

Amanda Carmer
New Visual Studies, Spring 2013

Information Visualization

Why Infographics Are Everywhere

The complex connectedness of modern times...demands a pluralistic understanding of the world that is able to envision the wider structural plan and at the same time examine the intricate mesh of connections among its smallest elements. Manuel Lima

This essay is intended as a structural and categorical investigation of infographics with an emphasis on the cognitive variables that affect sophisticated design. Graphic representations of information are ubiquitous today—from the walls of subway cars to the menu of your favorite restaurant, data sets in the form of pictures are everywhere. While infographics may be clogging sight lines they are also helping us to understand the complex connections and impact of the information they present. Designers of these new didactics utilize the inherent biological, cognitive and psychological processes of human vision to present their message effectively. This synthesis of science and design is best understood within the arena of visual studies—as W.J.T. Mitchell defines it, the field of research focused on “the visual construction of the social field,” (171). For our ability to see both dictates the form and content of design *and* is affected by it.

Manuel Lima, the author of *Visual Complexity: Mapping Patterns of Information*, began collecting information graphics, or in his terms—information visualizations, in 2004. He has since catalogued a virtual library of over seven hundred projects describing, in visual terms, everything from mapping discussion trends on Twitter to a storyline of the evolution of software, on his website VisualComplexity.com. Lima’s collection provides a wealth of examples to help us understand what types of information are typically presented

and what the most successful of these look like. In the simplest terms, information visualizations can be defined as abstract concepts, complex processes or data sets represented as pictograms, charts or graphs. Frequently found on VisualComplexity.com are colorful chartings of two basic types—tree-like structures and web or rhizome-like structures, through these two types we can trace the origins of information visualization.

To understand why and how information visualization has taken such specific forms we look to the historical development of its first exemplars; graphs, charts and symbols. We can trace the use of pictures, specifically the symbol of a tree, to communicate ideas and values from our ancient Neolithic ancestors through the development of the world's major religions. This reoccurring tree motif is typically invoked to explain a lineage or origin, the advantage of which is pragmatic; to “express multiplicity from unity,” (Lima 44). Early Hinduism has its tree of Ashvastha, in Buddhism this is called the Bodhi tree under which Gautama Buddha meditated and attained enlightenment. The myth of the tree of knowledge, of good and evil, is shared by Christians, Muslims, and Jews all over the world, the origin of which can be traced back to the ancient Babylonian civilization of Sumer, in modern-day Iraq. The most literal use of the tree to express religious particularities is in the mystical Jewish tradition of Kabbalah—the “Sephirotic tree: a diagram of ten circles symbolizing ten pulses, or emanations, of divine energy,” (Lima 23). The graphic representation of this tree is to be read in a zigzag pattern from top to bottom, left to right. It describes and explains the stages of divine creation, it assists devotees in understanding how “a sublime and intangible presence [translates into] a physical and earthly existence,” (Lima 23).

Looking forward in time, we see charts and graphs utilized by early scientists to explain the impact of their gathered data. Florence Nightingale documented the causes of

British Army deaths during the Crimean War between July 1854 and July 1855. She published her findings in *Notes on Matters Affecting the Health, Efficiency and Hospital Administration of the British Army* in 1858, including a polar-area diagram, an early pie chart, that clearly shows the disproportionate number of deaths due to preventable causes. This diagram helped persuade the British Parliament to institute massive changes in its army's medical administration and improve the living conditions of soldiers on the front lines. Today, visual representations of scientific findings are virtually required in most formal studies.

Over the course of the last century and a half industrialization and globalization have changed how and what scientists study. Warren Weaver, in his 1948 article entitled "Science and Complexity," breaks down the history of science into three stages: the first address problems of simplicity; the second, problems of disorganized complexity; and the third, problems of organized complexity, (2). Weaver recognized that as technology provided a sharper means to look at the world it also presented a greater web of interconnectedness for scientists to unweave. Science today is charged with the task of understanding the interconnected and interdependent variables of complex processes like price fluctuation, currency stabilization and war strategy, (Lima 45). In these cases, the symbolic tree as an organizational tool is no longer useful, instead the rhizome model has become the preferred structure. The rhizome offers an acentered, nonhierarchical, and non-signifying system, better suited to represent contemporary sorts of information. In addition, advanced computer software and Internet technology also play a role in the aesthetics of information visualization. Sophisticated programs like Adobe's Creative Suite and others enable designers to easily create refined graphics, while the Internet enhances rapid distribution and increased accessibility to information.

This massive amount of visual input requires a sharp, skilled eye and keen mind to make sense out of dynamic components. How we see plays a large part in how we process visual information. As Rudolf Arnheim suggests, “vision is not a mechanical recording of elements, but rather the apprehension of significant structural patterns,” (6). Interconnected biological and cognitive processes take place simultaneously in order for us to make meaning based on what we see. As light energy travels through the eye and lands on the retina it is transformed into electrical impulses then processed in the brain. The human eye is a sensitive organ, it is able to identify minute details rapidly by focusing in with the fovea, the center point of vision, while also recording general environmental details with peripheral vision. The advantage of this dual process is a wide spectrum of collected data, while the downside is that only a fraction of that data is complete. This is because peripheral vision is incomplete—the brain fills in the blanks with memories and existing knowledge.

This triage of visual collecting allows us to take in a broader range of visual information at one time, the brain is then able to process and make sense of what it sees within the context of what it already knows. Two types of cognitive processing take place almost simultaneously—bottom up and top down processing. Bottom up processing involves an automatic, relatively unconscious response to external stimuli, (Malamed 25). Top down processing involves an internal cognitive digestion and comparison of incoming stimulus to existing knowledge of the world. Biological processes trigger these cognitive processes, however learning requires further mental work—retention and recall. Our memories retain information on three different levels—as sensory memory, working memory, and long-term memory. A specific compartment within long-term memory, semantic memory, records facts and concepts, data and general knowledge about the

world. We rely on semantic memories in order to engage with new material and experiences, which can be thought of in terms of thinking strategies.

In her book entitled *Visual Language for Designers*, Connie Malamed describes four thinking strategies—the construction of schema, automaticity, mental models, and dual coding. Schema are mentally constructed categories for grouping information that facilitate storage and access later on. Automaticity refers to our ability to recall specific schemas with great ease, for example, word recognition—our ability to read is a process of automaticity. We use mental models, or the prediction of cause and effect relationships based on previous experience to anticipate events. Dual coding refers to our ability to recognize purely visual information as well as intended meanings inherent in that information simultaneously, like meanings associated with certain symbols.

Malamed points to these various strategies to help designers construct effective and meaningful graphics. She describes the initial response to graphically represented information as the pre-attentive or early vision stage. This is the first impression, the first few seconds of a viewer's interaction with a graphic. During this stage information is consumed on a virtually unconscious level and designers can use a handful of tools to direct attention. The structure of a graphic, how its component parts are placed and organized will set the tone and determine the trajectory of a viewer's experience. In western cultures we are conditioned to read visual information beginning in the top left-hand corner of a page and continuing horizontally toward the right. Knowing this, a designer can place pertinent information in the upper left and organize the remaining information accordingly. Emphasis on "primitive features" is also key. Principles such as color, movement, orientation and size can be used to create underlying meanings. Large, brightly colored text will invariably capture viewer's attention, while carefully placed lines

and shapes will move their eye around the page. Reducing realism, representing abstract concepts as concrete objects and clarifying complex relationships are also important goals of successful designers. Malamed insists that “an informative image is not only well designed; it captures both the feeling of the content [of the image] and facilitates an understanding of it,” (14-15).

Viewers are also becoming much more aesthetically savvy. In an interview with Creative Director Travis Fahlen I asked—has the level of viewer sophistication changed since you began working in the industry? He replied with an emphatic, yes. He states that his clients have greater “knowledge of the web and social media,” and this effects both what they want from him as a designer and how they interpret his work.

It is not enough, however, to consider the motivations of designers, we must also consider the utilitarian and aesthetic purposes of information visualizations. As visual studies scholars like Barbara Stafford and James Elkins suggest, our study of visual imagery must be expanded beyond the art historical canon to include all imagery. In an effort to connect science-based constructs to fine art, Lima points out that the aesthetics of information visualizations are reflected in the early Modernists’ turn toward abstraction—specifically in the work of Malevich, Kupka and Mondrian with their bare lines and shapes stripped to elemental basics, (12). Alternately, graphic designers utilize similar principles to evoke the complex meanings of data and scientific systems. In this way, infographics exist in the space where science, design and art intersect, (Lima 13). Information visualizations are an important part of this expanded discussion for the insights they provide into how we organize and understand the complex networks of our contemporary economies. In addition, analyzing our visual representations of complex systems can help us understand the source and nature of those constructions.

George Lakoff suggests that our understanding of and movement through the world is determined by pattern recognition and organization of information into categories. These categories function like schema and enable us to understand new categories through existing ones—through metaphor. The tree and rhizome structures utilized in many information visualizations are basic examples of visual metaphor in use. An interesting and humorous example of the rhizome structure is used to represent a complex set of data entitled The Grand Taxonomy of Rap Names. This graphic takes the form of a web—five qualitative categories represented as bubbles in five different colors serve as the basis for numerous derivative subcategories. These categories include Physical or Metaphysical Attributes, Alphanumeric properties, Wordplay, Crime, and Titles/Honorifics. Each heading is encapsulated in a colored bubble of varying size that visually describes their various significance and popularity in rapper’s name choices. Connecting lines from one category to the next are dotted with more bubbles, each containing a more specific name type or, floating in space without a bubble at all, a particular rapper’s name. Hence, we see at the intersection of Wordplay: Repetition and Titles/Honorifics: Markies is the rapper Marky Mark. In this case the information graphic is fun and enlightening. However, in some cases the information visualization can be misleading. In the designer’s effort to simplify complex information to make it easily understandable false relationships may develop.

To illustrate this misstep I present the popular Manual Photography Cheat Sheet infographic. This information visualization breaks down the complex controls of a manual film camera into colorful pictograms arranged linearly and stacked on top of one another. Standard Exposure, Aperture, Shutter Speed and ISO settings are all included. For the beginning photographer, these settings or measurements can be quite confusing—shutter

speeds are measured in fractions of a second yet are represented as whole numbers presenting the counterintuitive problem of ascending numbers referring to shorter increments of time. On the other hand, aperture settings are a measure of the gauged opening in the lens—greater numbers represent smaller openings. Because different film types are more or less sensitive to light and light quality changes with every situation, there is no exact combination of aperture and shutter speed setting, too many factors need to be taken into account. The fault of the Manual Photography Cheat Sheet exists in its static representation of these measurements. A beginning photographer might assume that the Aperture settings stacked neatly on top of the Shutter Speed settings indicate appropriate selections. This is not the case.

However useful information visualizations may seem it is important to attend to them with a high level of scrutiny to avoid misconception and mistaken understanding. Stafford explains that visual analogies like this allow us to form lateral links between concepts, states of being, and demonstrable experience, (61). For this reason graphic representations of information are truly loaded messages, capable of facilitating an incorrect understanding when the initial component of the metaphor is misrecognized. Only when we correctly understand the initial framework can we correctly form new knowledge.

There are notable advantages and disadvantages to representing data visually and these must be addressed as these models proliferate. In the beginning, the tree model illustrated unity through multiplicity and reassured scientists that the complexities of the modern world could be traced to a single origin. Later, as the study of various sciences evolved so too did the model used to represent scientific findings, the rhizome embodies the complex nuances inherent in our time. Ultimately, information visualizations facilitate

the comprehension of abstract ideas and processes and enable the illustration of complex relationships otherwise invisible or difficult to apprehend. It is important, however to keep in mind certain disadvantages of purely graphic representations of information. The assumption that pictures may cross cultural and language barriers is simply untrue—many visual elements from colors and lines to symbols and shapes hold very different meanings from one culture to the next. And, as described earlier, the over simplification of data can be misleading and result in false concepts.

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Abstract concepts,
complex processes and
data represented visually
through pictograms,
charts and graphs.

Contributing Factors and Conditions
Individualities and Characteristics
Technology and the Internet

Rhymes



Human Perception and Memory
Biological Process of Vision
Cognitive Processing
Memory

Semantic

Episodic

Procedural

Thinking Strategies
Schema
Automaticity
Mental Models
Dual-Coding

Design Strategies
Pre-attentive processing or early vision responds to primitive features:
Color
Size
Orientation
Motion

Organize

Direct the Eye

Simplify



History
Graphs
Charts
and
Symbols

Trees



Fluence
Nephograms



Visual Studies Theory
Visual Complexity: Mapping Patterns of Information
Science
Design
Art

Group Labels

Color-Coding

Self-Labeling

Visual Flow



Infographics

Information Visualization



through pictograms,
charts and graphs.

Trees



Florence
Nightingale



Innovate
Challenge
Undermine

W.J.T. Mitchell

James Elkins

Infographics

Information Visualization

Abstract concepts,
complex processes and
data represented visually
through pictograms,
charts and graphs.

Pattern Reco
Categoriza
Metapho

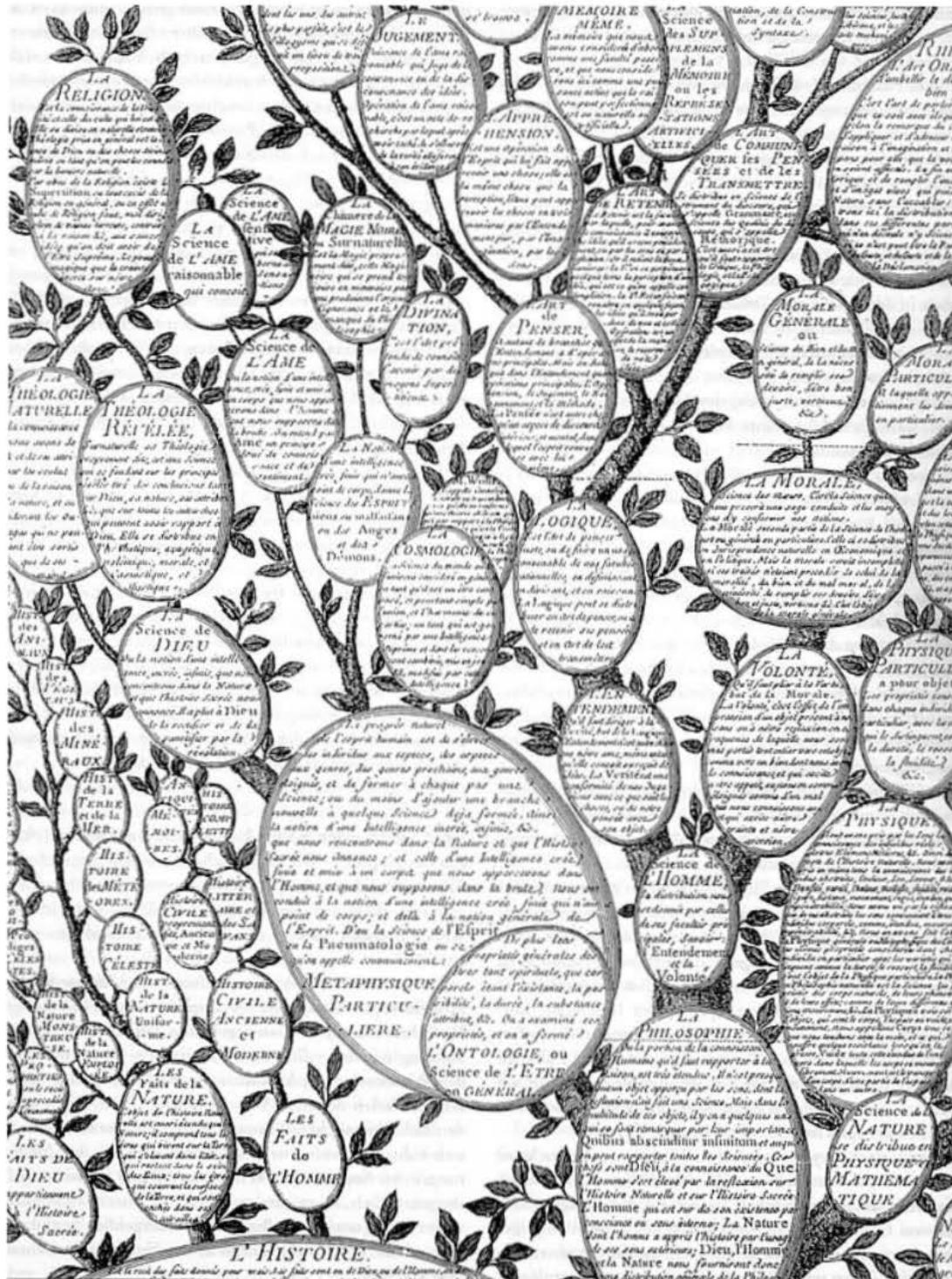
Innovate
Challenge
Undermine

2014-2015-2016-2017-2018-2019-2020-2021-2022-2023-2024-2025-2026-2027-2028-2029-2030-2031-2032-2033-2034-2035-2036-2037-2038-2039-2040-2041-2042-2043-2044-2045-2046-2047-2048-2049-2050-2051-2052-2053-2054-2055-2056-2057-2058-2059-2060-2061-2062-2063-2064-2065-2066-2067-2068-2069-2070-2071-2072-2073-2074-2075-2076-2077-2078-2079-2080-2081-2082-2083-2084-2085-2086-2087-2088-2089-2090-2091-2092-2093-2094-2095-2096-2097-2098-2099-2100

History

Graphs
Charts
and
Symbols

Trees

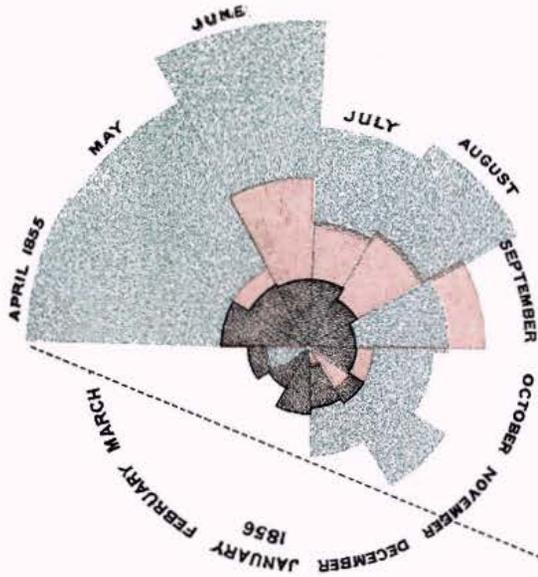


L'HISTOIRE

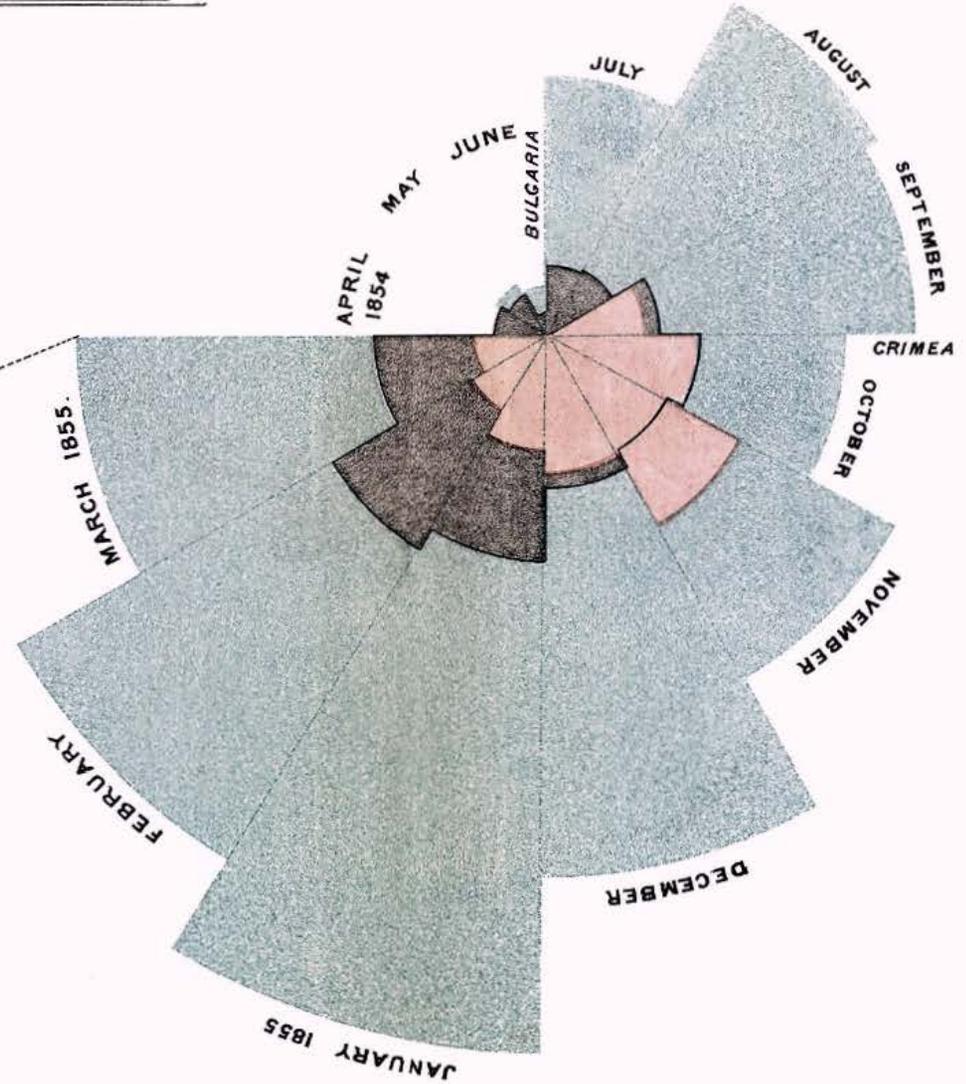
*Florence
Nightingale*

DIAGRAM OF THE CAUSES OF MORTALITY IN THE ARMY IN THE EAST.

2.
APRIL 1855 TO MARCH 1856.



1.
APRIL 1854 TO MARCH 1855.



The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex.

The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic diseases; the red wedges measured from the centre the deaths from wounds; & the black wedges measured from the centre the deaths from all other causes.

The black line across the red triangle in Nov^r 1854 marks the boundary of the deaths from all other causes during the month.

In October 1854, & April 1855, the black area coincides with the red; in January & February 1856, the blue coincides with the black.

The entire areas may be compared by following the blue, the red & the black lines enclosing them.

Contributing Factors and Conditions

Industrialization and Globalization

Networks

Abstract Sciences

Technology and the Internet

More Data

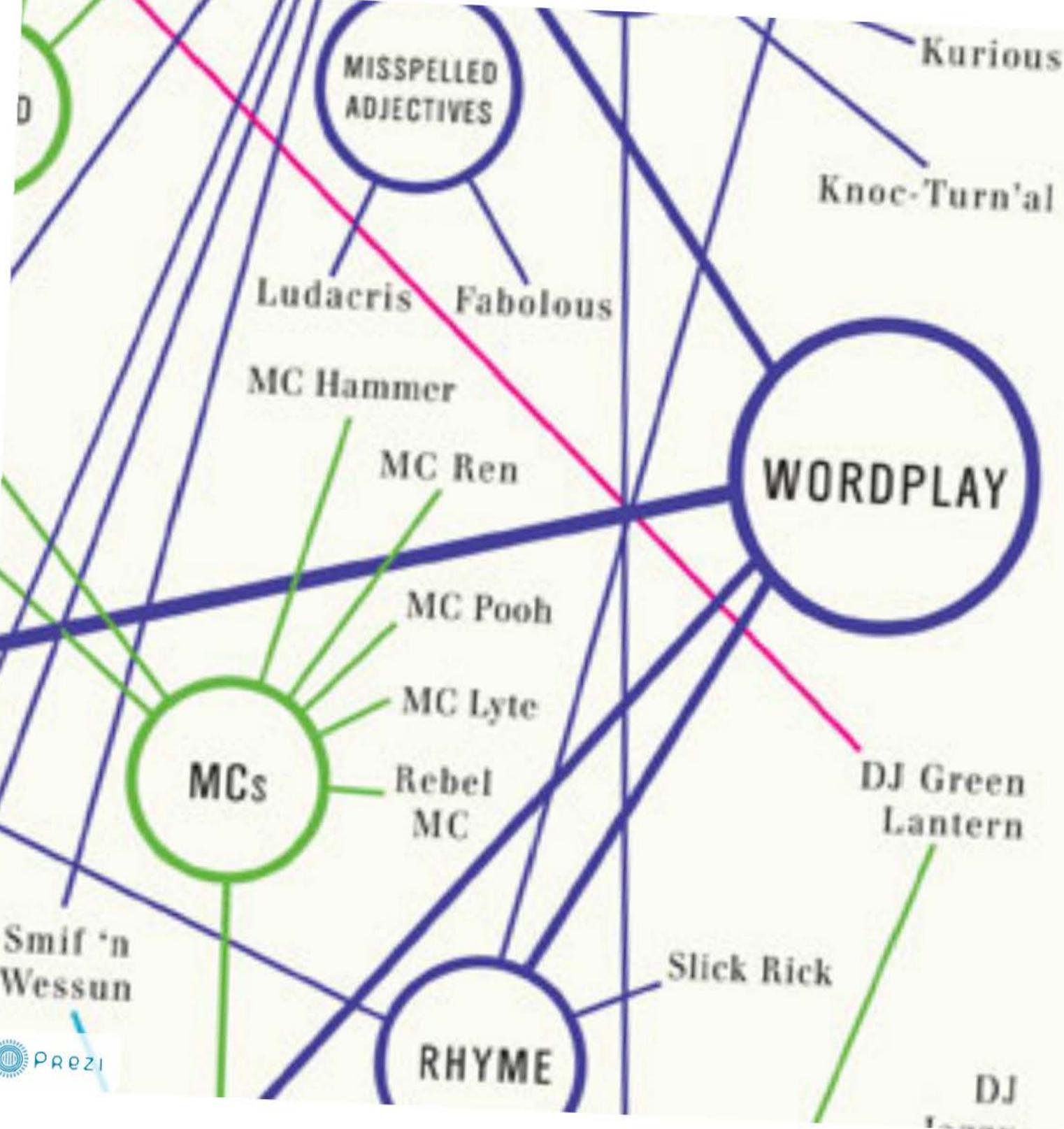
Accessibility of Information

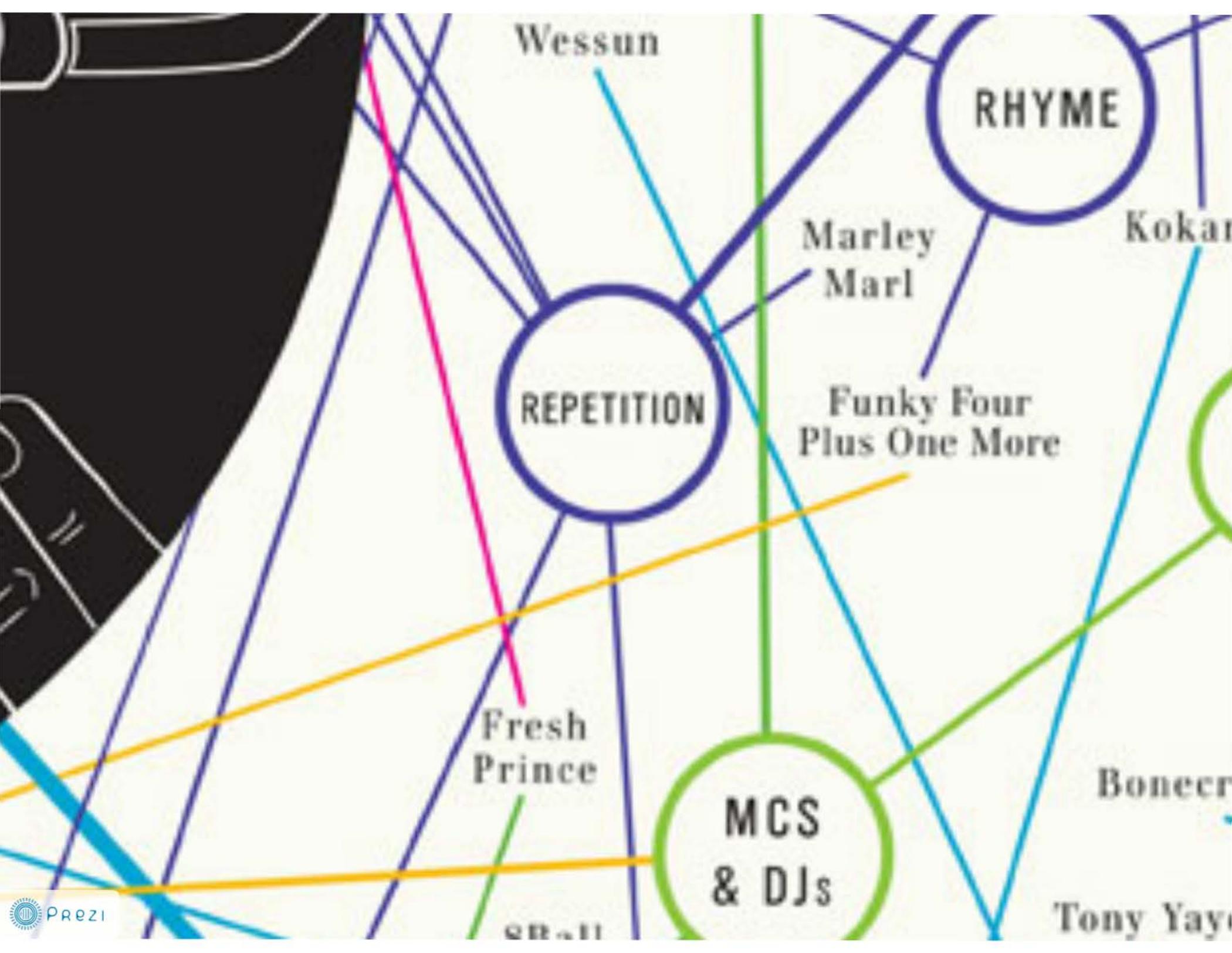
Complexity of Information

Ability to Create and Manipulate Graphics



Rhizomes





Wessun

RHYME

REPETITION

Marley
Marl

Funky Four
Plus One More

Kokan

Fresh
Prince

MCS
& DJs

Bonecr

Tony Yayo



LES/
RIFICS

Prince
Markie

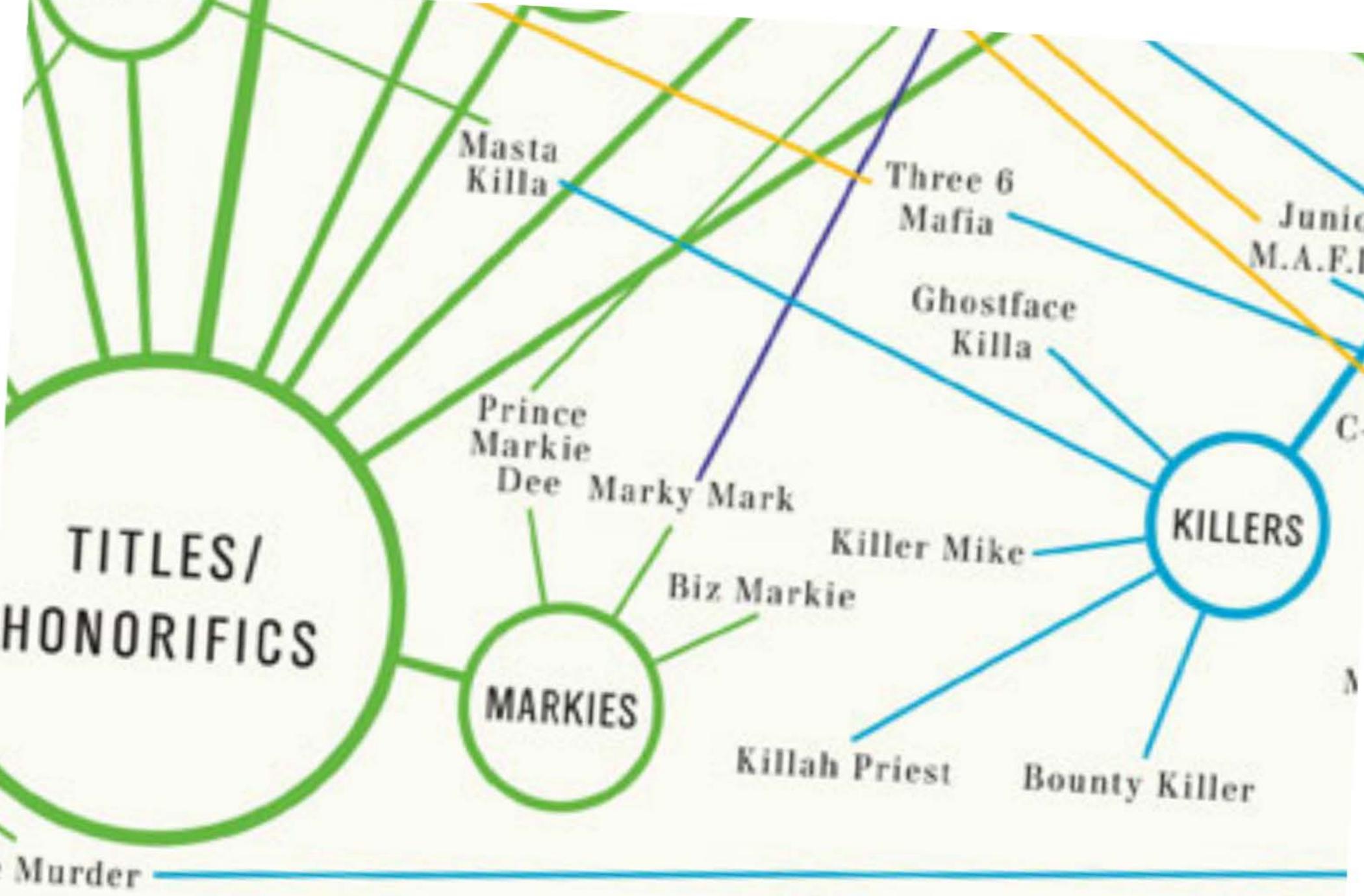
Dee Marky Mark

Killer Mike

Biz Markie

MARKIES

Killah Priest



Murder

Human Perception and Memory

Biological Process of Vision

Light on Retina

Electrical Impulses in Brain

Cognitive Processing

Bottom Up vs. Top Down

Memory

Sensory

Working

Long-Term

anatomy

Biological

Light

Electrical

Semantic



Episodic

Procedural

Thinking Strategies

Schema
Automaticity
Mental Models
Dual-Coding

Design Strategies

Pre-attentive processing or early vision responds to primitive features:

Color

Size

Orientation

Motion

Organize

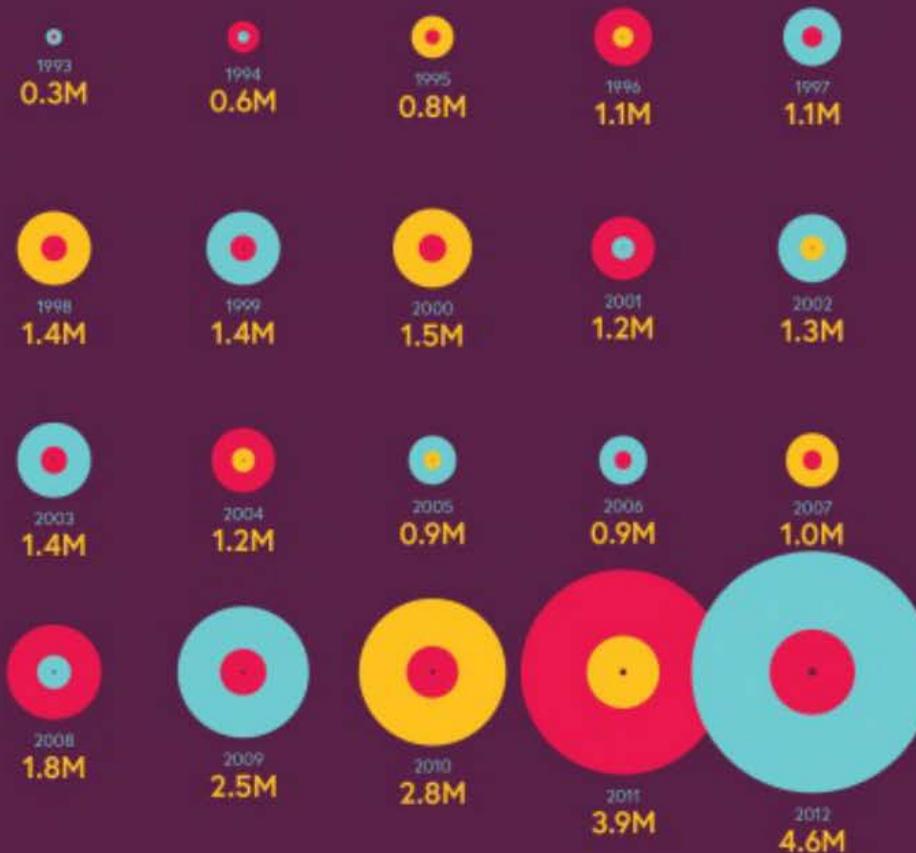
*Emphasize
Group*

19 Years and Rising

vinyl record sales over the last nineteen years

Since 2011,
record sales
have increased
17.7%

FIGURES IN MILLIONS



19 Years and Rising

vinyl record sales over the last nineteen years

Since 2011,
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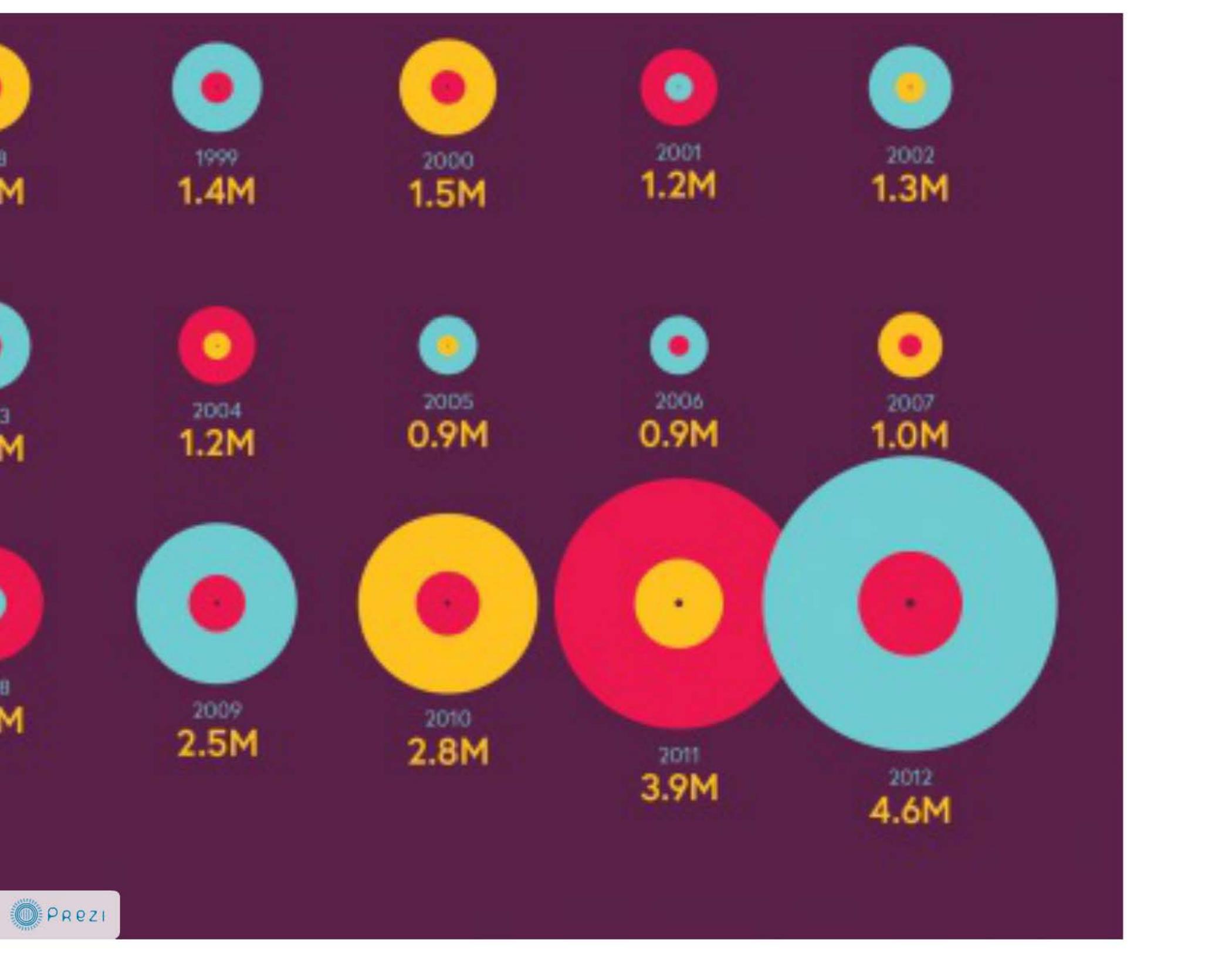
1993
0.3M

1994
0.6M

1995
0.8M

1996
1.1M

1997
1.1M



Direct the Eyes

Movement

Pattern

Positioning

Eye Gaze

Direct the Eyes

Movement
Pattern
Positioning
Eye Gaze

Understanding Google PageRank...

n. PageRank (pāj)-(rāngk) -
A 0-10 score assigned by Google that rates the popularity of an indexed web page based on the number & type of external links pointing to that page. (abbr. PR)

KEY	
	Your posse = Sites like you
	The high school principal = .edu websites
	The jocks and cheerleaders = PR 5 or higher
	The followers = PR 4 sites
	The drama crowd = PR 2-3 sites
	The marching band = PR 0-1 sites
	The outcasts = Spam sites

PageRank is a Popularity Contest Like Running for Prom King

PageRank Requires The Right Votes

Consider who links to you, because links are like votes. If your main votes for Prom King come from the marching band and the drama club, you won't win the crown. Similarly, links from low PR sites hold less clout for Google.

The Right Votes Lead to Many Followers

If popular people vote for you, your chances of winning Prom King increase, especially when followers follow their lead. Similarly, Google trusts high PR sites. If they link to you, they are vouching for you, which increases your own PR. Like hanging with the right crowd, their popularity will rub off on you.

PageRank Takes into Account Who is Voting for You

If the principal wants you to win, then maybe he'll fix the results in your favor. Google trusts authority websites, like those that end in a .edu or .gov more than .com. The more links you get from one of those sites, the better.

Google puts more trust in links from sites similar to you than from sites not like you. Why? If your friends won't even vote for you to be Prom King, then why should others?

Sometimes, guilt by association can be very damaging and not just to your social status in school. Google might start to see your site as spammy if you get a lot of links from spammy sites like link farms.

How People Vote for You Can Affect Your Overall Score

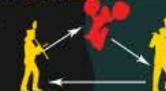


Sometimes, students can vote for multiple people at once which gives more people a chance at the crown. This means that one person's vote is less valuable, as they are giving it to other people as well. Similarly, if you have a link from a page with multiple links, the amount of PageRank that comes from that page is split up among the links.

If You Vote for Me & I Vote for You, Our Votes Cancel Each Other Out



Someone running for Prom King might be tempted to promise a friend that he'll vote for them if they vote for him. In the end though, those two votes just cancelled each other out. Similarly, Google notices when you trade links, and even with 3-way link exchanges, they tend to cancel those links out.



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= **PR 5 or higher**



The followers
= **PR 4 sites**



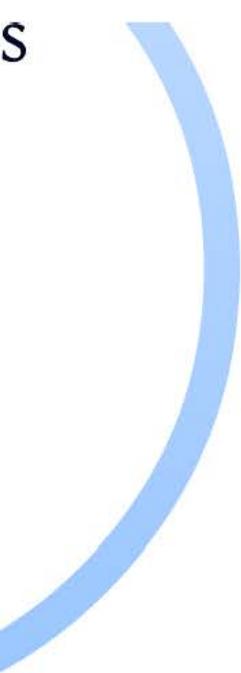
The drama crowd
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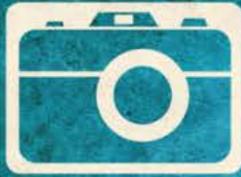
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Simplify

Reduce Realism
Make Abstract Concrete
Clarify Complexity



Manual Photography

CHEAT SHEET
EXPLORE THE MANUAL SIDE
OF PHOTOGRAPHY

BY: MIGUEL YATCO

EXPOSURE

NIKON	TRY TO KEEP YOUR LIGHT METER AT "0"	CANON
+1..1..0..1..1-		-2..1..0..1..2
	OVEREXPOSED	
	UNDEREXPOSED	

APERTURE

f/1.4 f/2 f/2.8 f/4 f/5.6 f/8 f/11 f/16

SHALLOW DEPTH OF FIELD DEEP DEPTH OF FIELD

BRIGHTER *SHALLOW: BLURRED BACKGROUND* *DEEP: EVERYTHING IN FOCUS* DARKER

SHUTTER

BULB 30" 15" 10" 2" 1" 1/25 1/30 1/50 1/100 1/125 1/250 1/320 1/500 1/1000

LONGER EXPOSURE SHORTER EXPOSURE

BRIGHTER *BULB: EXPOSURE TIME UNDER THE CONTROL OF THE PHOTOGRAPHER* DARKER

ISO

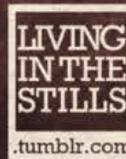
100 200 400 800 1600 3200

LOW SENSITIVITY TO LIGHT HIGH SENSITIVITY TO LIGHT

USE DURING DAY TIME USE DURING NIGHT TIME

HIGHER QUALITY (SMOOTH) LOWER QUALITY (NOISY)

Brought to you by:



NOTE:
VALUES MAY VARY DUE TO
DIFFERENT LENSES & CAMERAS!

Good Luck!

COPYRIGHT 2011 | MIGUEL YATCO | LIVINGINTHESTILLS.TUMBLR.COM

College of Design & Social Context

Snapshot May 24 2012



Description

This chart illustrates the composition of the Higher Education (HE) segment of the College of Design and Social Context (DSC) at RMIT University.

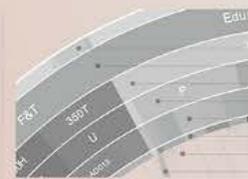
One of RMIT's three colleges, DSC has a total HE EFTSL of around 11000, and a headcount over 14000 students. DSC's largest school by HE EFTSL is Media and Communications. Across all schools, undergraduate enrollments account for the greatest share of student load, and FTSCCBS (government subsidised) places the greatest

proportion of fund sources; 210 programs are offered across the eight schools of DSC. Over 2000 courses sit across these programs (not illustrated).

The centre captures articulation pathways between programs. Coloured lines illustrate pathways within schools. Line width indicates the enrollment volume of the source program in each articulation pair. Grey lines capture existing and potential articulations across schools. Here, transparency indicates the EFTSL size of the source program. The chart captures a total of approximately 4700 articulation pathways.

Guide

- Fund Sources
- DSC School
- DSC Subschool
- Program Level U-PR
- Program
- Program Visibility Indicator
- Program Articulation Pathways (Coloured)
- Inter-school Articulation Pathways (Monochrome)



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