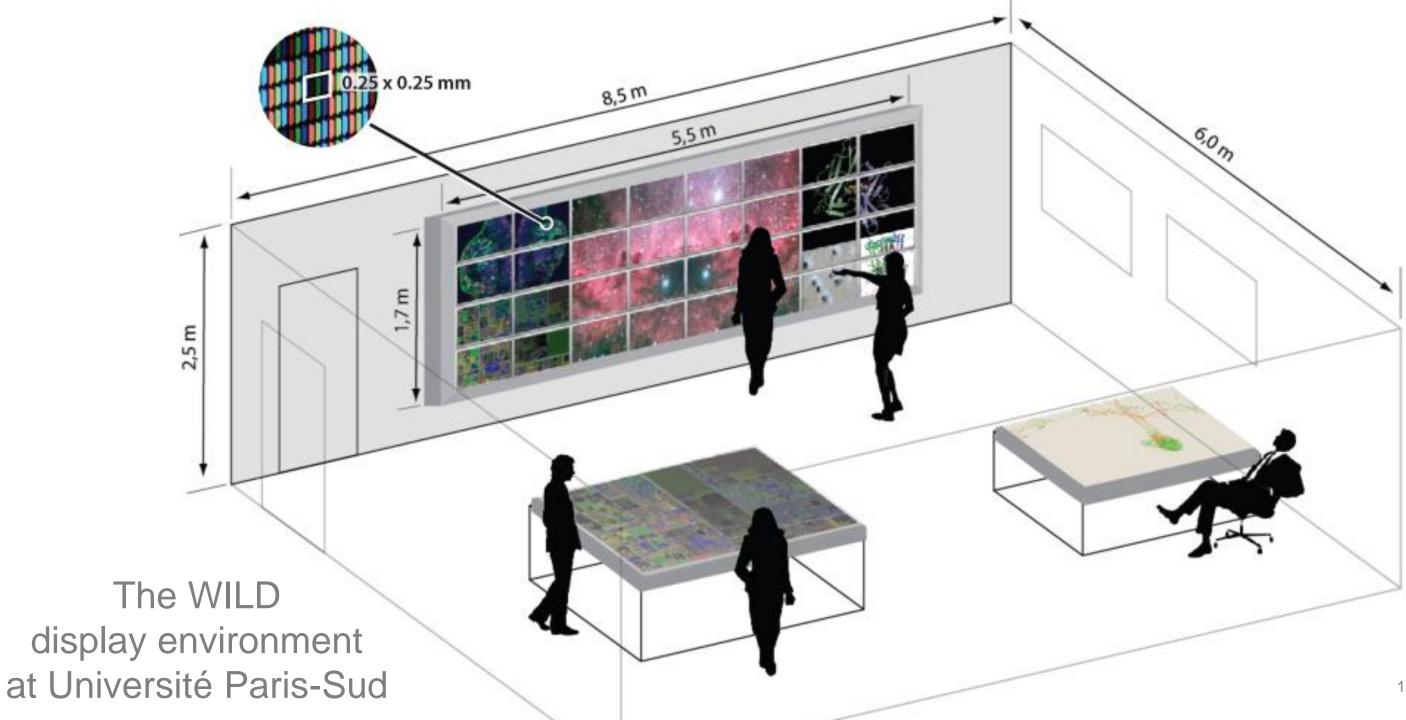
Examples





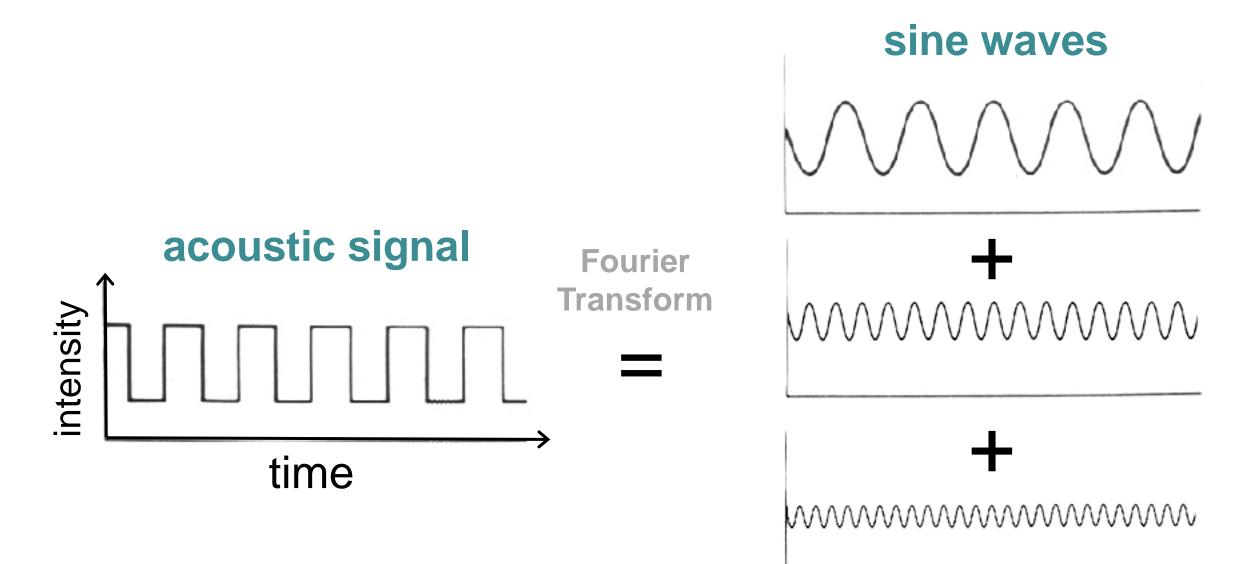


Can they Convey More Visual Information?





Frequency Domain Approach



frequencies in Hertz

Frequency Domain Approach

sinusoidal gratings



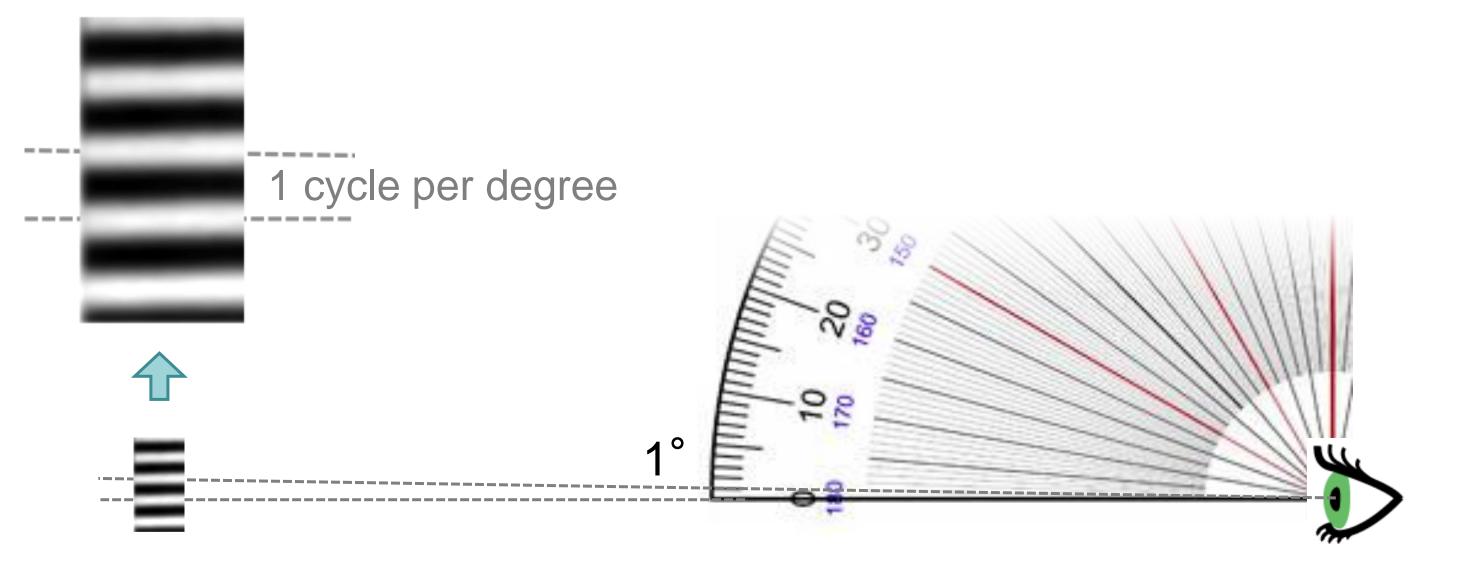
(1D) Fourier Transform



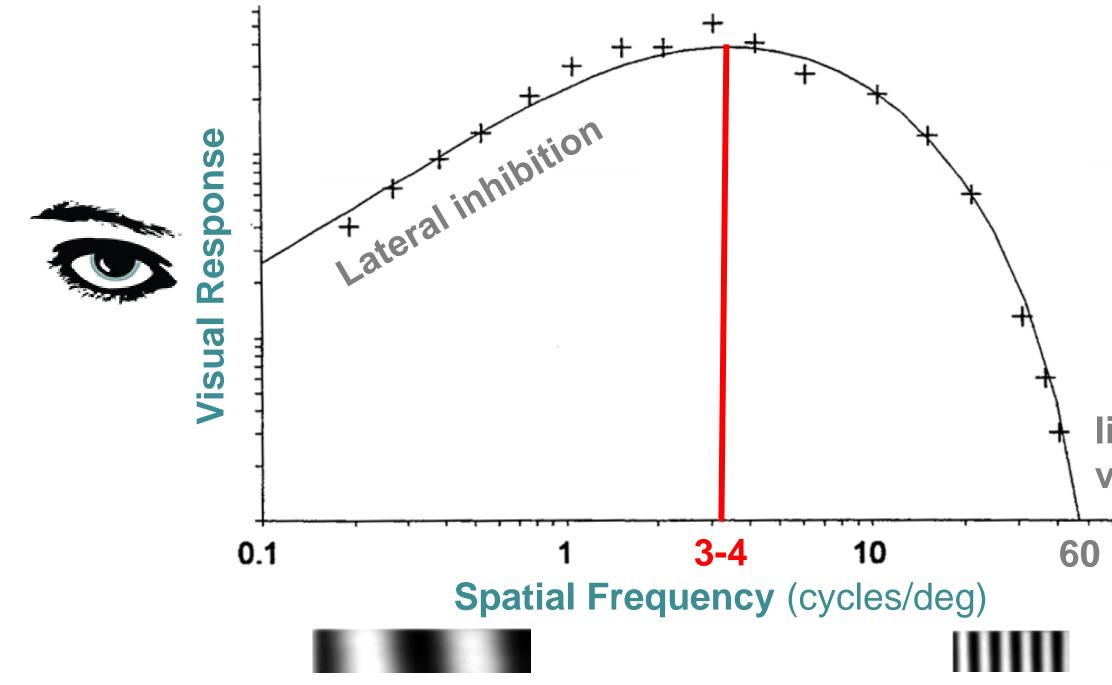


frequencies in cycles/degree of visual angle

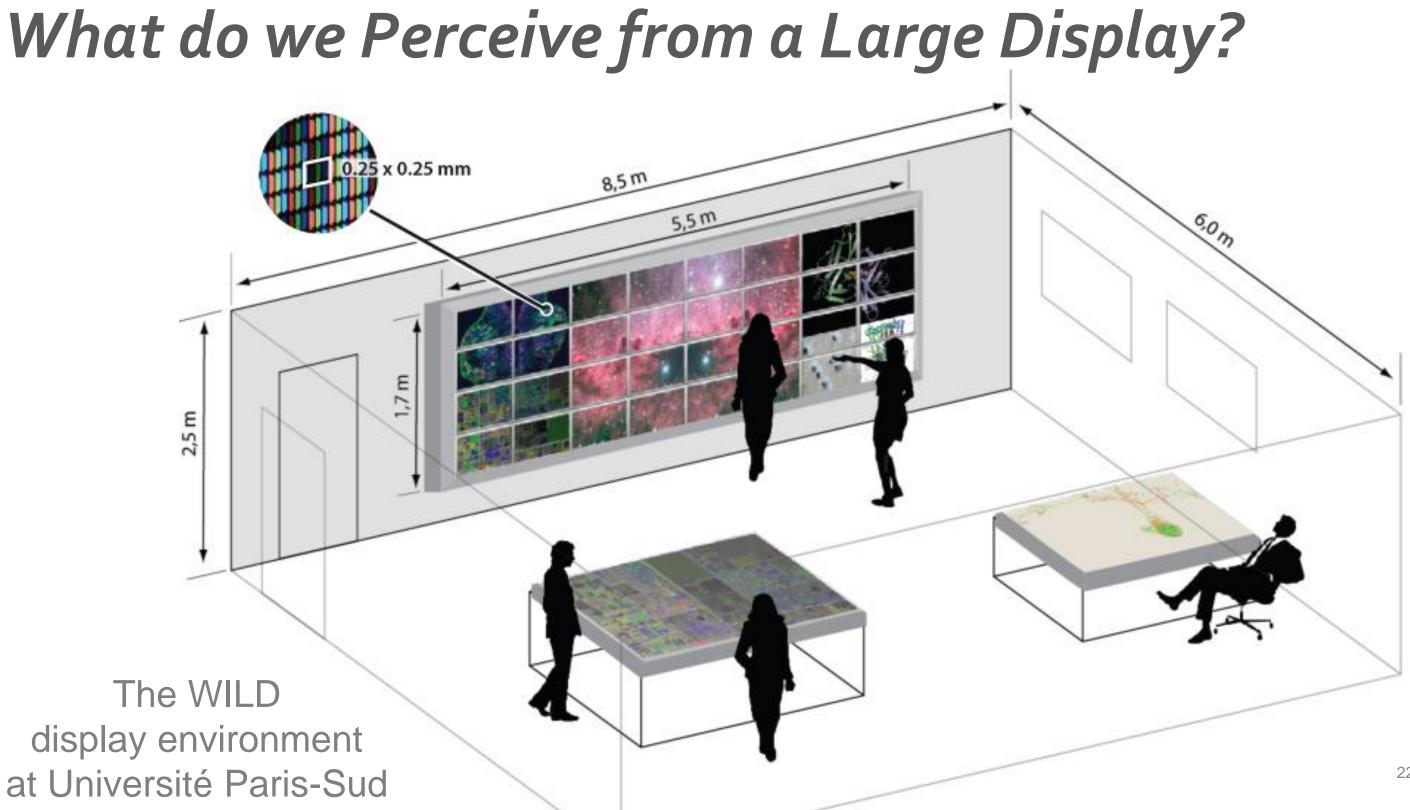
Contrast Sensitivity Function

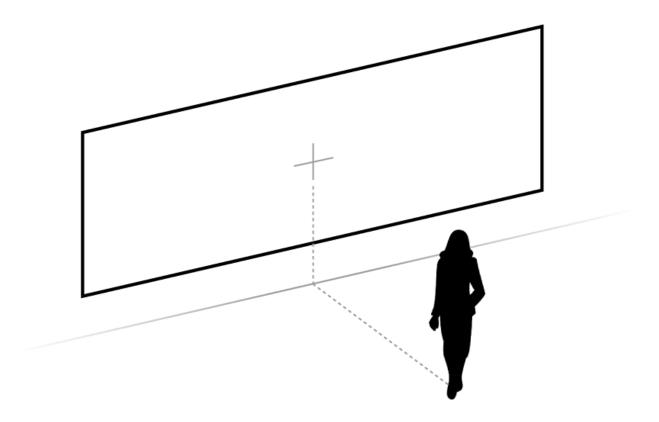


Contrast Sensitivity Function

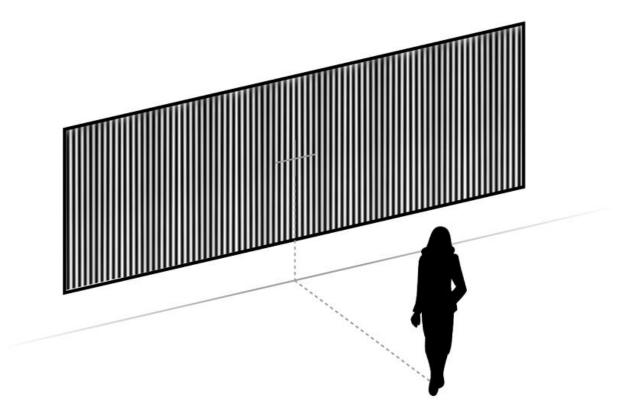


limit of visual acuity

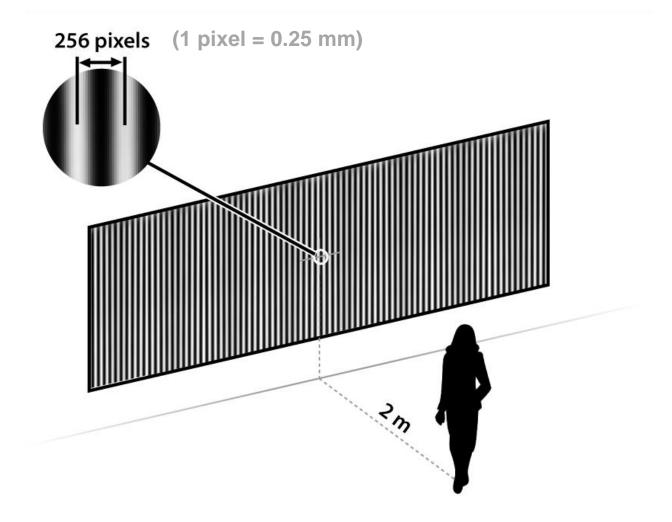




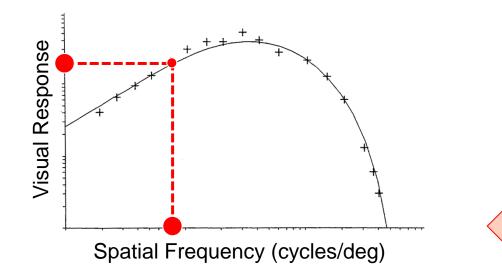


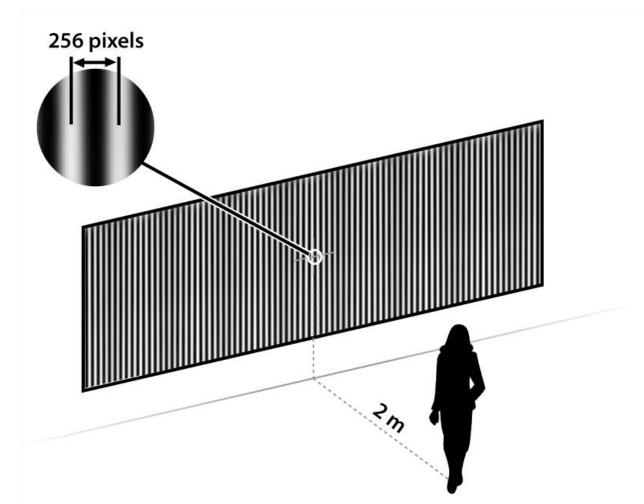




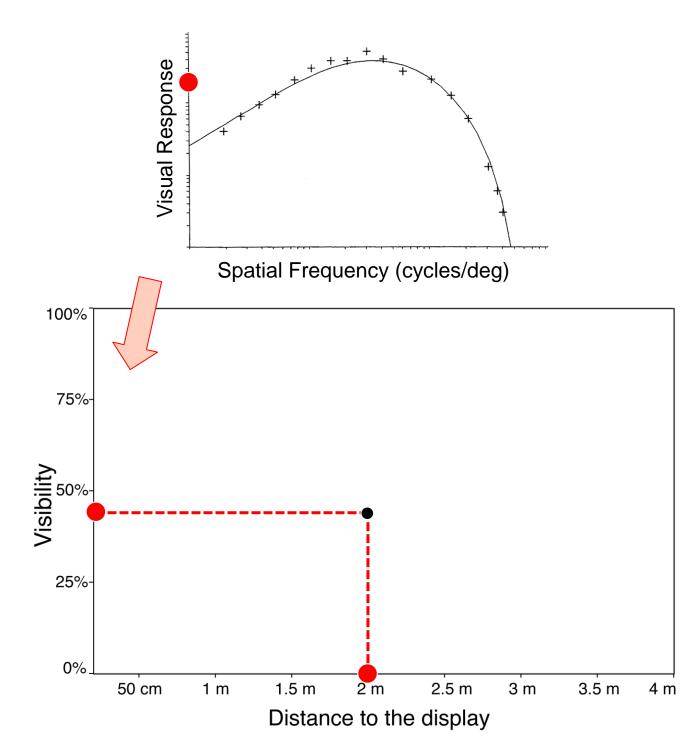


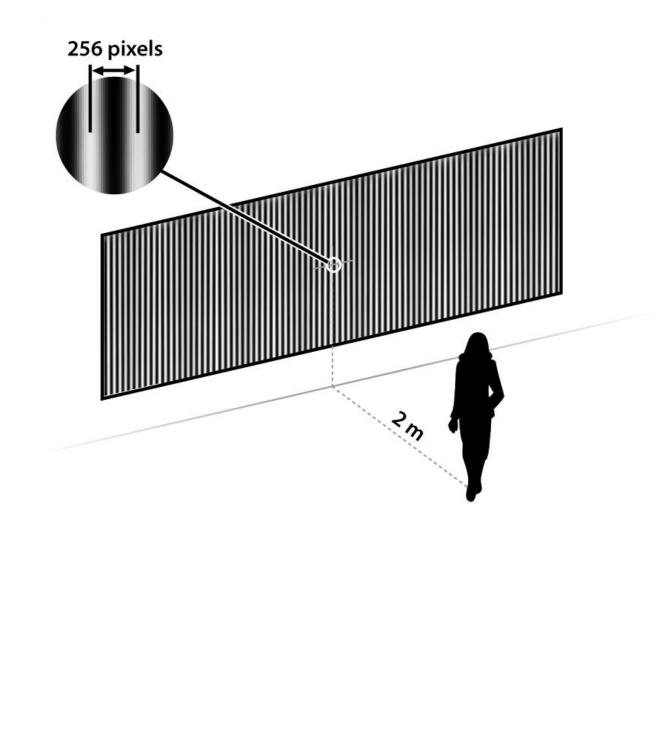




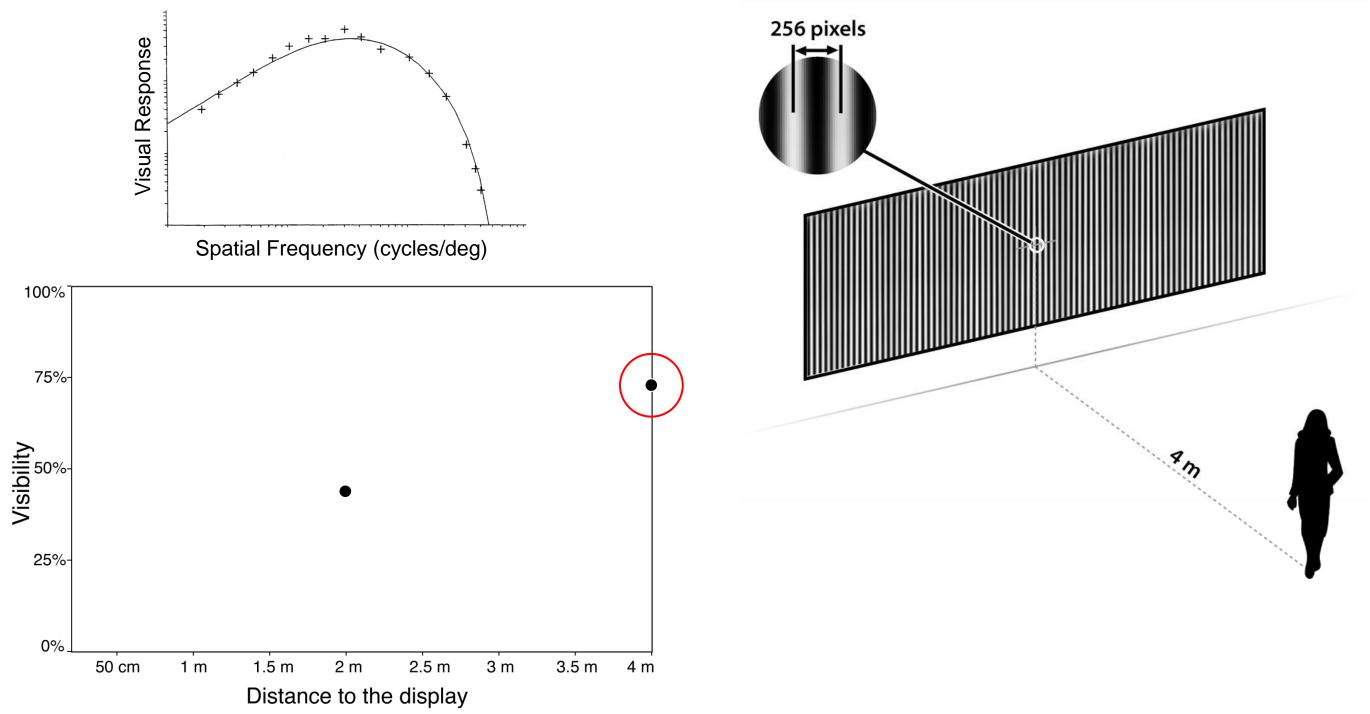




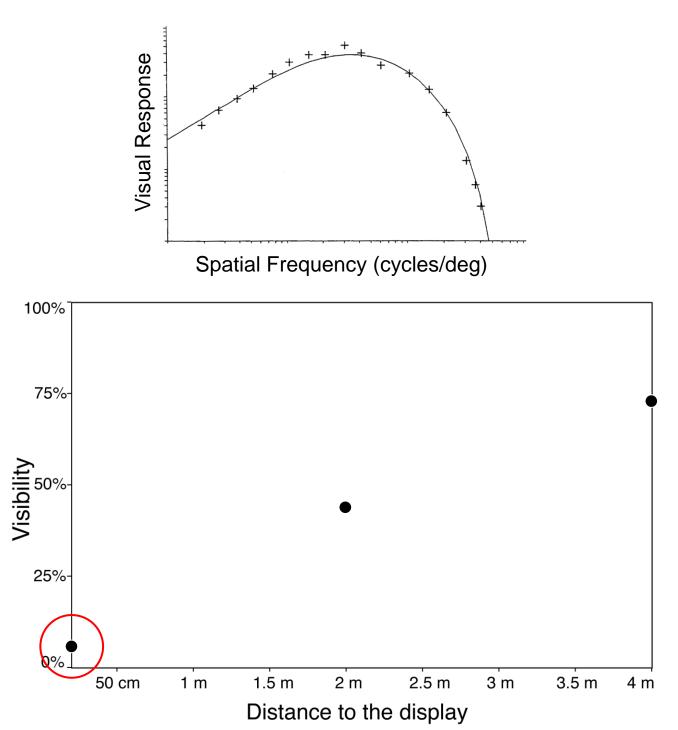


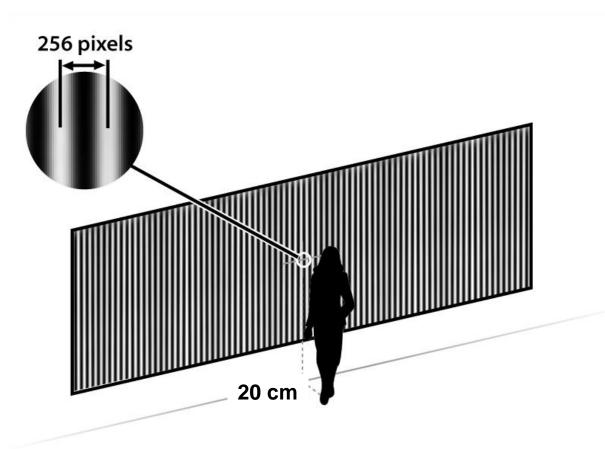




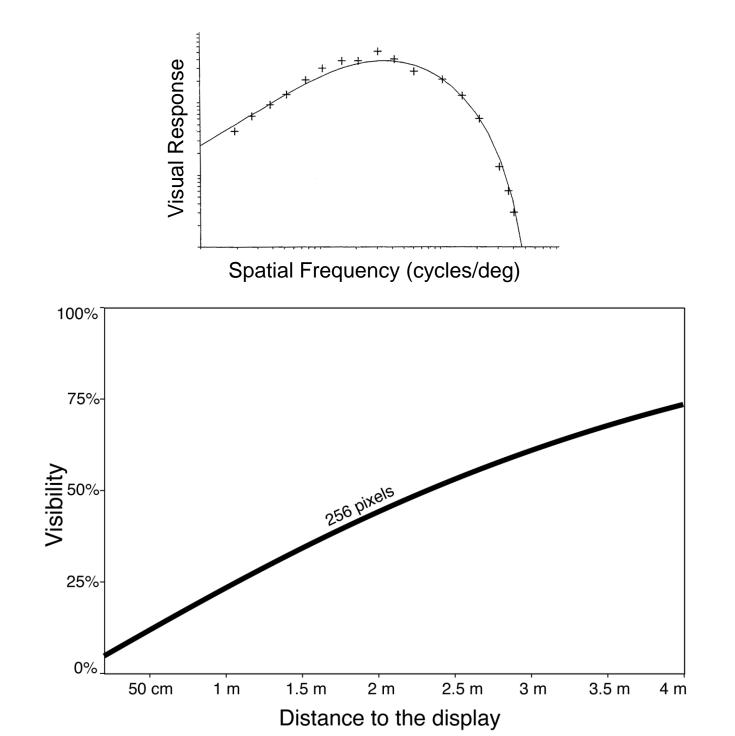


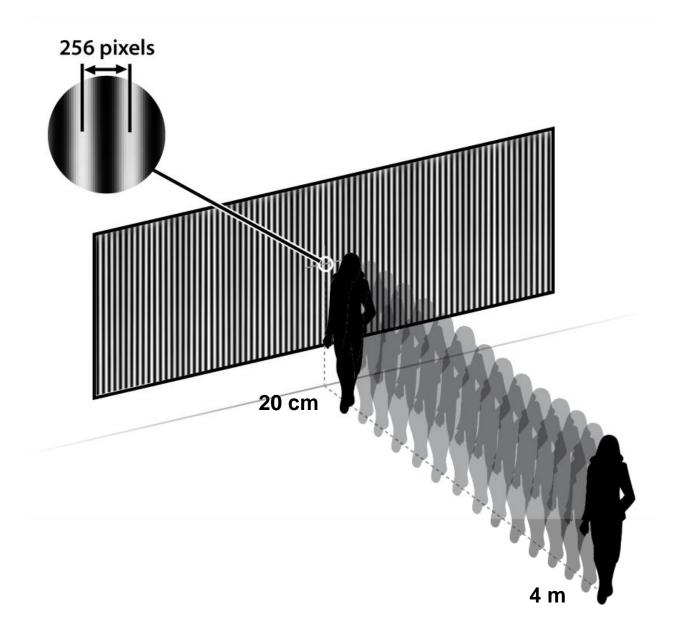




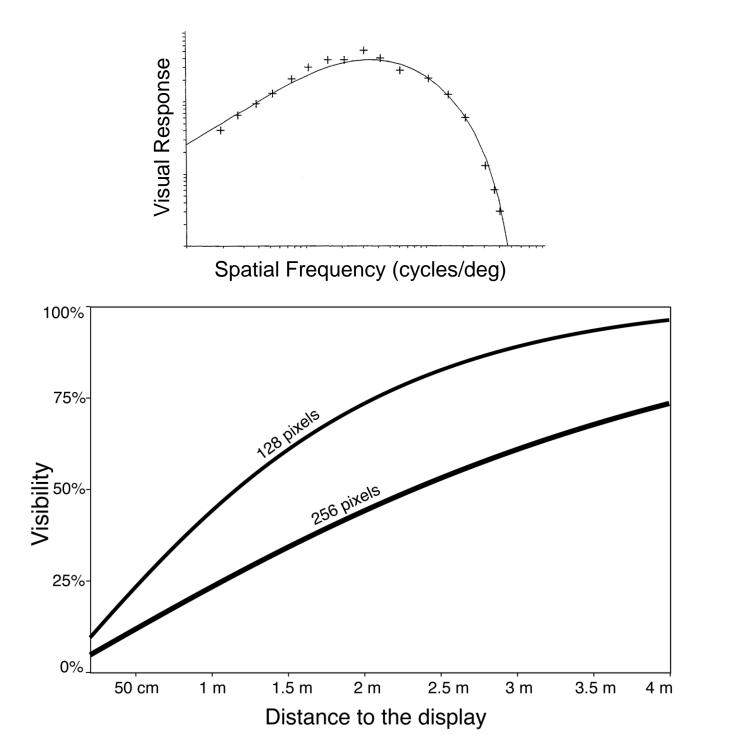


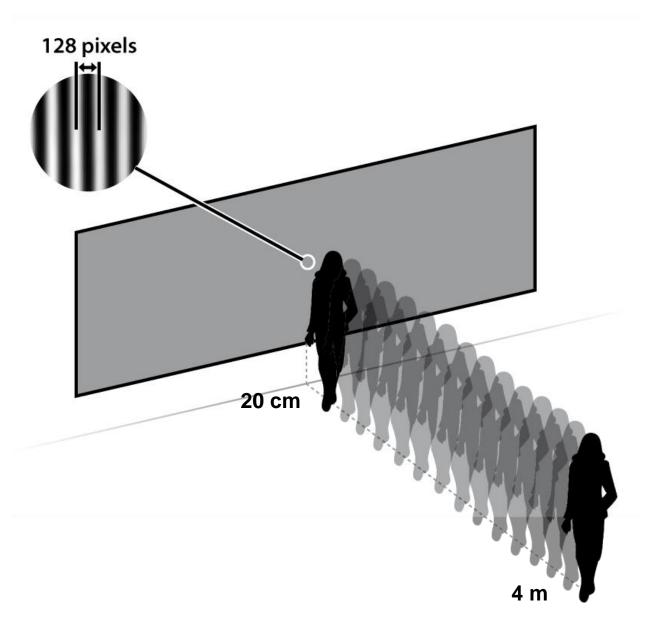




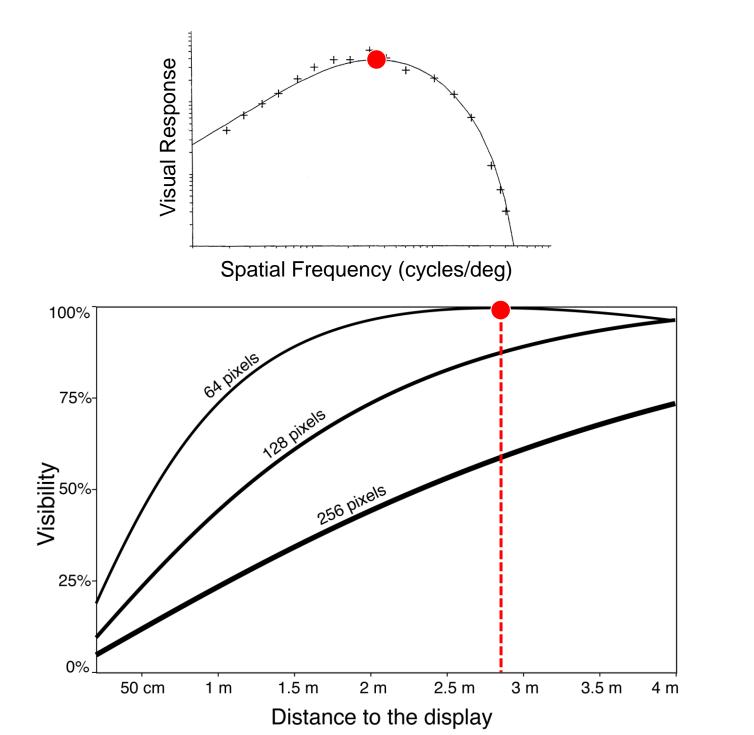


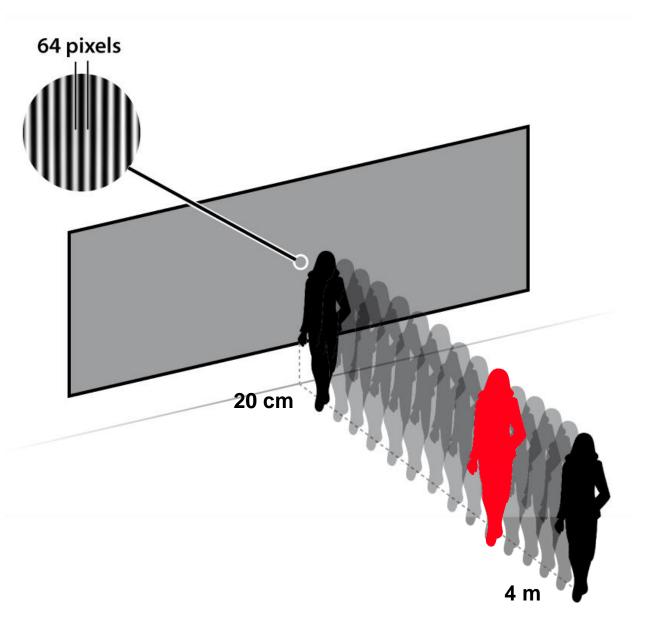




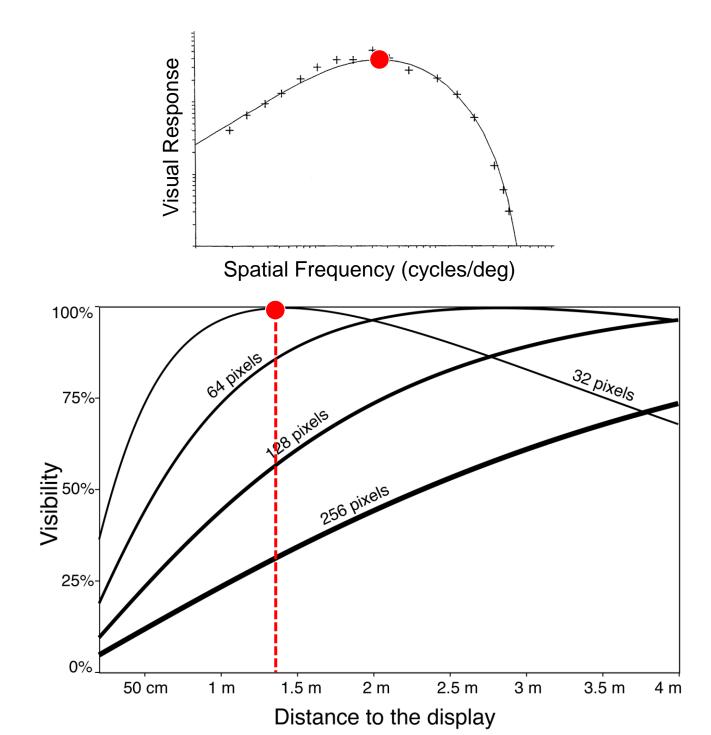


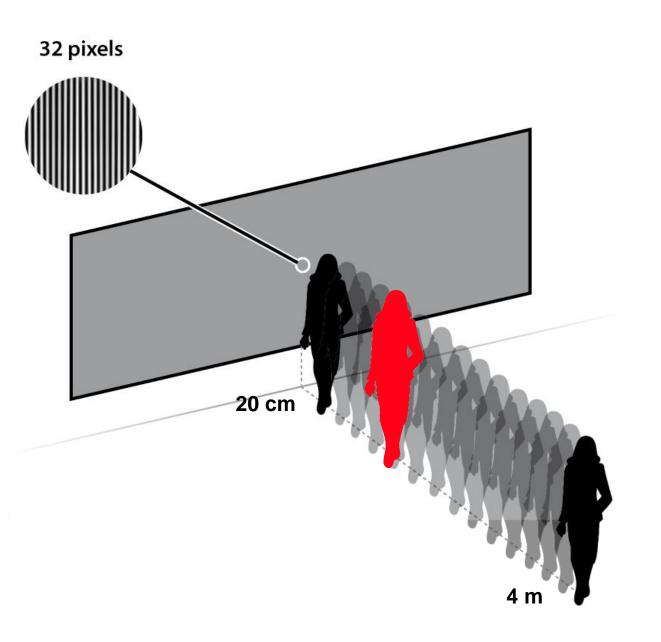




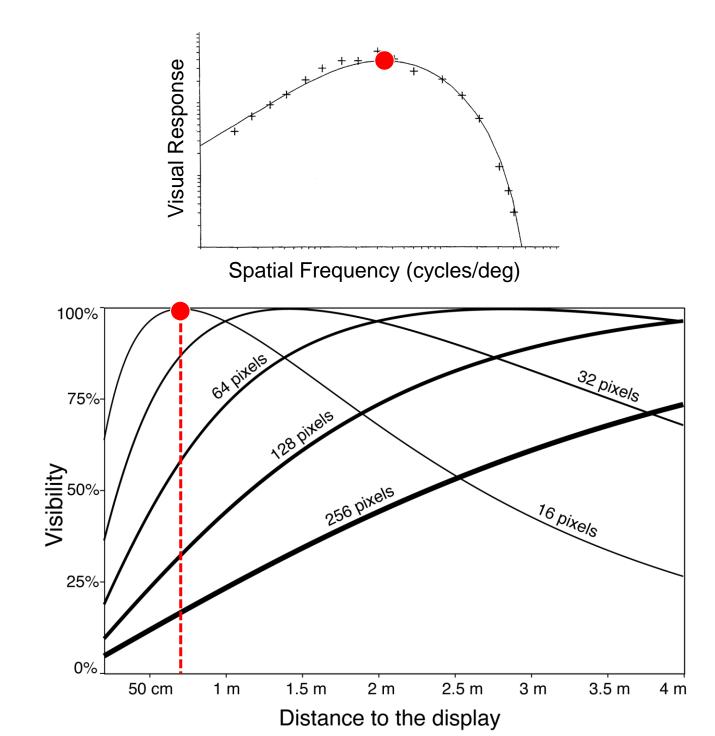


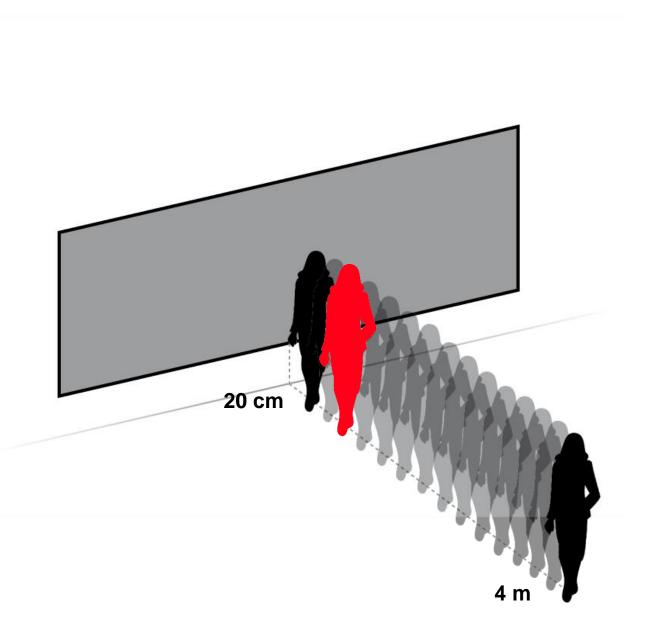




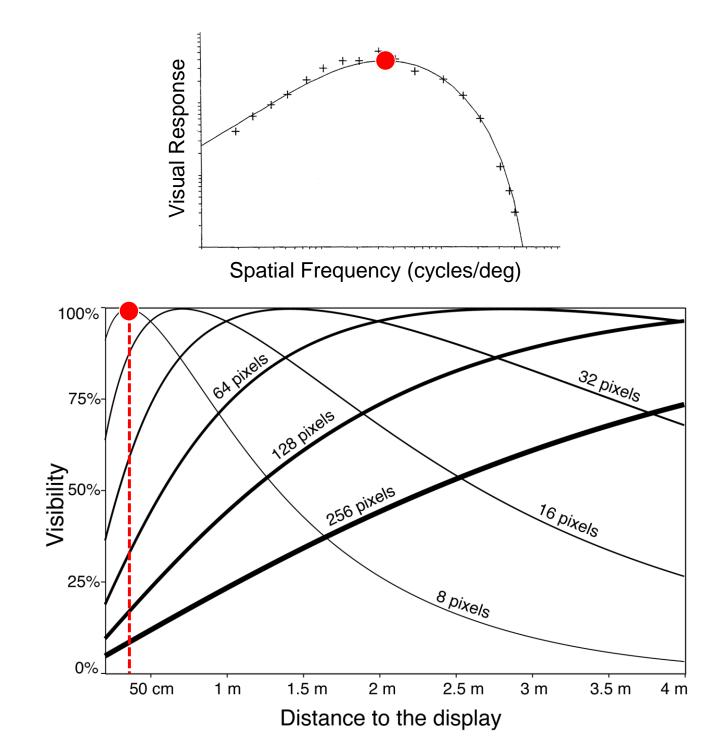


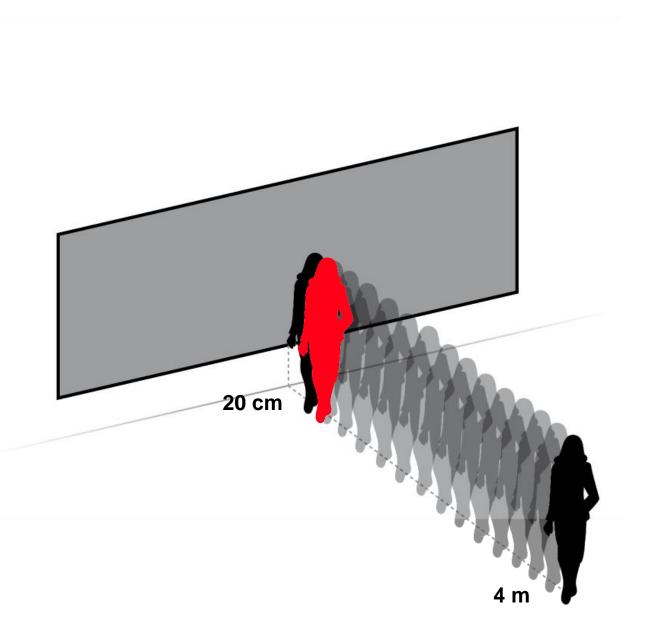




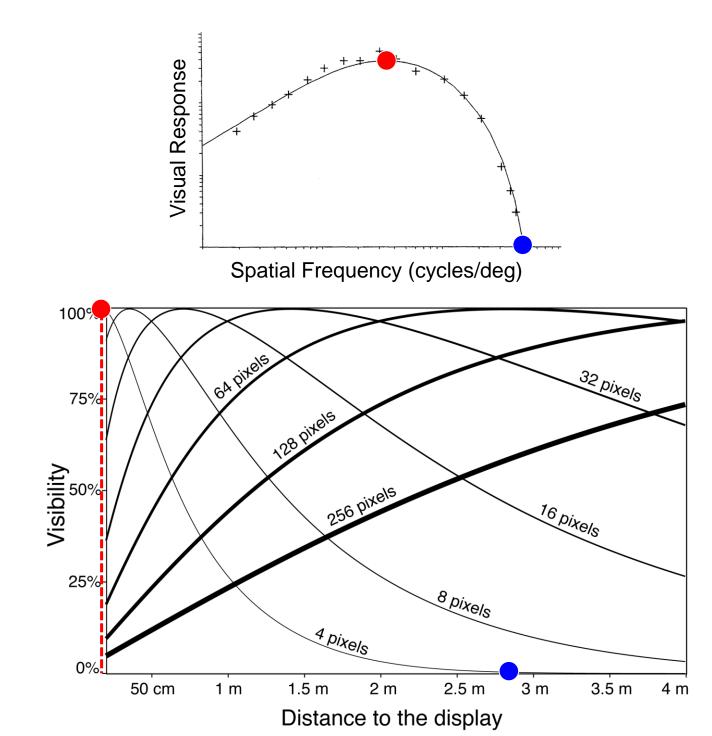


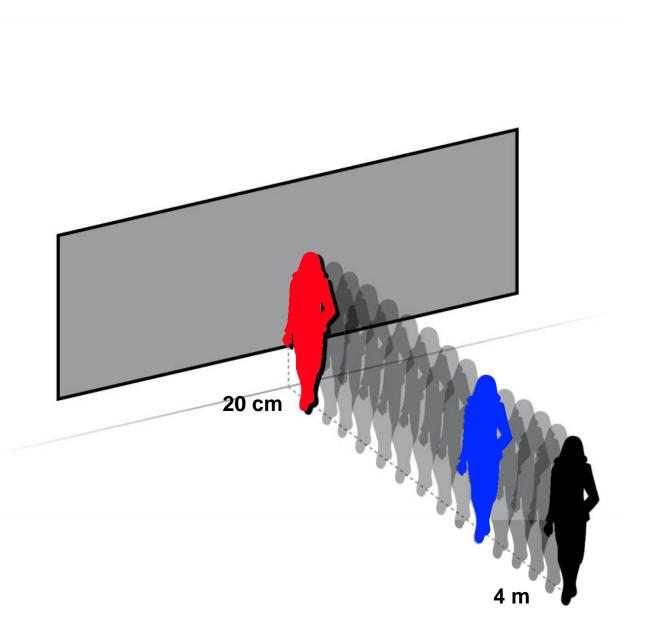






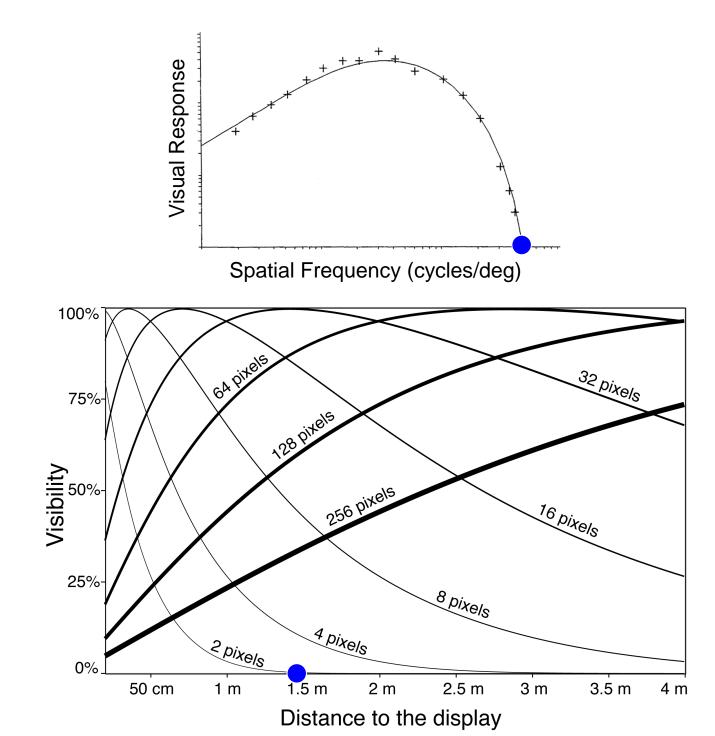


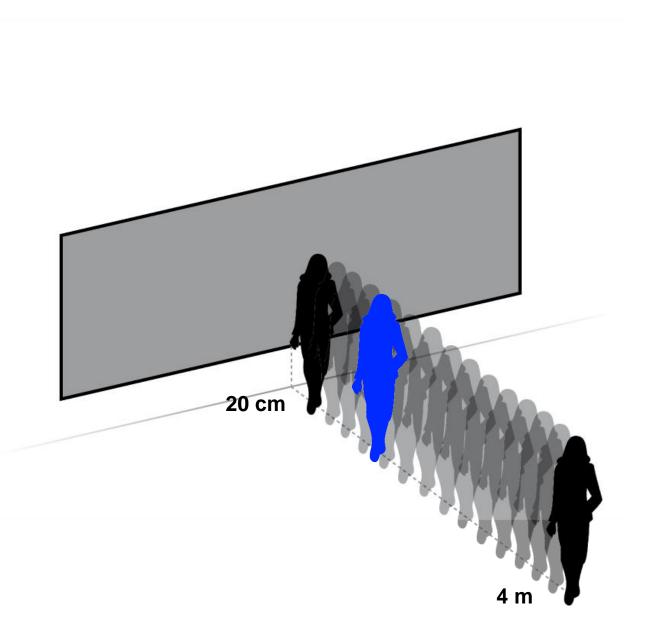






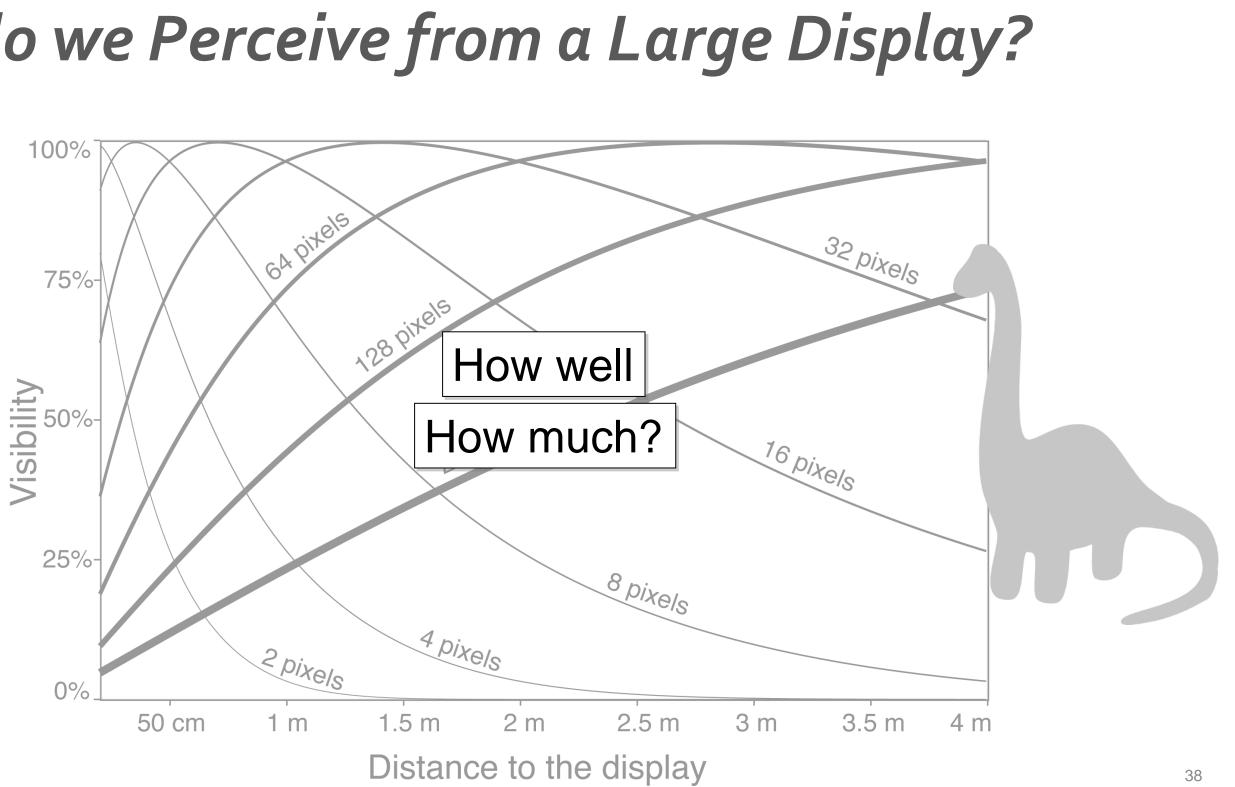
What do we Perceive from a Large Display?



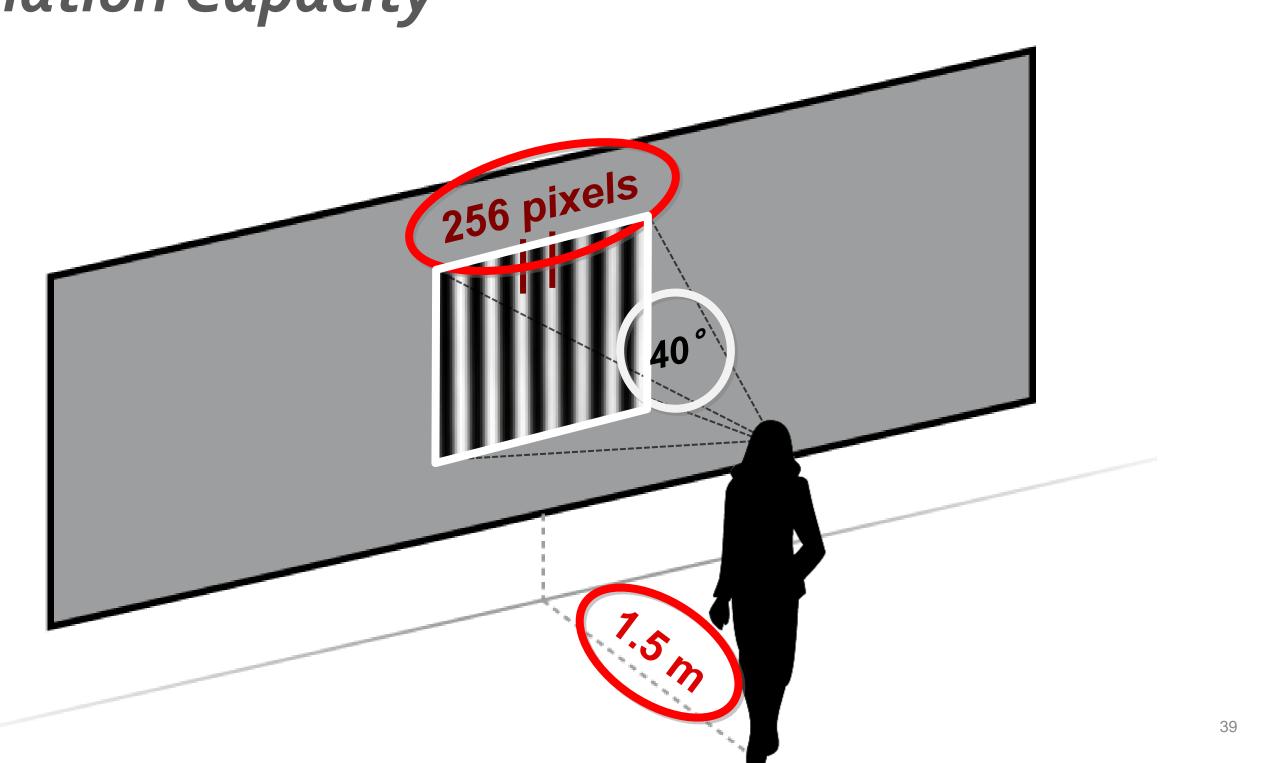




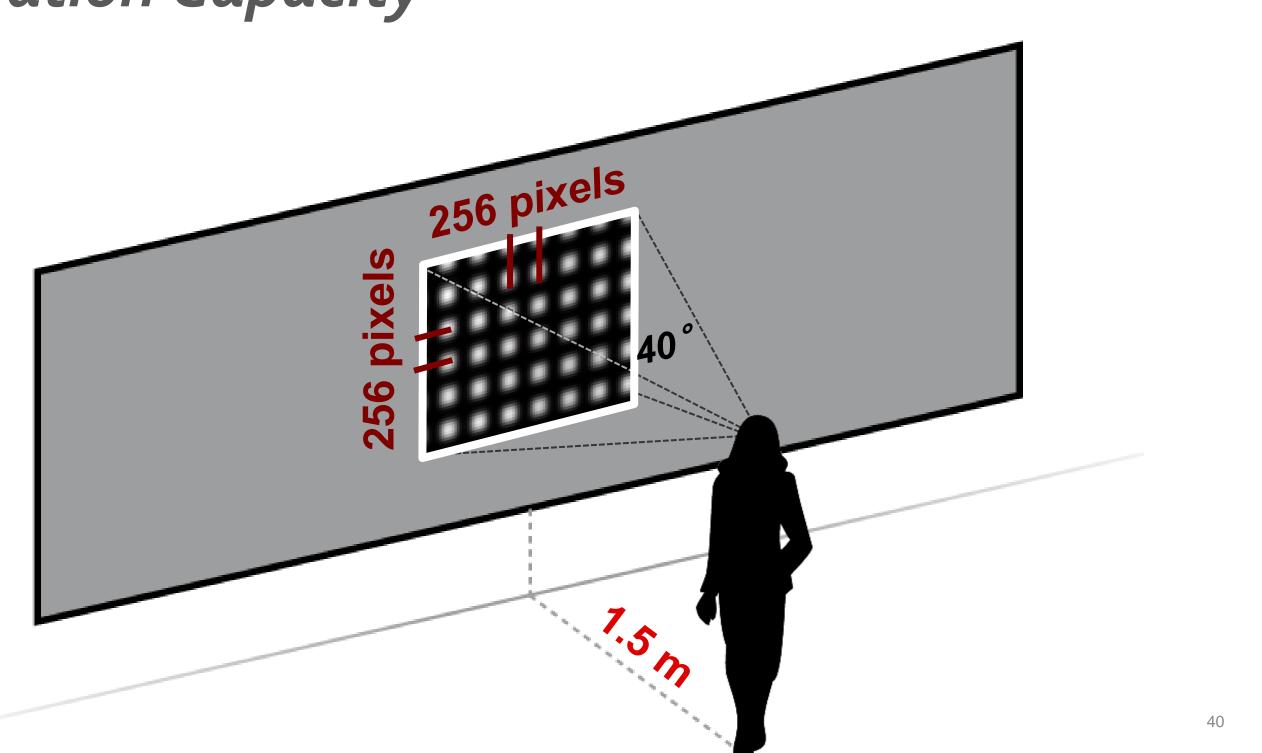
What do we Perceive from a Large Display?



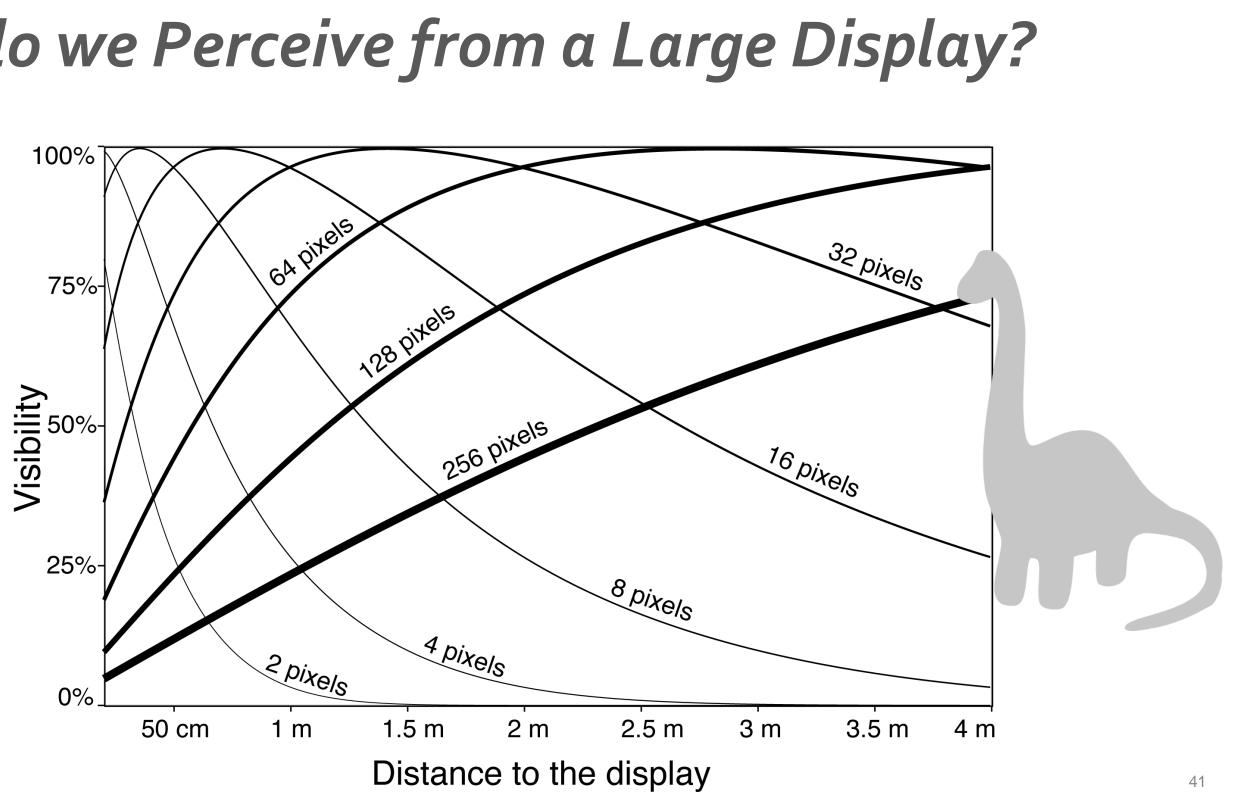
Information Capacity



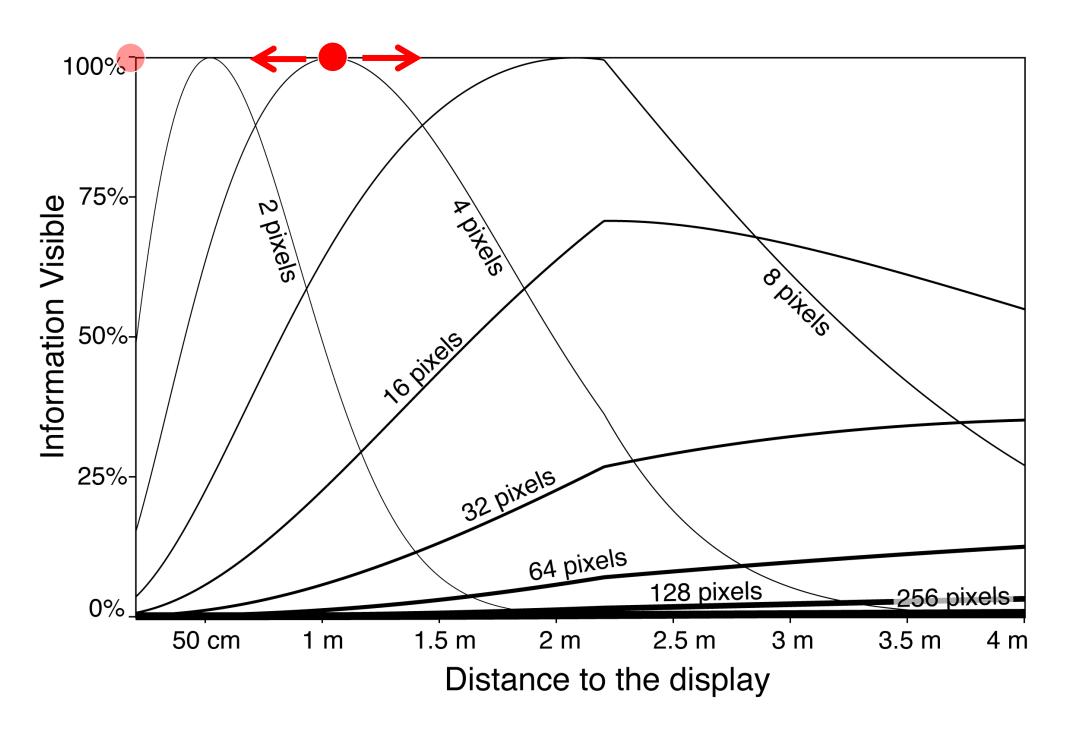
Information Capacity



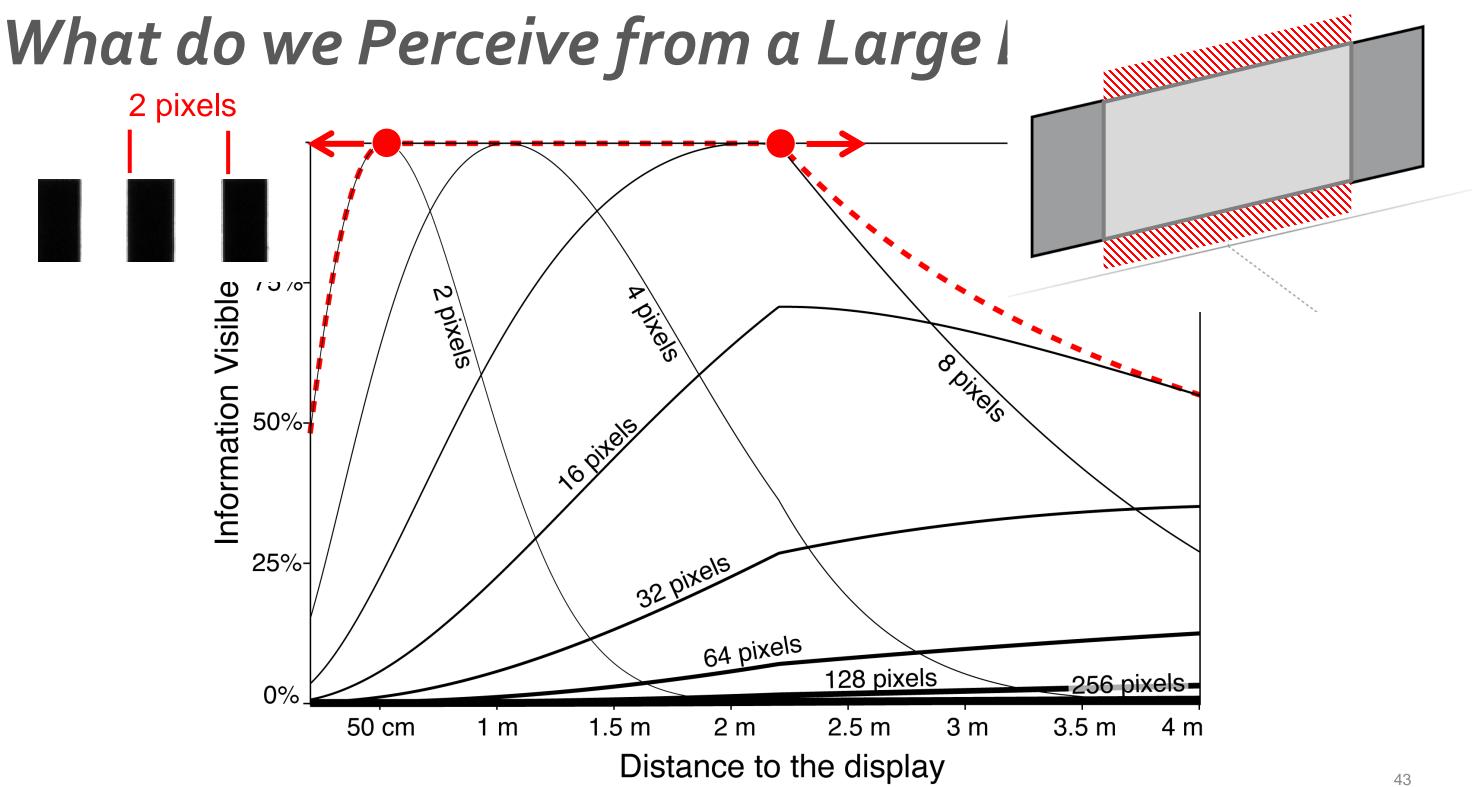
What do we Perceive from a Large Display?



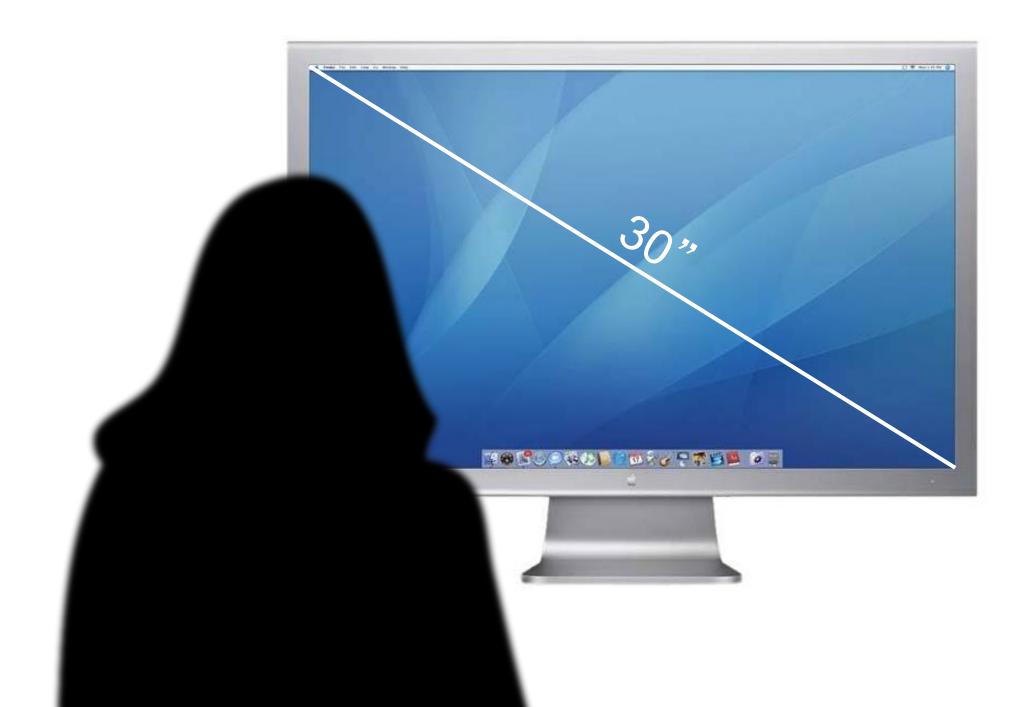
What do we Perceive from a Large Display?



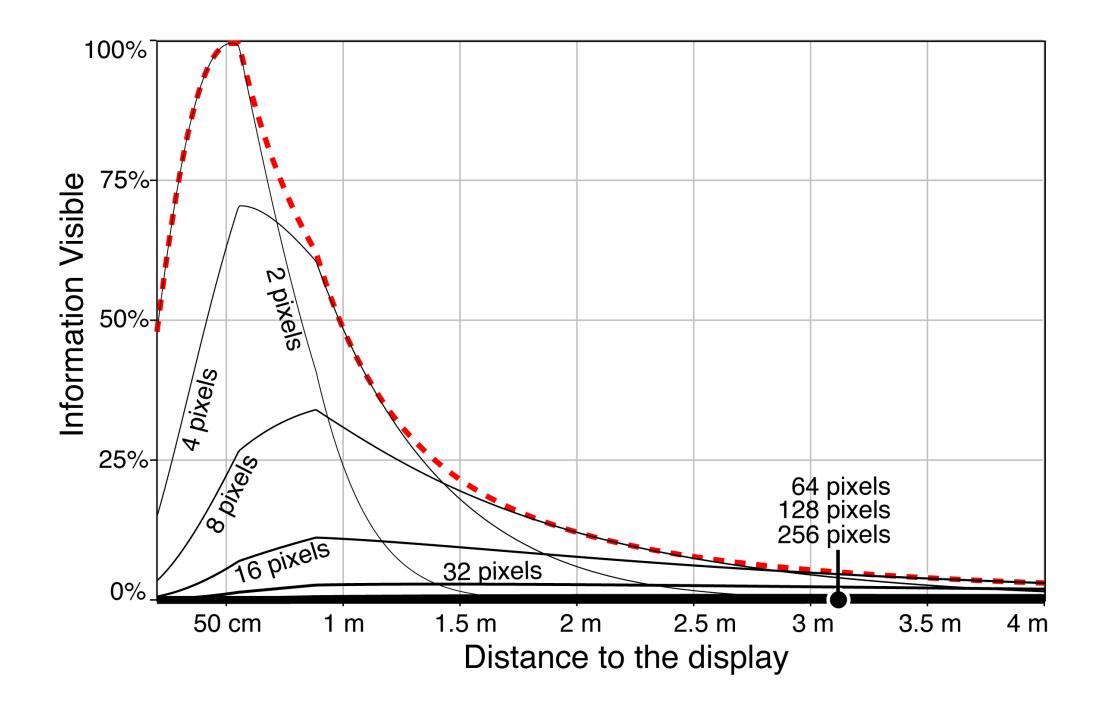




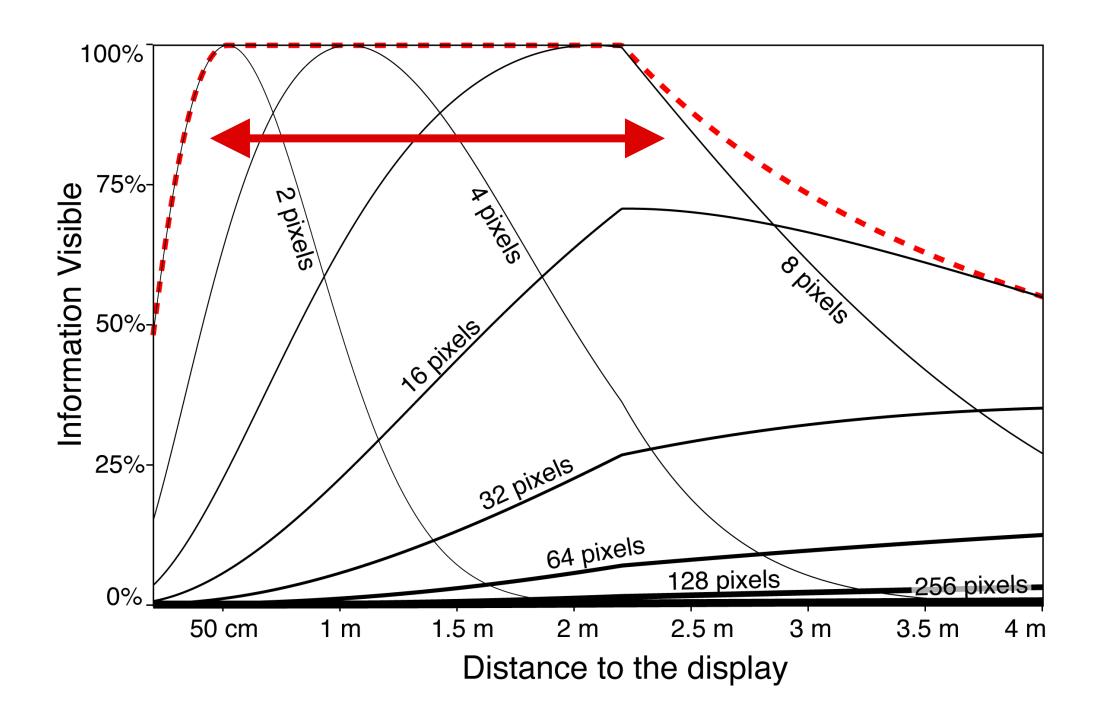
Comparison with a Desktop Display

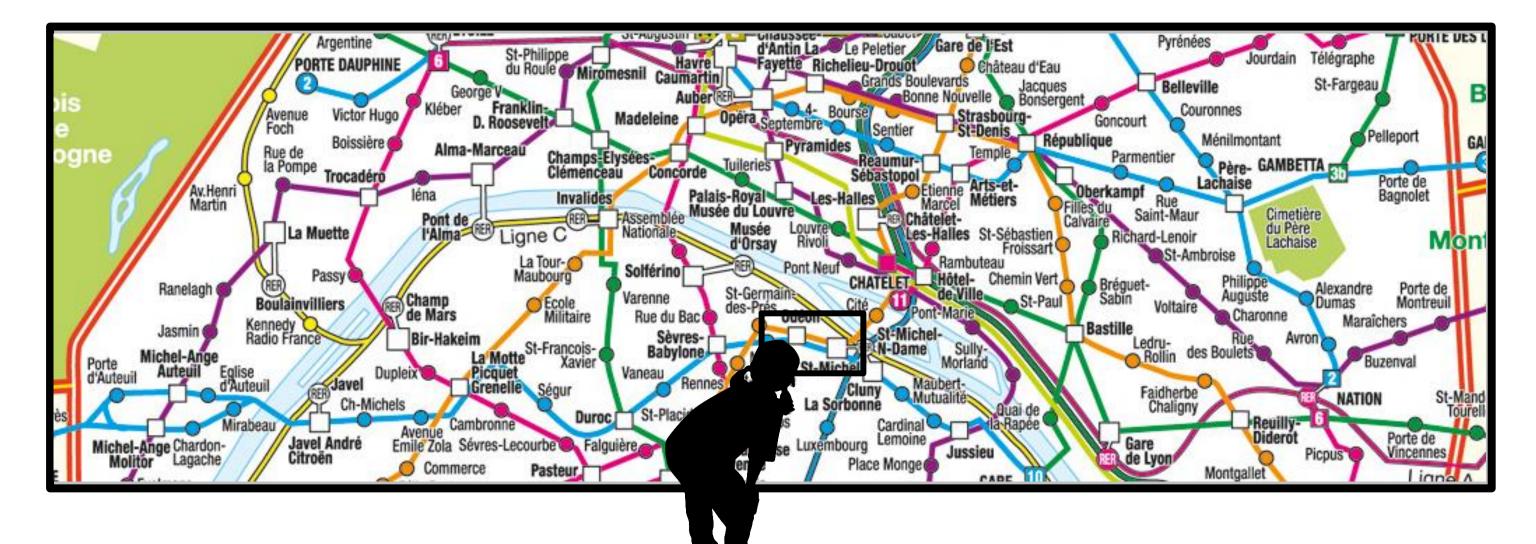


Comparison with a Desktop Display

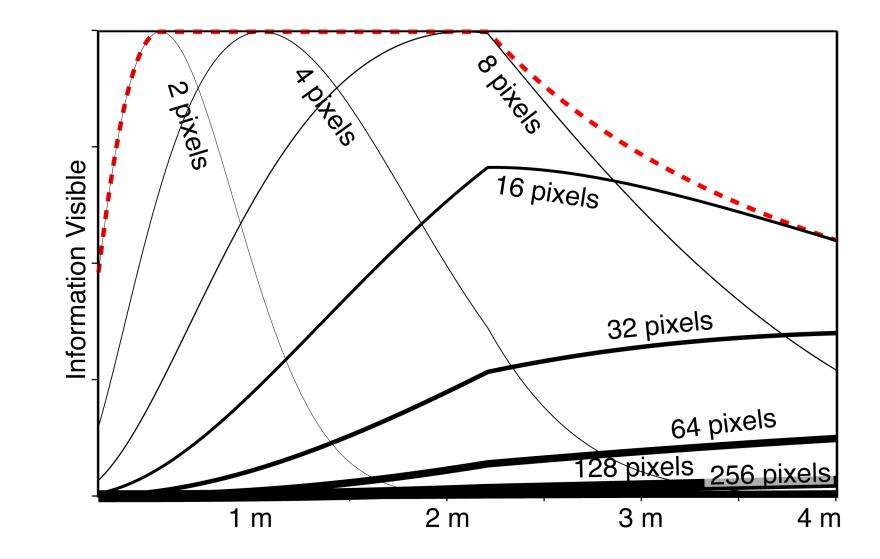


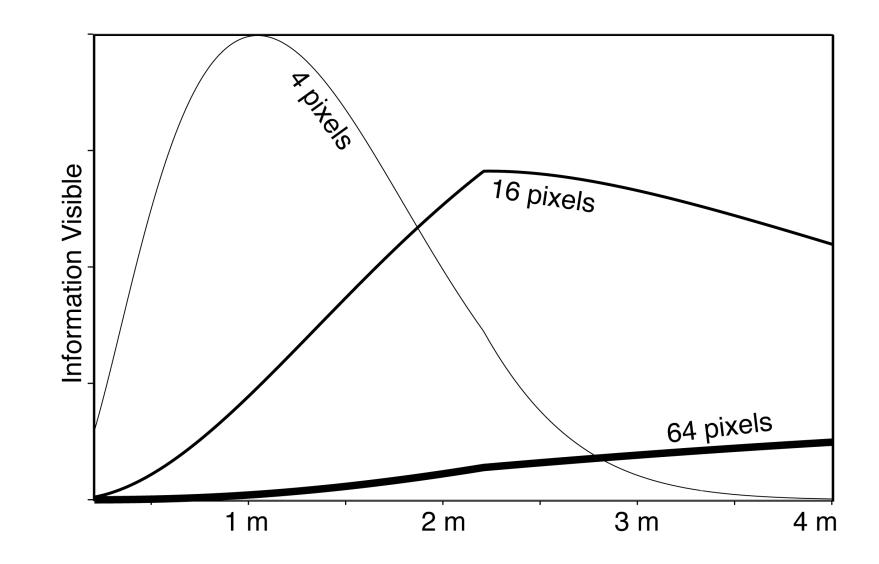
Leveraging Large Displays

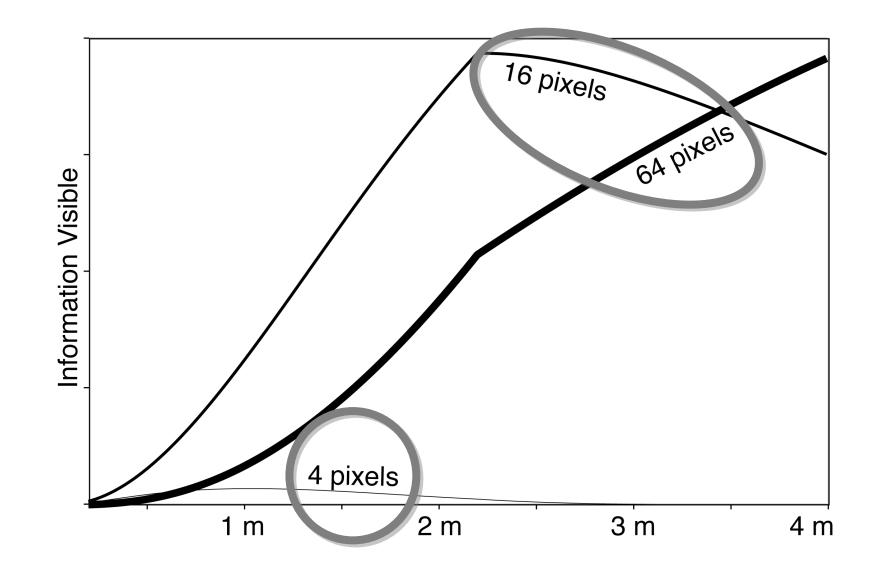


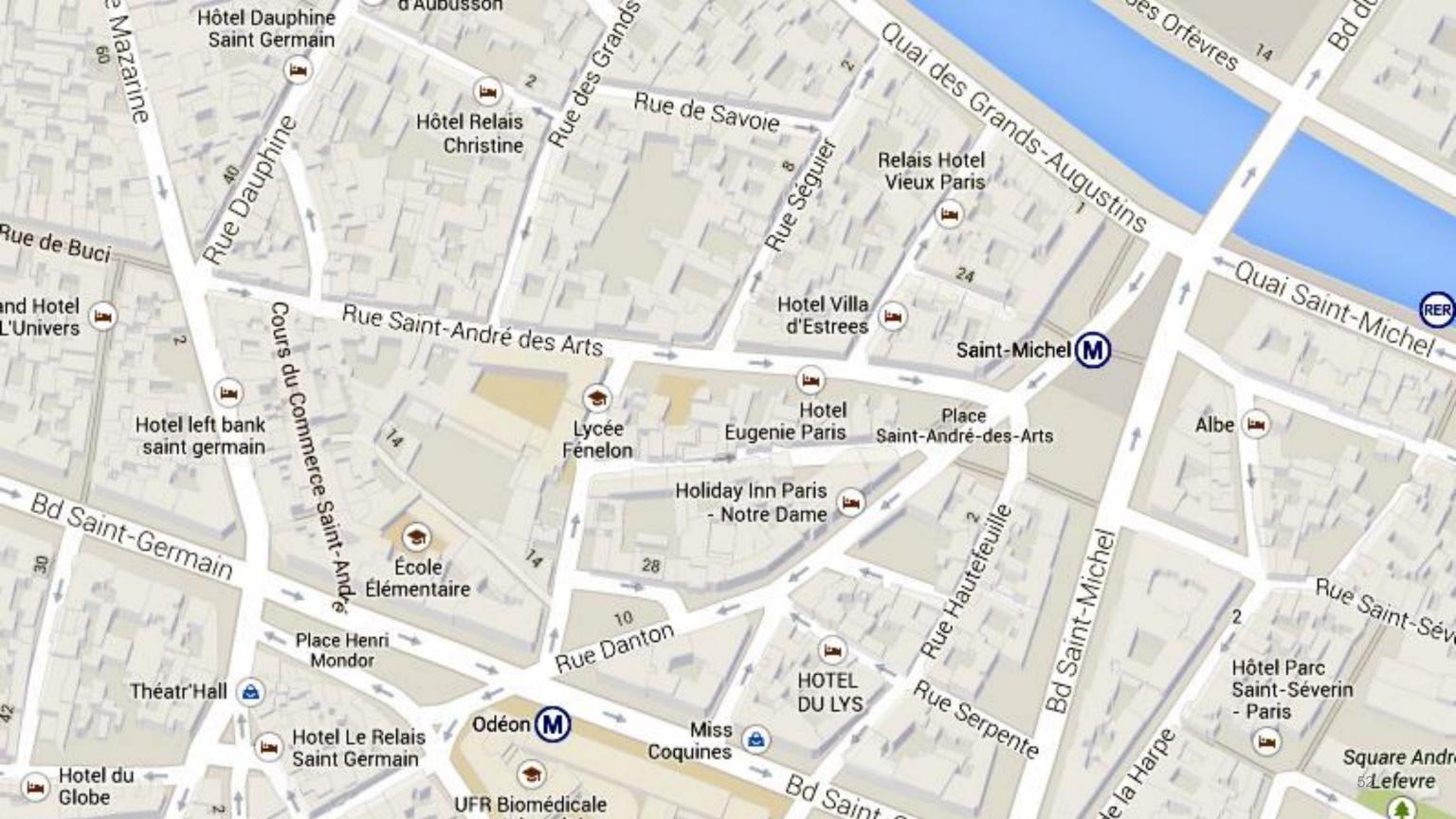


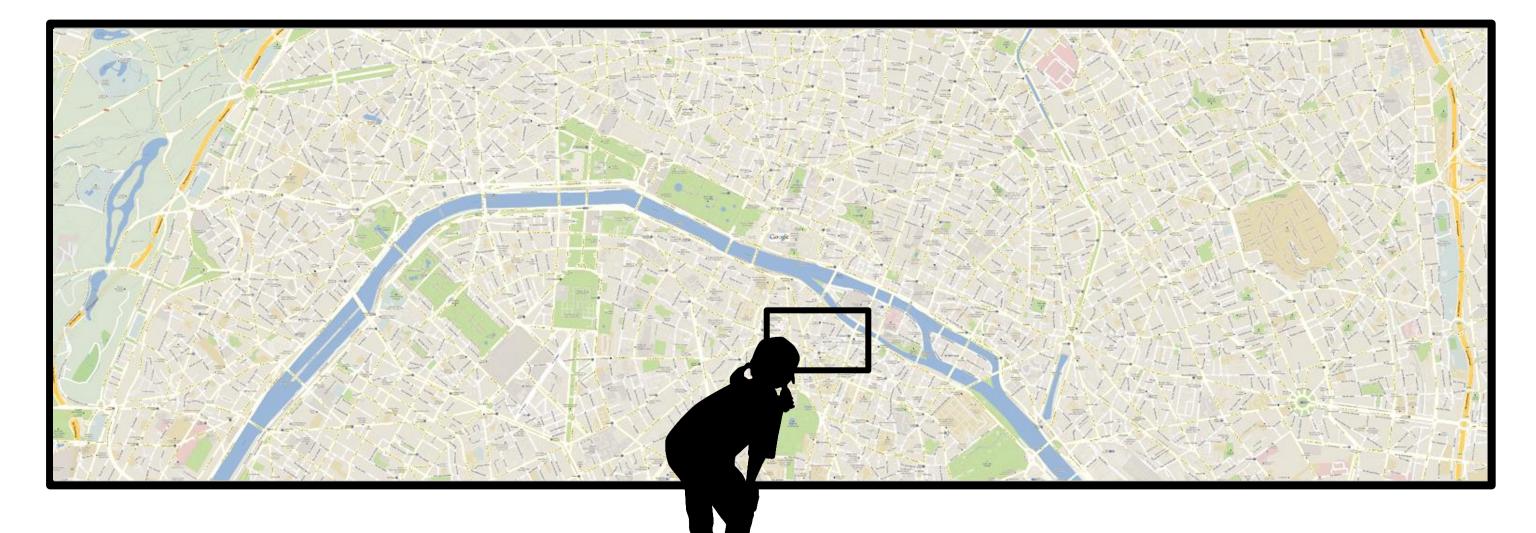


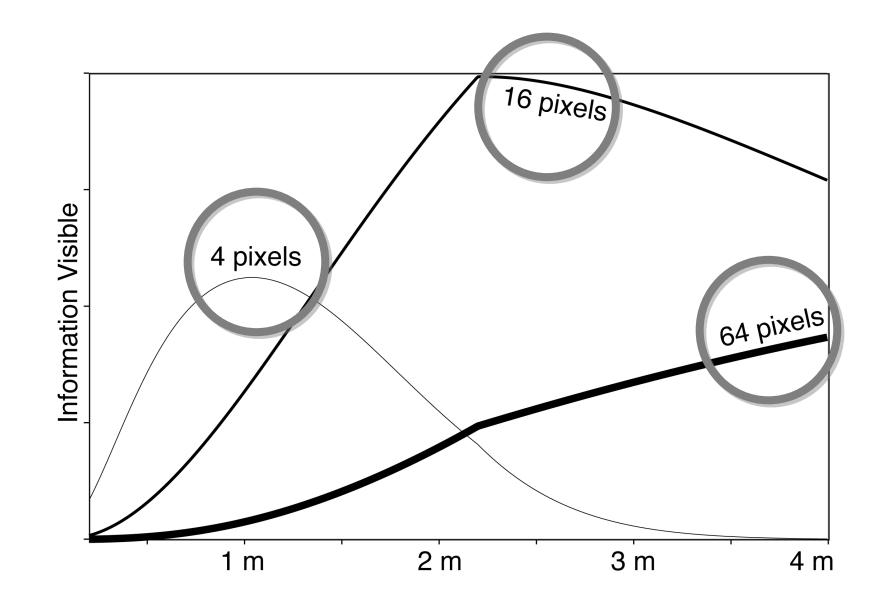




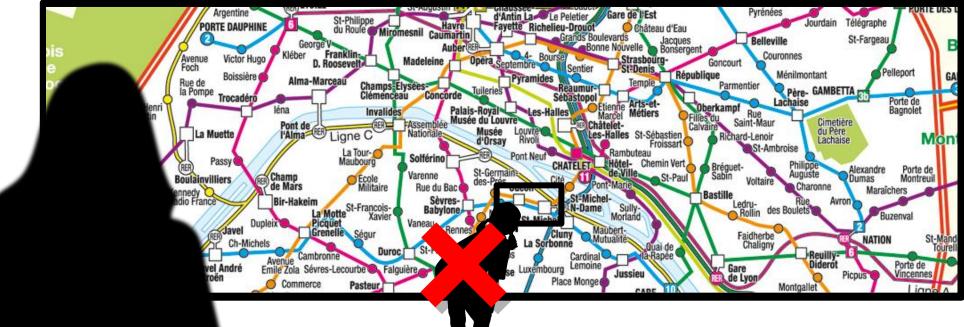




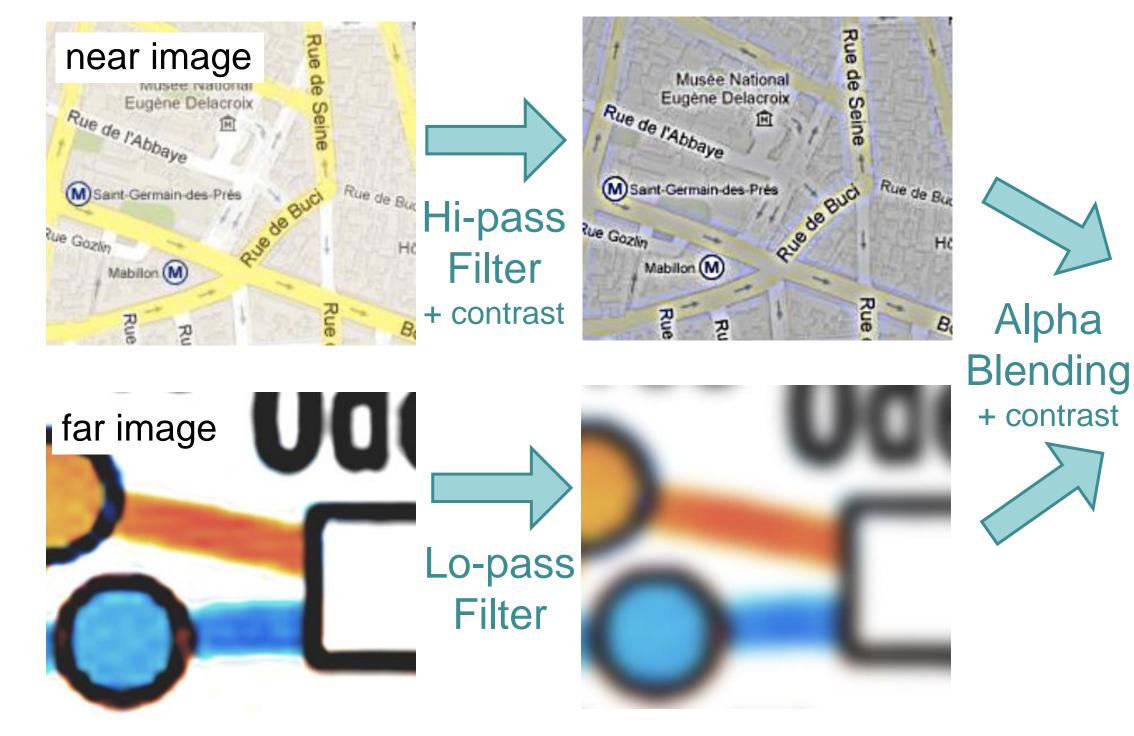


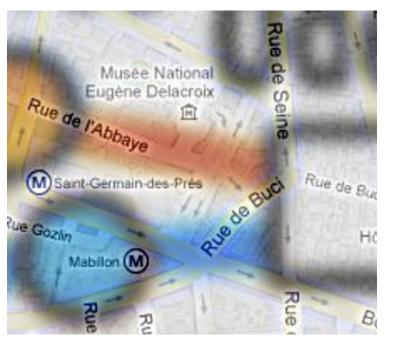
















Place Sant-André-des-Arts

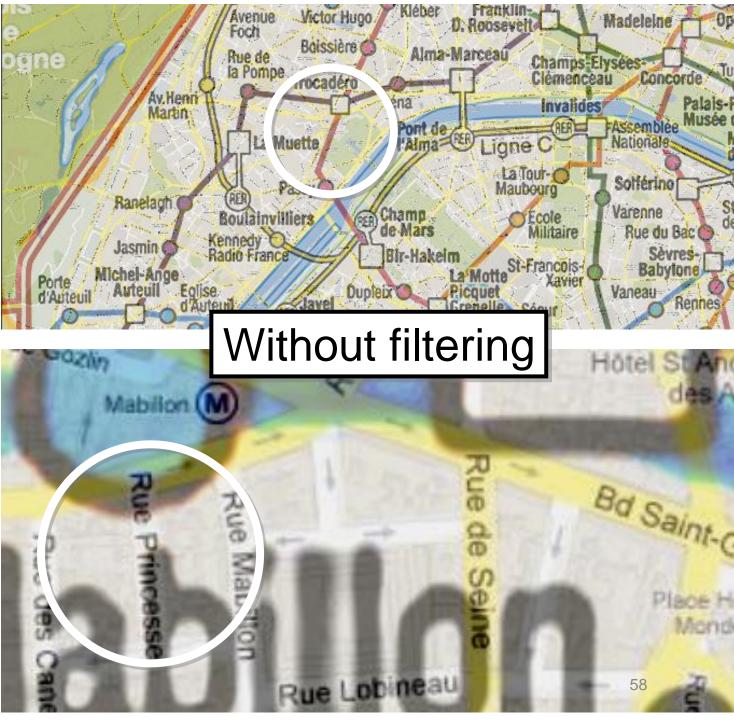
Cinema Esp Saint Michel

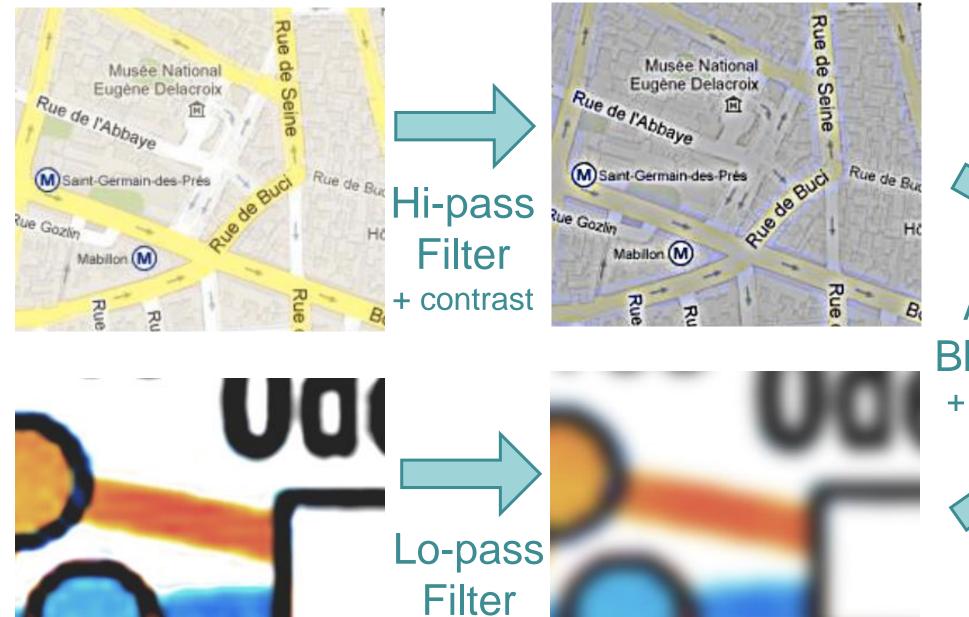
Color And Color

- Notre-D

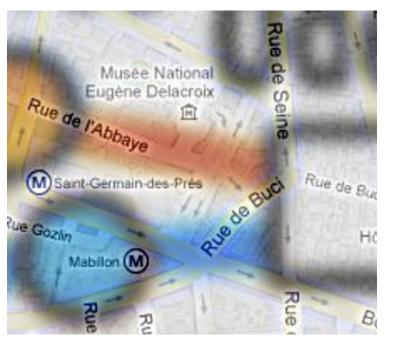
Sa

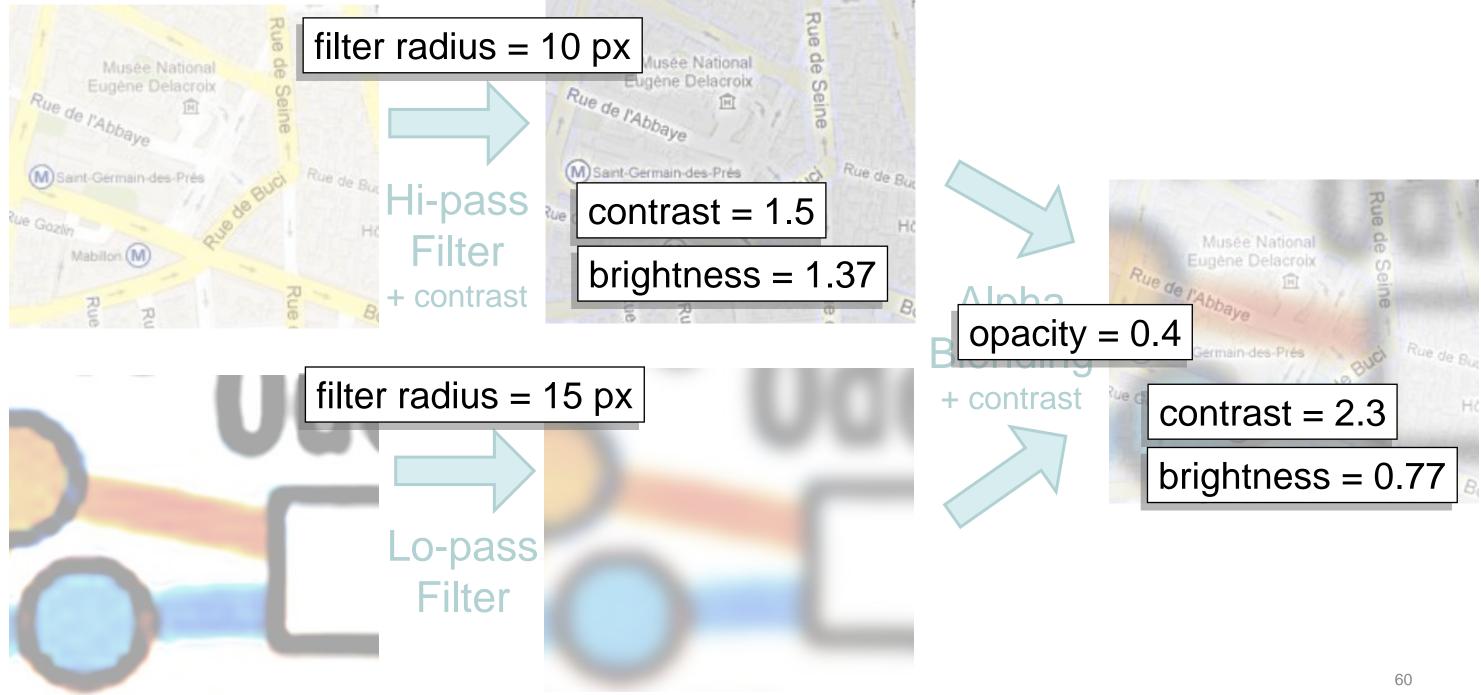




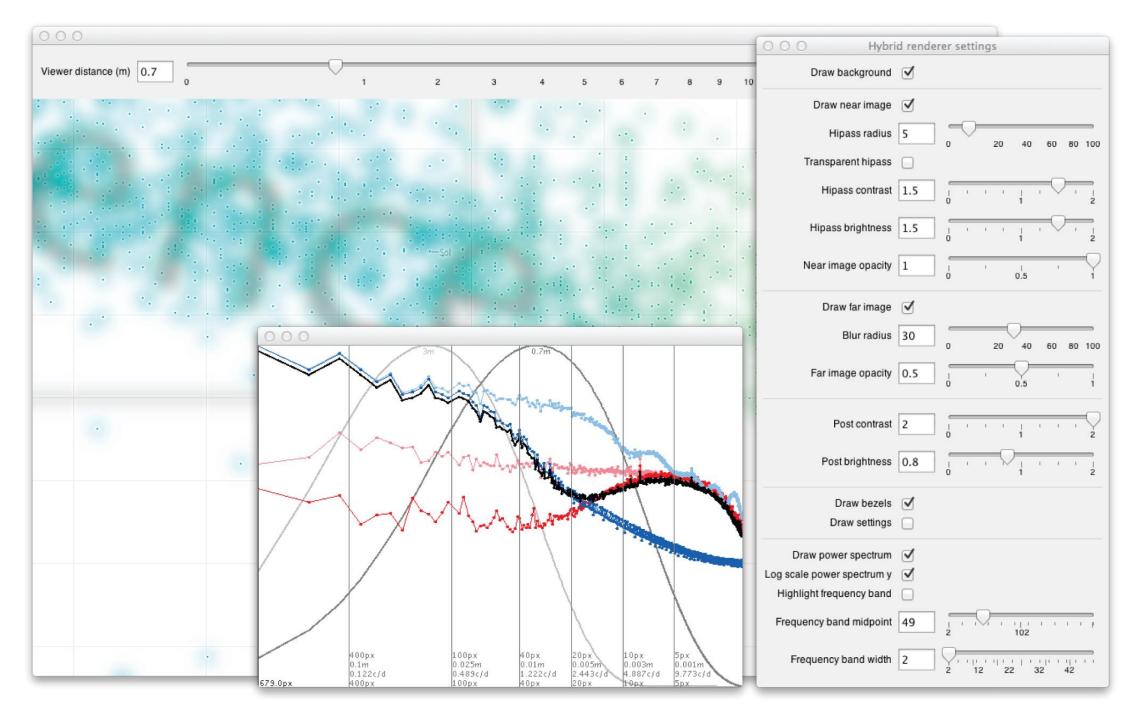








Hybrid Image Maker



Hybrid Images for Large-Scale Visualizations

 Theoretical grounding why & when use hybrid images?

Tools

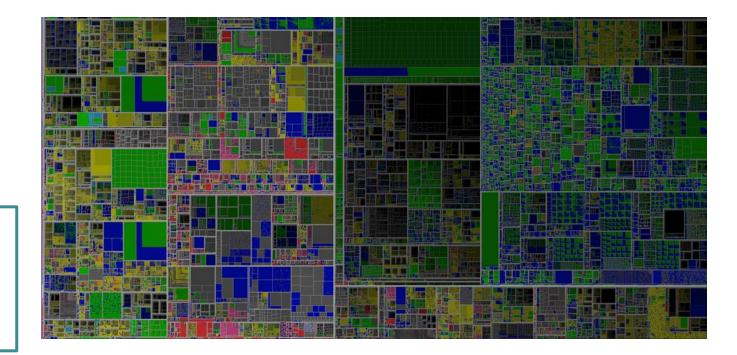
how to support their creation?

Examples

what are they really good for?

Design principles

how to build effective ones?







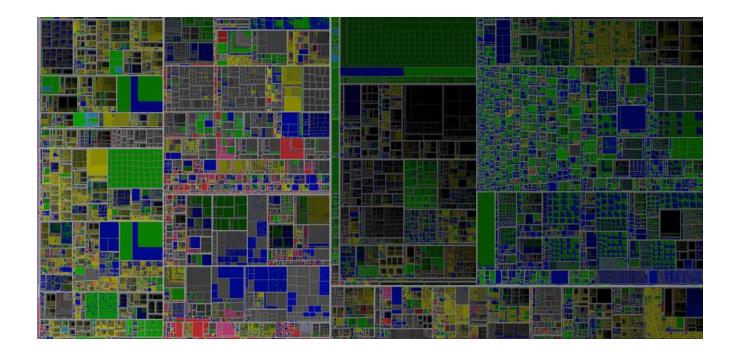
Hybrid Images for Large-Scale Visualizations

- Theoretical grounding why & when use hybrid images?
- Tools
 - how to support their creation?
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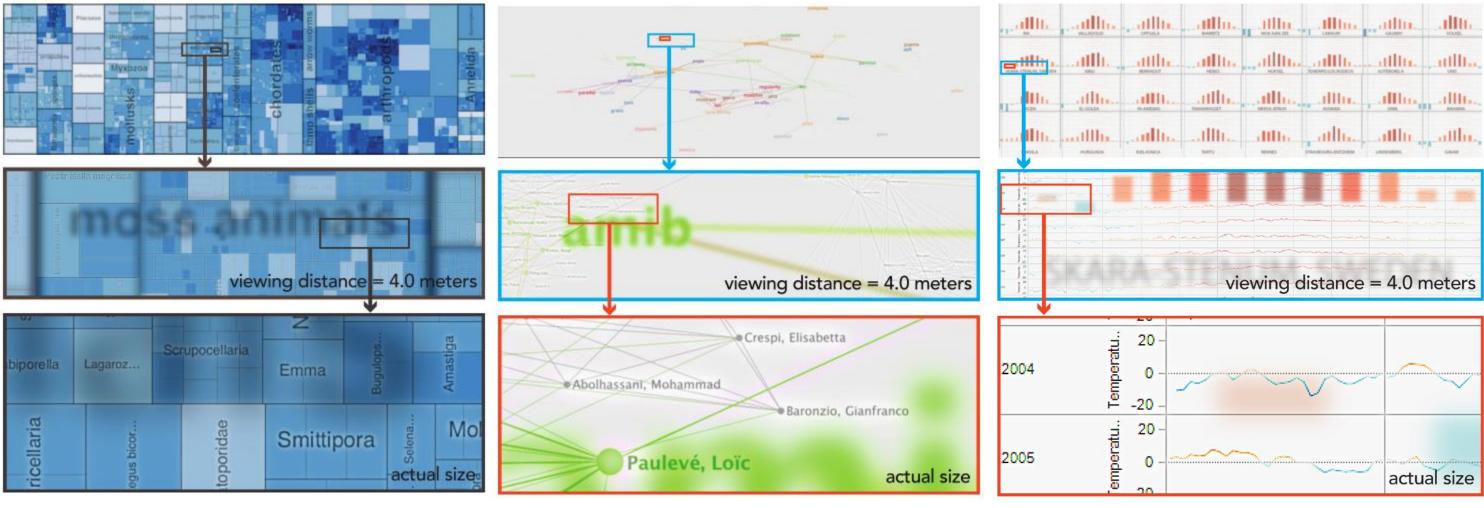






http://aviz.fr/hybridvis





Tree of Life Treemap

co-authorship network

...and more

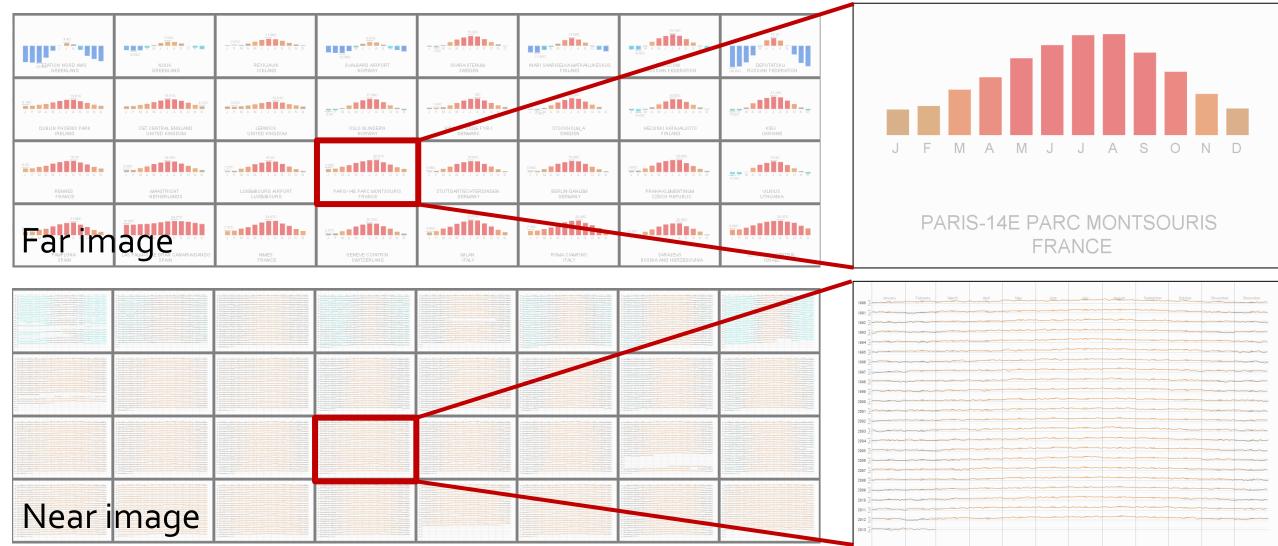


temperature data

http://aviz.fr/hybridvis

HI-Visualization Techniques

- Mixing multiple visualizations
- Navigation aids & summaries





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http://aviz.fr/hybridvis

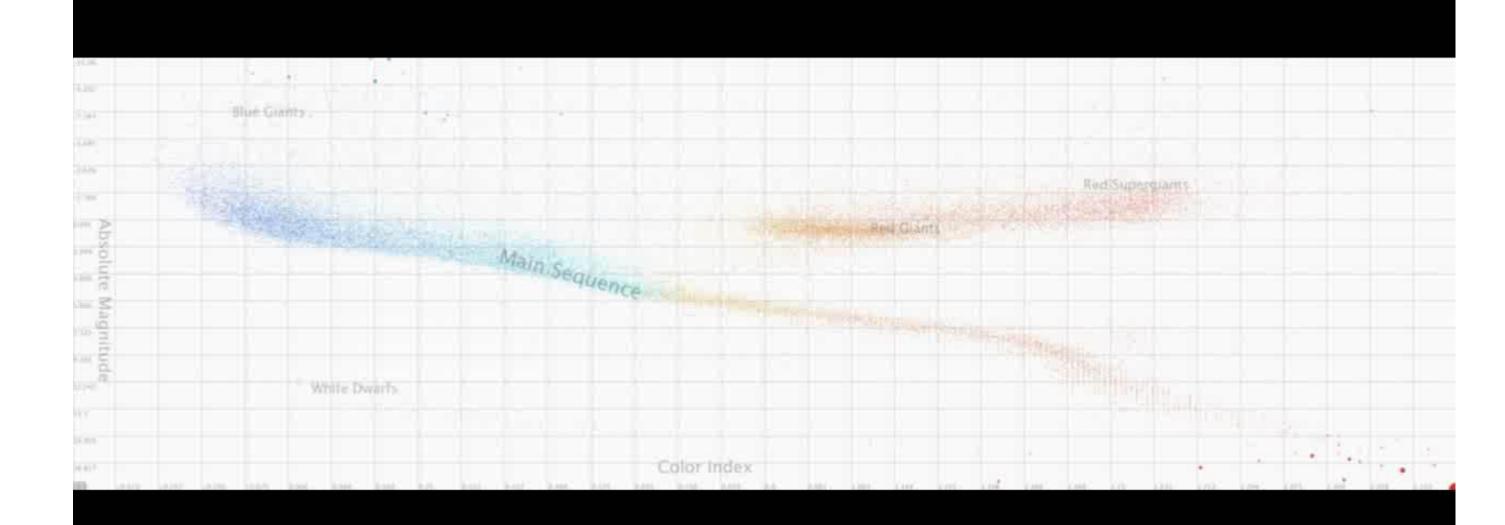
HI-Visualization Techniques

- Support perceptual grouping
- Highlight values
- Dual-scale reference structures

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Hertzsprung-Russell diagram (think of this as a scatterplot)





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homehair worms. arrow worms entoprocts Piacozoa loriciterans . 1 threadworms (II) chordates coelenterates arthropod phoronida kinoritynche. priapulains Myxozoa orthorectids authors are recommended sponge mollusks shells the state of the s solution weather _ flatworms. Cilibatora lamp

Cycliophora

r bears

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Limitations

- No fully-automated hybrid-image visualization possible
 - visibility != legibility
 - yet, some feature legibility can be predicted (text, grids)
 - color may change due to filtering
 - contrast removed through blending
- Fast preview but final image production slow in full res (hardware acceleration possible)

Conclusion

 Theoretical grounding why & when use hybrid images?

• Tools

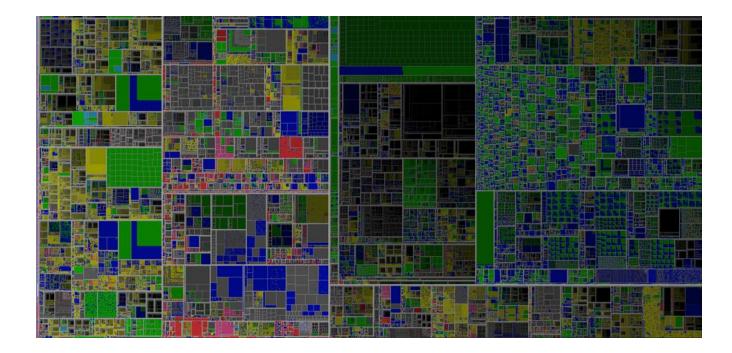
how to support their creation?

• Examples

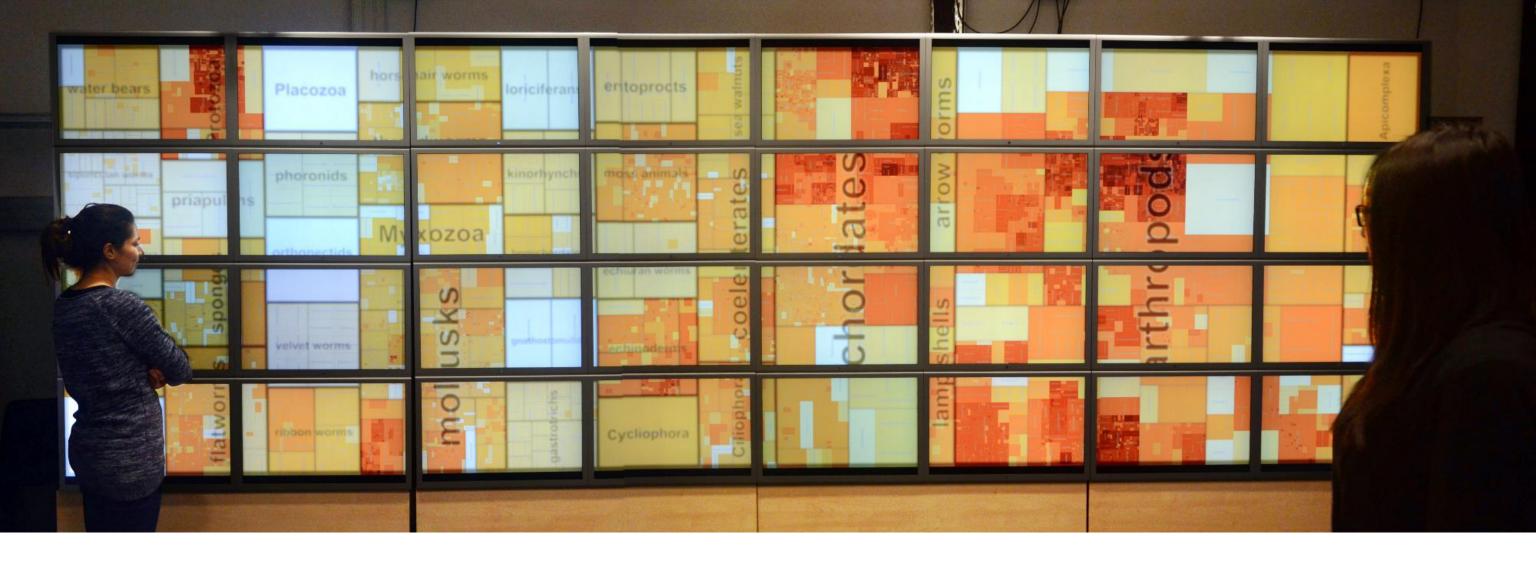
what are they really good for?

• Design principles

how to build effective ones?













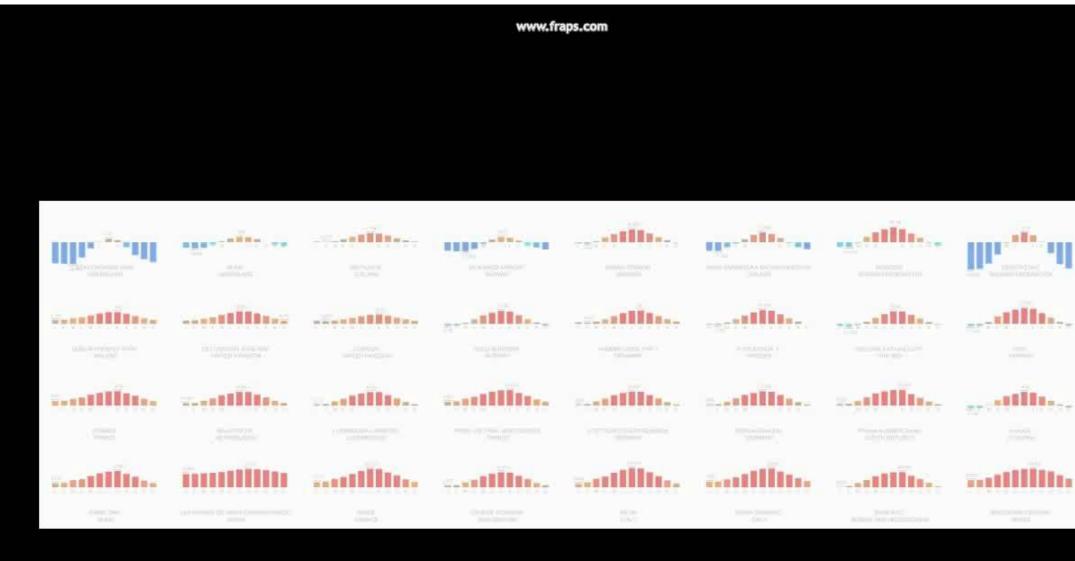
http:aviz.fr/hybridvis

Funded by: ANR-11-JS02-003

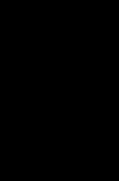


Question Slides

Video: Information Loss When Walking Close





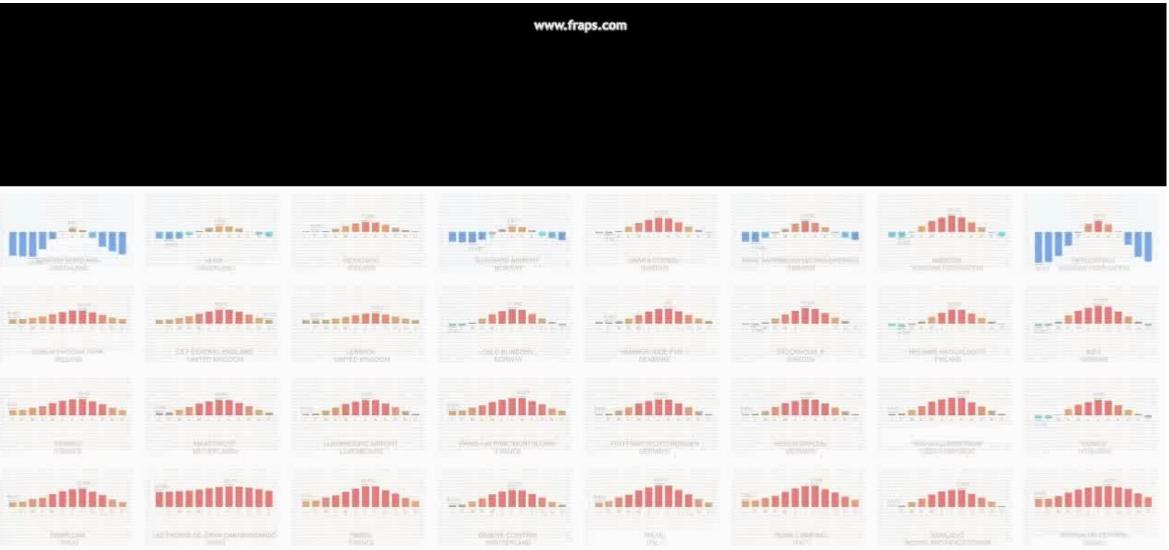




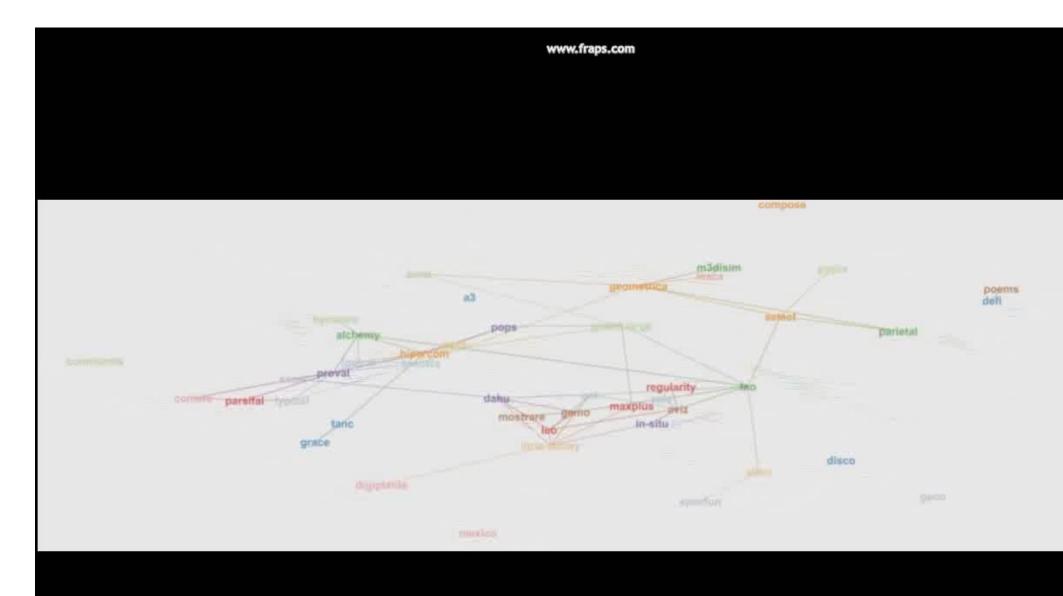
Video: Mental Aggregation

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February 2.410	Match 10.059	April 10,810	Mav 12.870	15,350	30/γ. 20.380	
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Fabrany 730	March	April 10.530	May 17,150	18,518	July-	
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February 6.530	March	Apiil 10,080	Mav 18,955	durre 18.120	July. 20.730	
February	March	April	May 140460	June 19:06C	Juny 19.810	

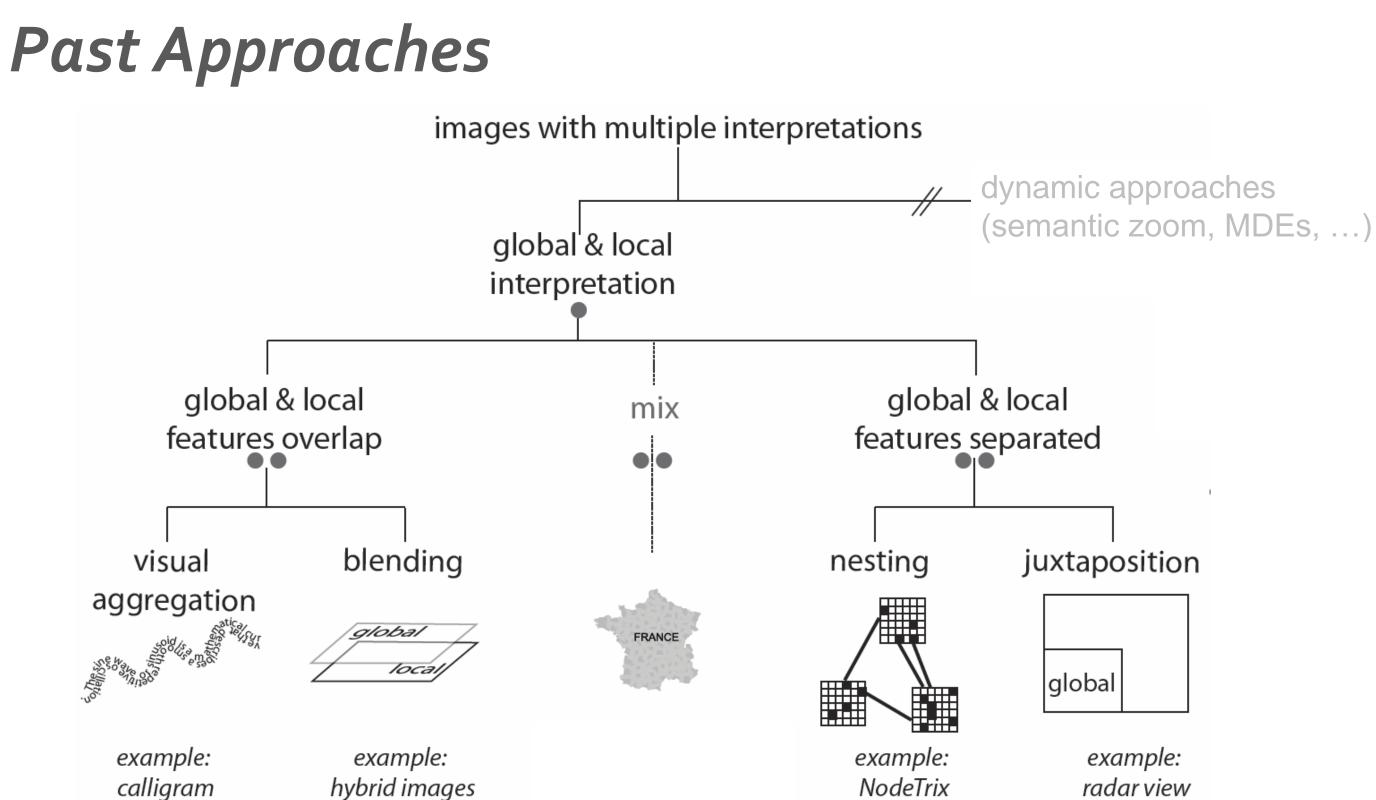
Video: Alpha blending



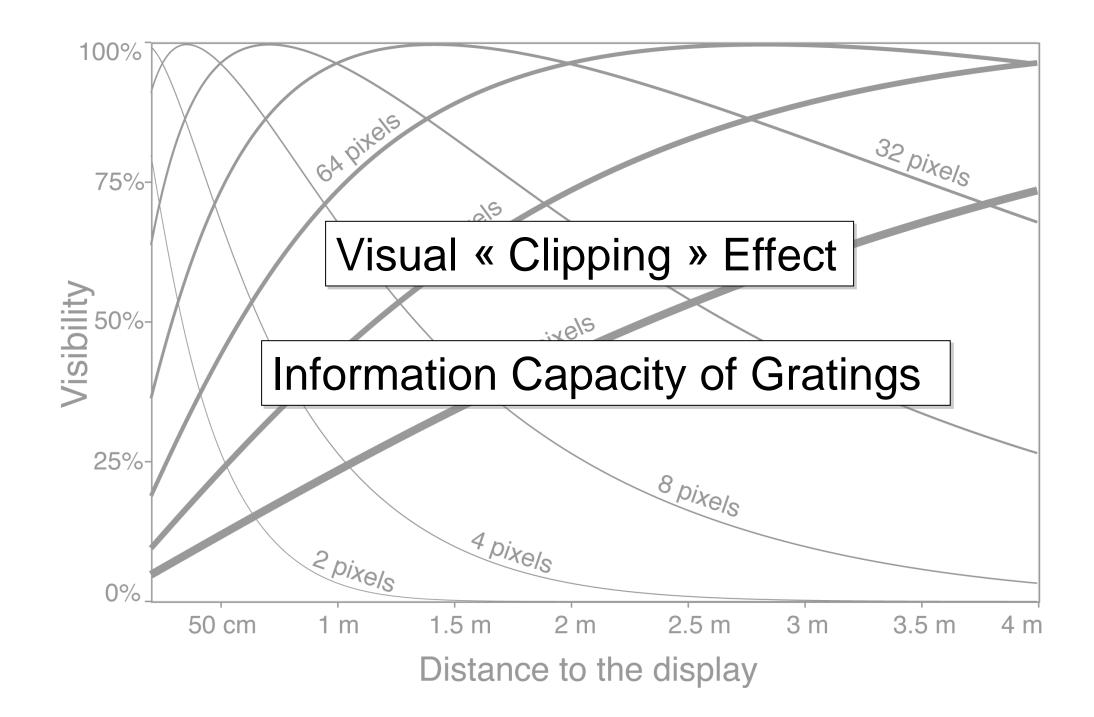
Video: Graph vis



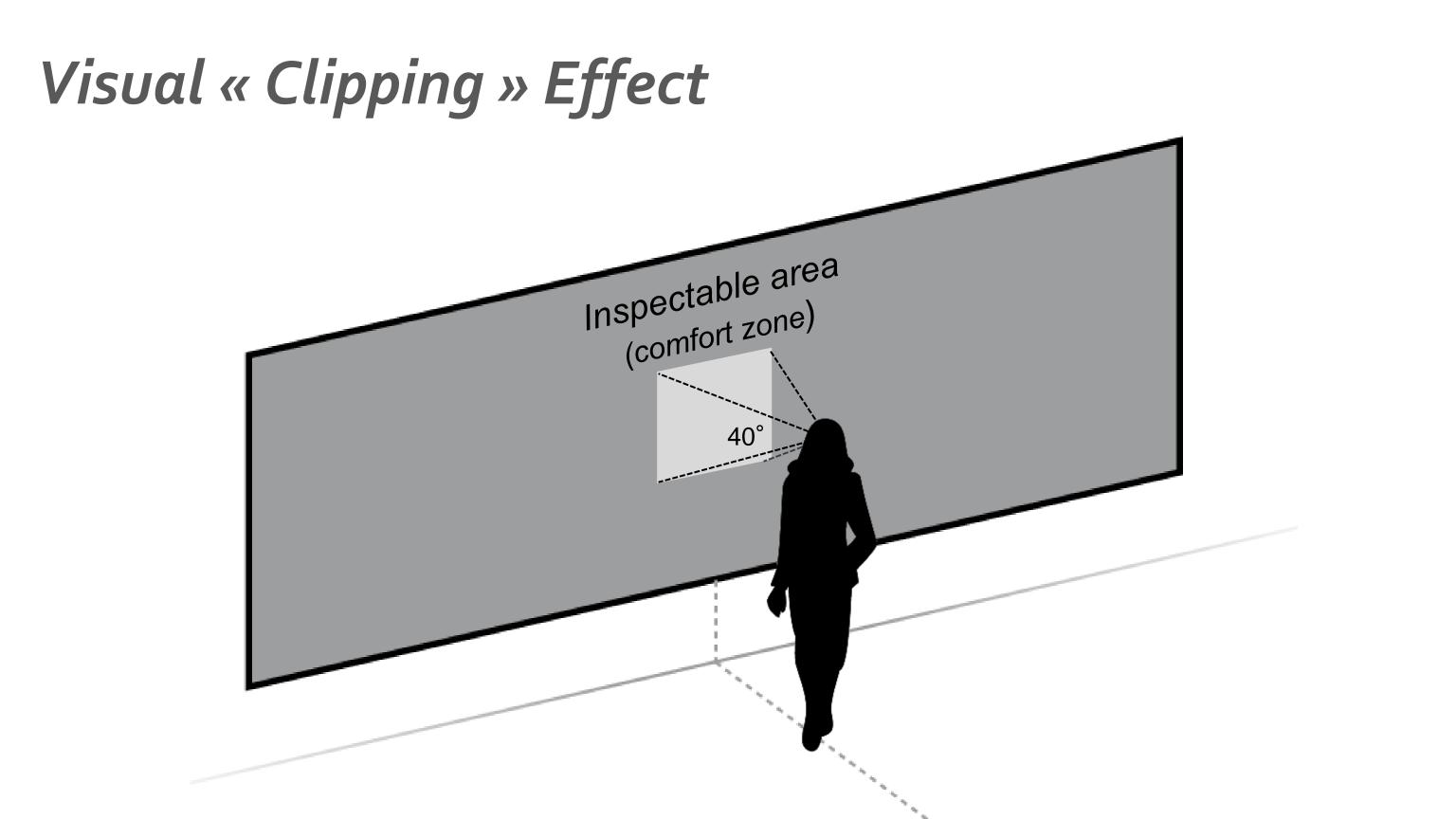




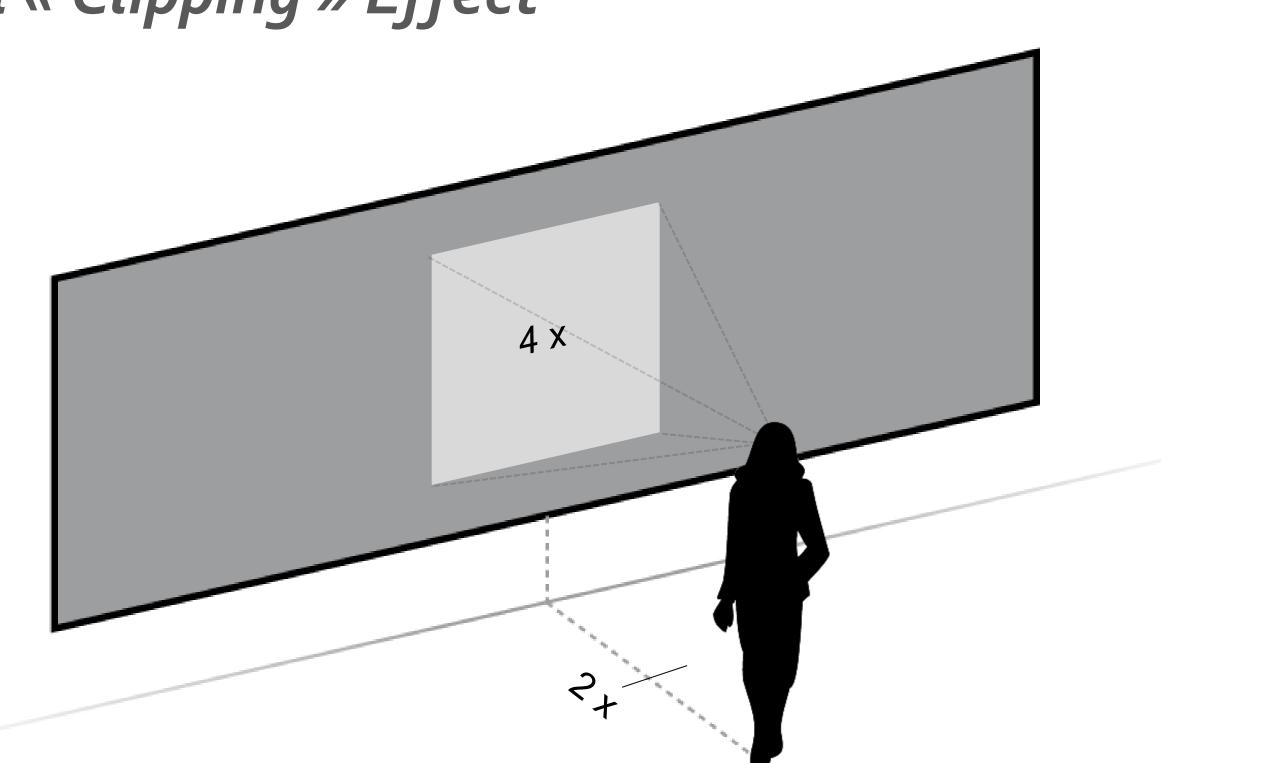
What do we Perceive from a Large Display?

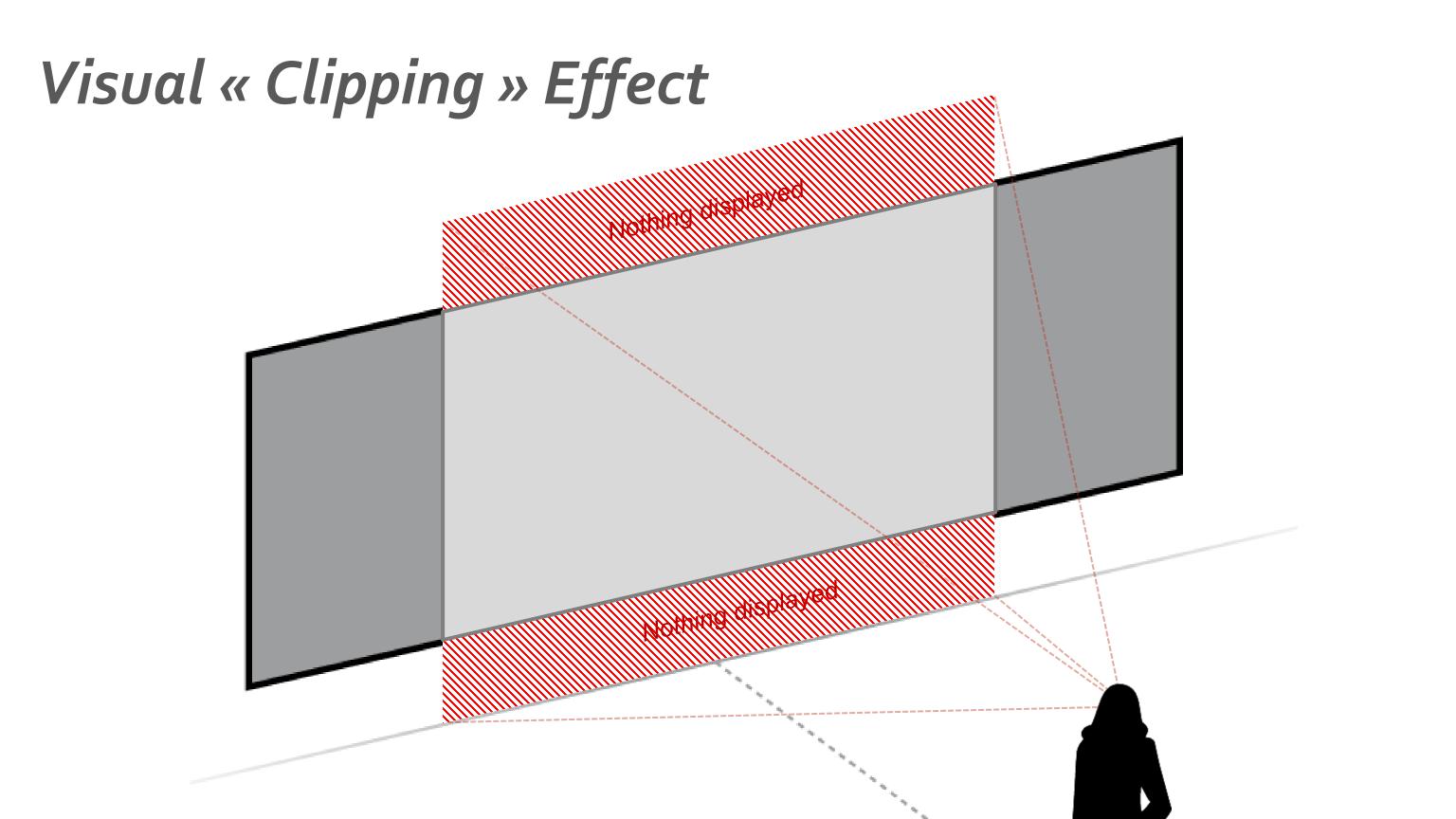






Visual « Clipping » Effect





Visual « Clipping » Effect

