ARTSCIENCE MUSEUM™ PRESENTS

BIG BANG
DATA

WHAT DOES DATA MEAN TO YOU?
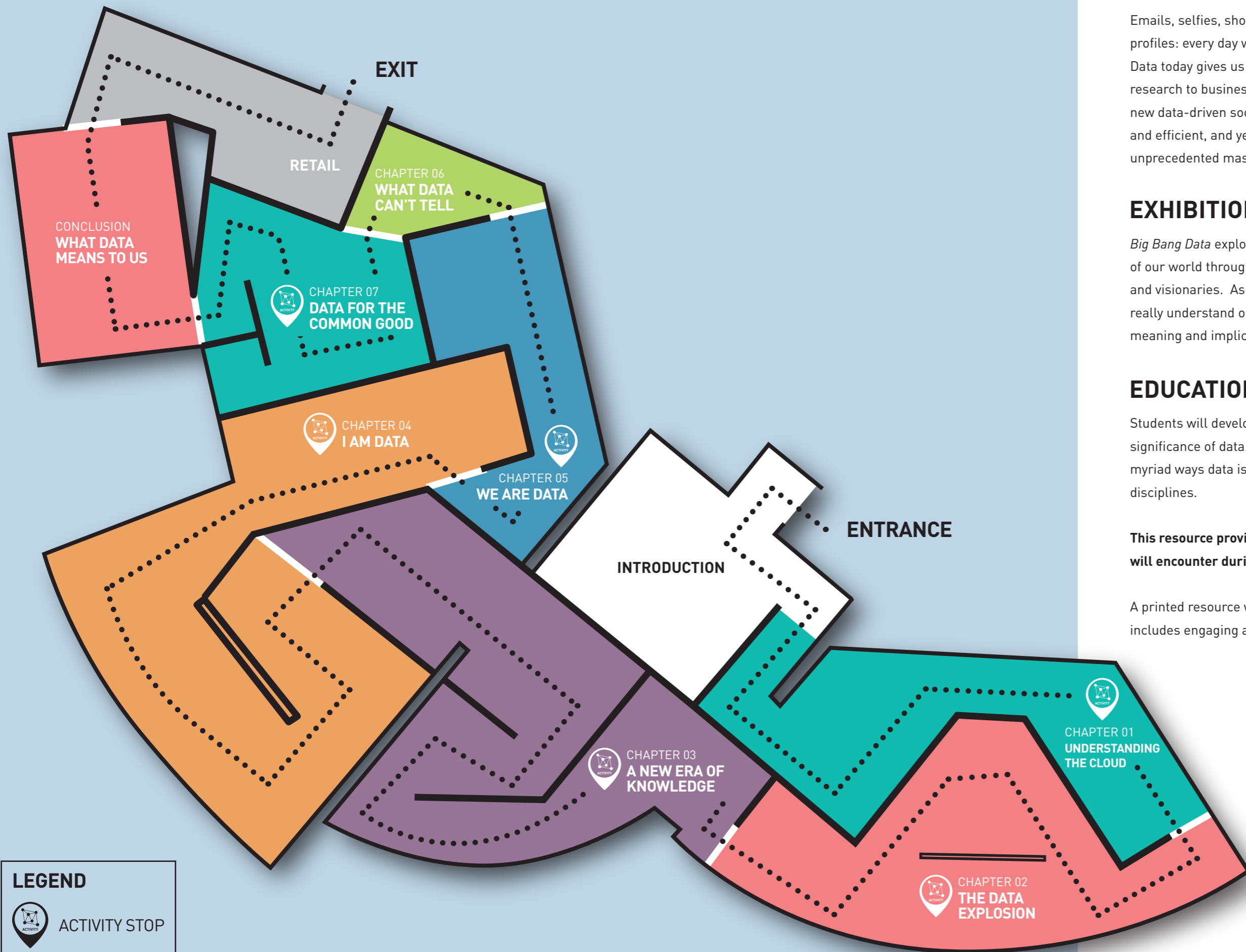
ACTIVITY

**EDUCATOR'S
RESOURCE**

ArtScience
Museum
MARINA BAY SANDS

EXIT

RETAIL

CHAPTER 06
WHAT DATA CAN'T TELL

CONCLUSION
WHAT DATA MEANS TO US

CHAPTER 07
DATA FOR THE COMMON GOOD

CHAPTER 04
I AM DATA

CHAPTER 05
WE ARE DATA

ENTRANCE

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CHAPTER 03
A NEW ERA OF KNOWLEDGE

CHAPTER 01
UNDERSTANDING THE CLOUD

CHAPTER 02
THE DATA EXPLOSION

LEGEND

ACTIVITY STOP

EXHIBITION OVERVIEW

Emails, selfies, shopping transactions, Google searches, dating profiles: every day we are producing data in huge quantities. Data today gives us new ways of doing things: from scientific research to business strategy, politics to social interaction. Our new data-driven society has the potential to be more fair, stable and efficient, and yet it has also created a tool for unprecedented mass surveillance and commodification.

EXHIBITION GOALS

Big Bang Data explores the issues surrounding the datafication of our world through the work of artists, designers, journalists and visionaries. As the data explosion accelerates, we ask if we really understand our relationship with data, and explore the meaning and implications of data for our future.

EDUCATION FOCUS

Students will develop an appreciation of the concept and significance of data. They will also gain an understanding of the myriad ways data is visualised and harnessed across disciplines.

This resource provides information about what your students will encounter during their visit to ArtScience Museum.

A printed resource will be provided for all students, which includes engaging activities relating to the exhibition chapters.

UNDERSTANDING
THE CLOUD

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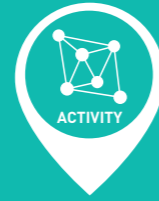
Everyday large amounts of data are produced whether through phone calls to your family and friends, photos uploaded to Instagram, streaming videos, playing gaming apps, GPS signals, transactions, checking bus times on various applications and others. Just take emails as an example. In a day, over 100 billion emails are sent all over the world. Emails travel through fibre optic cables that are lying on the seabed. There are millions of kilometres of these "Submarine Cables" that carry large amounts of data around the world and are one of the main data transmitters for global communication for the entire world.

On 28th August 1850, the first cable was made with copper conductors and natural latex. It was laid between England and France. Unfortunately, the cable was damaged after only sending out a few messages due to strong waves and current.

The insulating cable was replaced in the early 20th century by alloy tapes with wires made of iron-nickel, permalloy and the copper-iron-nickel and mu-metal to achieve high speed performance. This durable cable along with better laying techniques and a faster transmission speed, expanded submarine connections around the world, opening up the business trades.

By 1979, fibre optic cables were being used. They were able to carry larger amounts of data safely and at higher speeds and made the Internet accessible for the user to gain access to available data and information.

JAPAN

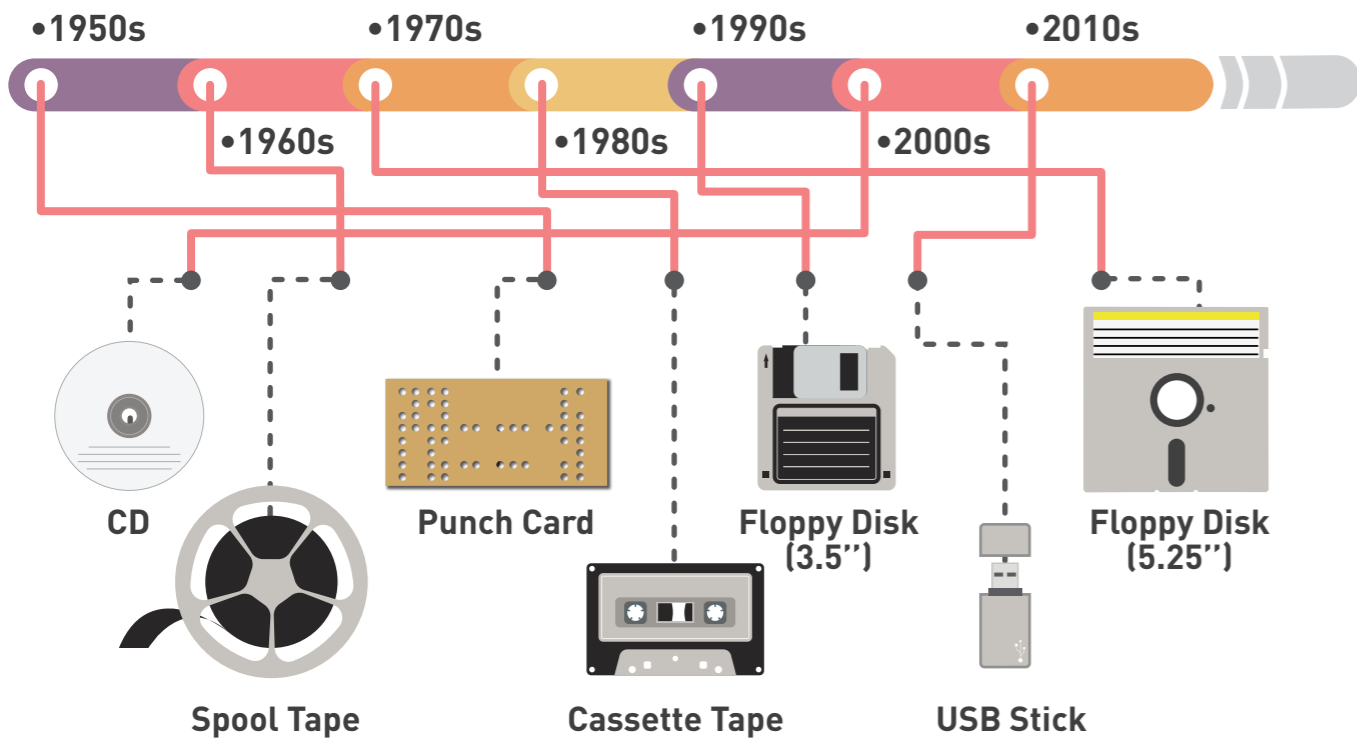SINGAPORE

THE DATA
EXPLOSION

ACTIVITY

WWW
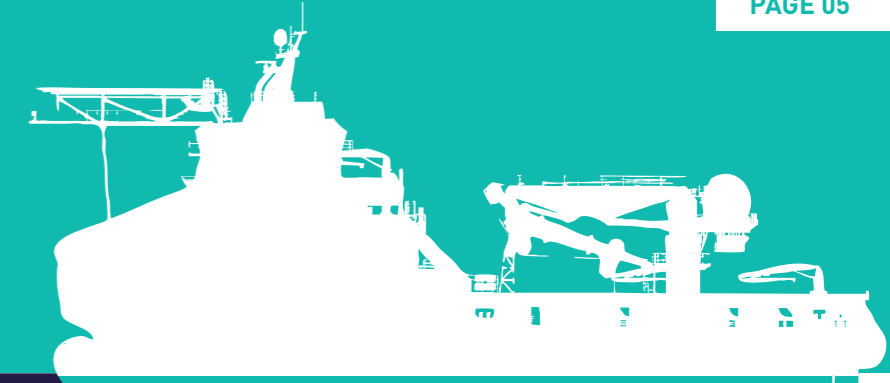
Data storage is an archive of your digital data such as text, numbers, pictures, and audio. The history of data storage extends from hardcopy archiving to softcopy storage, in forms of portable to remote data storage.
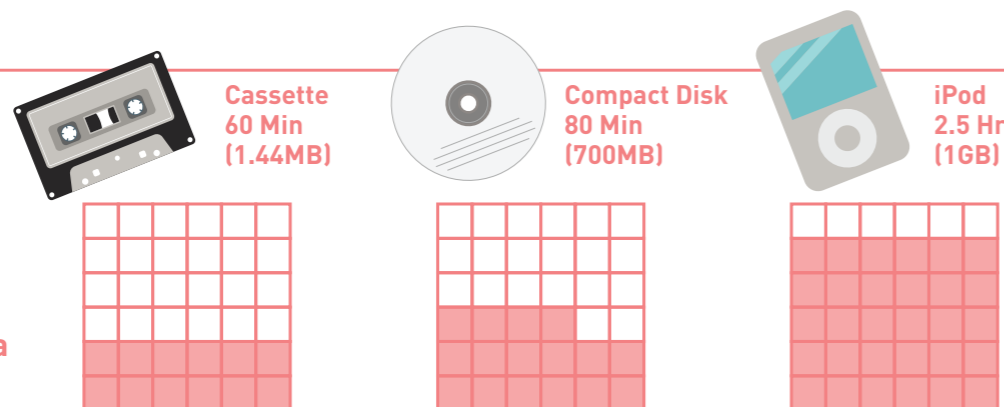
Perforated paper also known as a "Punch Card" is the oldest form of data storage. Invented by a French textile worker, Basile Bouchon, it was used to store patterns that were then applied to cloth. This was later developed into the first patented data storage in 1884 by Herman Hollerith. Punch Cards were first used for computers but were replaced in the 1970s by the floppy disk as a form of portable storage device.

Match the device to the decade it was invented.

•1950s   •1970s   •1990s   •2010s

•1960s   •1980s   •2000s

CD   Punch Card   Floppy Disk (3.5")   Floppy Disk (5.25")

Spool Tape   Cassette Tape   USB Stick

Cassette 60 Min (1.44MB)

Compact Disk 80 Min (700MB)

iPod 2.5 Hr (1GB)

Colour in the storage capacity of the devices. Each square represents a song of 5 minutes.

FLOPPY DISK

The first floppy disk invented was the 8" floppy disk of 1MB in 1971. Its successor, the 5.25" floppy disk of 160KB was developed in 1976 and was replaced by the smaller 3.5" floppy disk in 1984. With the capacity of 720KB and later 1.44MB, it was the most widely used diskette until the end of the 1990s. Today, the floppy disk is no longer supported.

References:
What is floppy disk? Retrieved from:
http://www.computerhope.com/jargon/f/floppydi.htm
What is 5.25-Inch diskette? Retrieved from:
http://www.computerhope.com/jargon/num/525inch.htm

CASSETTE TAPE

The oldest cassette tape was invented by the electronics company, Philips in 1964. The cassette tape is a compact version of the earlier magnetic tape used for audio recording, playback, and audio storage. An average cassette tape can hold 60 to 90 minutes of audio recording. It was commonly used from the 1970s to the early 2000s.

Reference:
Wikipedia. Retrieved from:
https://en.wikipedia.org/wiki/Compact_Cassette

COMPACT DISC

The world's first Compact Disc (CD) was introduced in 1982 in Japan, followed by the CD-ROM (Read Only Memory) in 1985, the CD-R (Recordable) in 1991 and the CD-RW (Rewritable) in 1997. Generally used for audio and video storage, it changed the way we listen to music. It quickly replaced cassette tapes and vinyl records because of its durability and storage capacity.

Reference:
Philips. Retrieved from:
http://www.research.philips.com/technologies/projects/cd/cd-family.html

SPOOL TAPE

Spool tape is an audio device using magnetically coated, polyester-type plastic film to record and play back sounds. The development of the magnetic tape began in the 1930s in Germany. Spool tapes were often used in professional recording studios, radio stations, home audios, police and medical records from the 1950s to 1980s.

References:
Beginnings - Museum of Magnetic Sound Recording. Retrieved from http://museumofmagneticsoundrecording.org/Beginnings.html
The Vintage Reel to Reel Tape Recorder. Retrieved from http://www.clydesight.com/wollensak_reel_to_reel_tape_recorder/reel_to_reel.html

USB STICK

Invented by a Singapore company Trek Technology and IBM in 2000, the Universal Serial Bus Stick or USB Stick also known as the "Thumbdrive" transformed the way digital data are stored and transferred. The first USB Stick had the storage space of 8MB, five times the capacity of a floppy disk. This thumb-sized device soon replaced the floppy disk because of its increased storage capacity. Improvements were made along the evolution of technology and we now have the USB 3.0 Stick that provides high speed data transfer with an enormous capacity of 1TB (that is 8×10^6 more than the first ever USB Stick in 2000).

References:
National Library Board. Retrieved from:
http://eresources.nlb.gov.sg/infopedia/articles/SIP_1071_2010-03-23.html

A NEW ERA OF
KNOWLEDGE

ACTIVITY

I AM DATA

ACTIVITY

A set of data, or results, can be shown in many ways. Some charts are more suitable to show trends and distribution results while others better show comparisons or a process. Below are some examples as found in the exhibition.

The earliest form of data visualisation date to the time of the ancient Egyptians with map-making and illustrations. Later statistics graphs were used in the field of Mathematics and Science. Today, technology has contributed to the wide use of data visualisation.

References:
Springer. Retrieved from:
http://link.springer.com/chapter/10.1007%2F978-3-540-33037-0_2#page-1
Milestones in the History of Thematic Cartography, Statistical Graphics, and Data Visualization. Retrieved from:
http://www.datavis.ca/milestones/index.php?group=1600s

Charles Joseph Minard was a civil engineer. Charles Minard's *Figurative Map of Successive Men Loss in the French Army During the Russian Campaign 1812-1813* is considered one of the best statistic graphs ever drawn, combining multiple detailed contexts into a graph. It is a clear report of a war in 1812. It specifies the time, temperature, geography, troop's directions and number of soldiers alive.

References:
Sandbergs, Michael. Data Visualization Blog. Retrieved from:
https://datavizblog.com/2013/05/26/dataviz-history-charles-minards-flow-map-of-napoleons-russian-campaign-of-1812-part-5/

John Snow was a physician. His chart *On the Mode of Communication of Cholera* significantly contributed to modern epidemiology because of his discovery of Cholera contamination in the water travelling along Broad Street (Broadwick) in London. His investigation saved many lives and changed the water and waste system of London. His 1854 map of the Cholera outbreak shows the number of cholera deaths marked in black by the home address along and around Broad Street.

References:
Dr. John Snow's map of the 1854 London cholera outbreak. Retrieved from:
https://www.udel.edu/johnmack/frec682/cholera/

Florence Nightingale was a nurse. Her 1854 coxcomb illustrations, *Notes on Matters Affecting the Health, Efficiency and Hospital Administration of the British Army*, show a collection of data on the number of deaths in the hospital and the causes of death in the different months. The chart showed that one of the main causes of mortality was epidemic disease rather than battlefield wounds, and this led to revolutionary improvements in the cleanliness of military hospitals. Nightingale used this graphic illustration as a way to explain complex data simply, clearly and persuasively. This special form of pie chart became known as a Nightingale Rose Diagram, now commonly referred to as a radar chart.

References:
Rogers, Simon. The Guardian. Retrieved from
http://www.theguardian.com/news/datablog/2010/aug/13/florence-nightingale-graphics

Today, technology enables us to take photos, update our social profiles and write emails at any moment. Not only does this reflect the need to record and share everything we do, but it results in an incredible amount of data production. Erik Kessels' *24 hrs in Photos* is made from the images that were uploaded to Flickr in just a 24 hour period in 2011. It provides us with a small indication of the vastness of data production through social media alone.

Who is responsible for the explosion of data? We are. We contribute to the majority of data produced daily by searching, browsing the web, watching videos online, looking through hash tags on Instagram, leaving a digital trail that represents part of our life. Once thought of as an acute preoccupation amongst many individuals is now an accepted process. This installation gives us an idea of the amount of physical/hardcopy data generated in a day from a public domain in 2011; a view of what an inundation of images really means.

Reference:
Big Bang Data. Retrieved from:
http://bigbangdata.cccb.org/en/24-hrs-in-photos-by-erik-kessels/

Every Minute..

1.8 FACEBOOK LIKES

278,000 TWEETS

200,000 PHOTOS UPLOADED

204 MILLION EMAILS

(2013). Blog.qmee.com.
Retrieved from:
http://blog.qmee.com/wp-content/uploads/2013/07/Qmee-Online-In-60-Seconds2.png
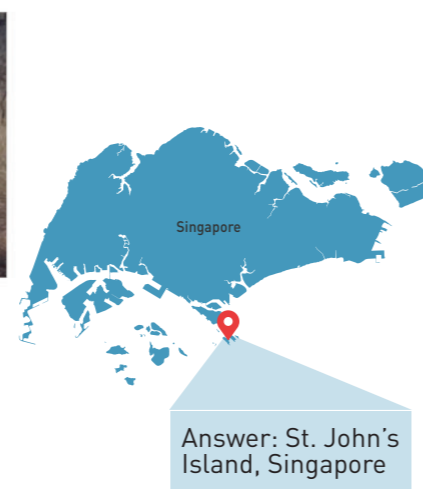
WE ARE DATA

ACTIVITY
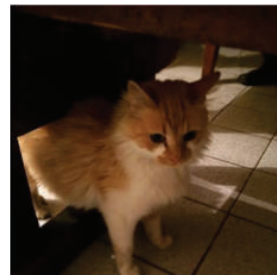
1. I am in Argentina. This place is often called 'The End of the World' and it is the closest country to Antarctica. Can you find me?

Answer: Ushuaia, Tierra del Fuego, Argentina

2. I hang out by the pier, on a tiny island situated 6.5KM south of Singapore. Can you find me?

Answer: St. John's Island, Singapore

We are not always aware of the digital footprint we are leaving behind when we share personal information online. Many people do not read the terms and conditions when installing or approving applications on their phone, giving consent to reveal their personal data online, allowing public and third party services to access users' personal information. Personal data are valuable. They are detailed information that includes GPS location, personal interests, connections, communications and more. Both public and private sector are making use of data analytics to better understand users. For example, recently Facebook launched reactions (Love, Haha, Wow,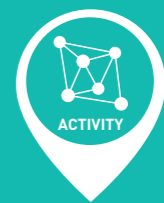 Angry, and Sad). It allows the user to react to online posts. With this new data collection system, companies can analyse their audience's interests to create a better marketing strategy; and tailor-make a product for the user's lifestyle based on information found on their social media.

The playful project *I Know Where Your Cat Lives* by Owen Mundy illustrates how easy it is to access information such as your demographics and location on the Internet—a public network—even if you have just posted a photo of your cat on Instagram.

Reference:
Information Commissioner's Office. Retrieved from:
https://ico.org.uk/media/for-organisations/documents/1541/big-data-and-data-protection.pdf

DATA FOR THE COMMON GOOD

ACTIVITY

Data plays an important part in this 21st Century community. Besides producing large amounts of data and tracking our digital footprints, we rely on data and technology daily, more than we realize. Take for example the usage of data via different applications to trace how long we walk in a day as well as regulating our time according to transportations' arrival and departure timings.

In 2011 when a tsunami hit Fukushima, Japan, it caused the subsequent meltdown of the Fukushima Daiichi Nuclear Power Plant, and accurate and trustworthy radiation information was publicly unavailable. *Safecast.org* was thus formed in response as an international, volunteer-centered organization devoted to open citizen science for the environment. The organisation quickly began monitoring, collecting, and openly sharing information on environmental radiation and other pollutants, growing quickly in size, scope, and geographical reach. By creating a network of radiation sensors around the country, Safecast.org enabled the Japanese people to know what levels of radiation they were exposed to wherever they went. This use of data clearly benefitted the public.

In recent years, Singapore encountered severe haze conditions due to a neighbouring country's deforestation practices. So in 2014, the National Environment Agency (NEA) introduced a mobile application called "myEnv" which allows the user to gain immediate access to information of the hourly Pollutant Standards Index (PSI). The application uses the phone's location to alert the user should PSI levels increase to a level of concern. Apart from this, the said application also provides useful information on dengue hotspots, weather warnings and a list of nearby hawker centres in Singapore. The National Environment Agency continues to encourage all living in Singapore to report any relevant situation through the use of this application. The aim is to raise the awareness of environment ownership amongst its peoples.

Reference:
myENV - Android Apps on Google Play. Retrieved from:
https://play.google.com/store/apps/details?id=sg.gov.nea&hl=en

REFLECTIONS

Let us take some time to reflect upon what we have learnt about big data and what it means to us.
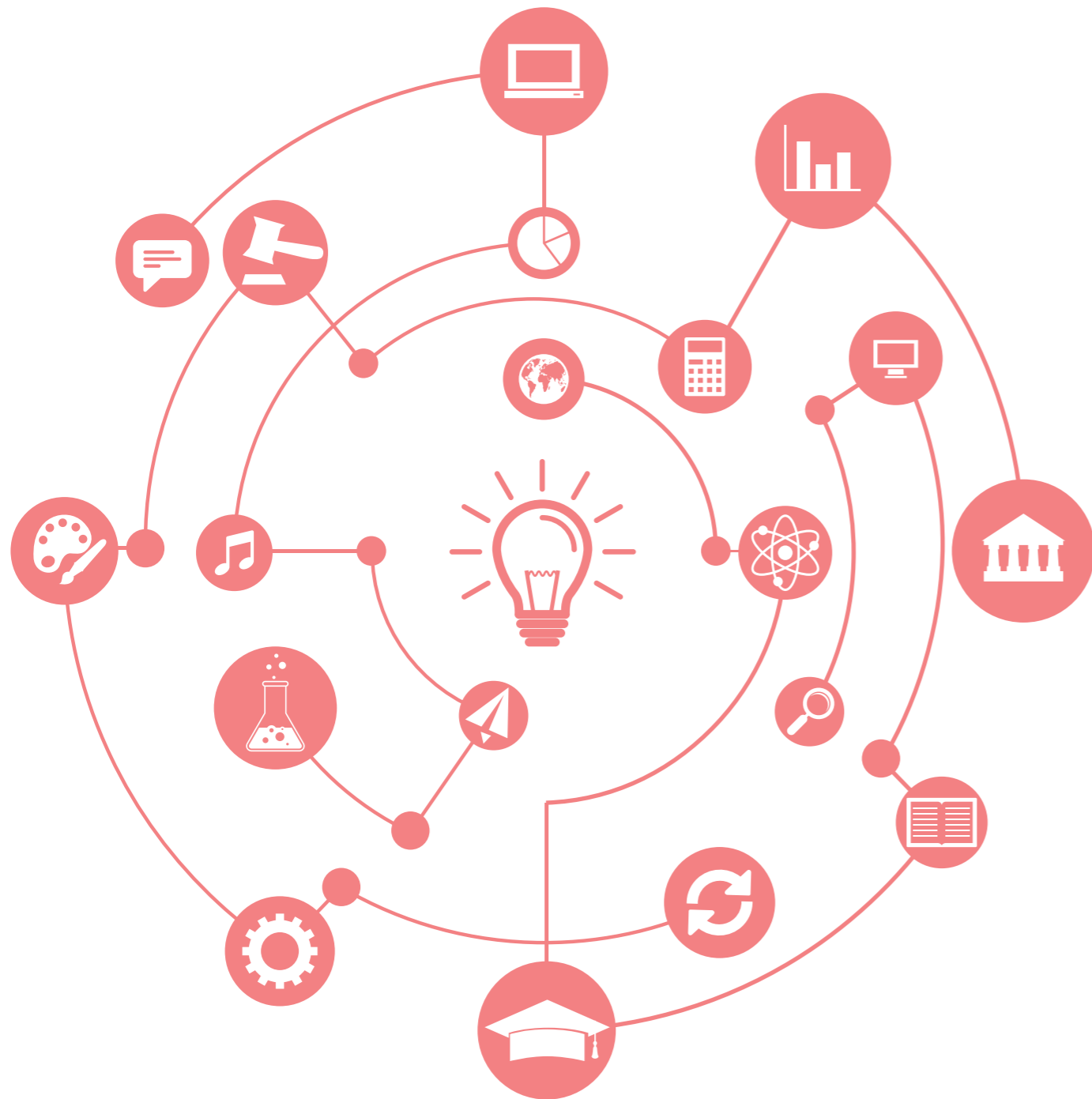
CURRICULUM LINKS

Art
- To be curious and to gather information from visuals and what they see
- To communicate thoughts, ideas or feelings by speaking, writing, drawing or in some other way
- To engage students to express their thoughts and feelings in various forms.

Social Studies/Individuals and Societies
- To inquire into real-world issues
- To develop curiosity to learn more about the world they live in and make careful observations
- To encourage and develop knowledge, conceptual understanding, research skills, analytical and interpretive skills, and communication skills, contributing to the development of the student as a whole

Mathematics
- To organize data collected into appropriate statistical diagrams
- Use thinking skills such as classifying, comparing, analysing, drawing diagram & tabulating

Cyber
- Understand that we make up the network
- Responsibility in online participation
- Knowledge that what is posted affects self and others

Source: Ministry of Education Singapore Subject Syllabuses
Singapore Examinations and Assessment Board

INTERACTIVE GUIDED TOUR (1 hour)

Guided by our trained facilitators, students can enjoy an interactive tour of the exhibition which aims to discuss our relationship with data, and explore the value and implications of data in our everyday lives and our future.

WORKSHOP DESCRIPTION

Making Data Footprints (1 hour)
Understand the fundamentals of data in this hands-on workshop: what it is, how it is collected, and how it can be visualised. Experiment, get creative with various materials and share your data visualisation project with friends and family.

FUN FACTS
About Data in Singapore

OVER **230,000**
#NDP2015 TWEETS
amongst other related events

Singaporeans set a new record for the **most number of tweets** for a one-day event in Singapore during the **National Day Parade** on **9 August 2015.**

In 2015, the volume of Domestic Mail (both ordinary and registered) was **628,629,000** compared to the volume of both ordinary and registered international mail which was **116,384,000.**

1,200,000 Tweets

From 23rd to 30th March 2015, the hashtag **#RememberingLKY** flooded Twitter upon the death of Lee Kuan Yew. It was in support of his family, people expressing their grief, as well as tweets that celebrated the Singapore's founding father's life and achievements.

90%

of mobile apps in Singapore do not adequately declare what consumer data is collected or how it is used, potentially falling foul of Singapore's Personal Data Protection Act (PDPA).

Singapore is a global trading hub that saw **20,093,958,00** minutes of international phone calls made in 2015.

Lim, A. (2015). You'd never guess what Singapore's most popular tweet of 2015 was.Sg.news.yahoo.com. Retrieved from https://sg.news.yahoo.com/you-d-never-guess-what-singapore-s-most-popular-tweet-of-2015-was-042104708.html

TwitterReverb. (2016). Reverb.guru. Retrieved from http://reverb.guru/view/026245030458617259

TwitterReverb. (2016). Reverb.guru. Retrieved from http://reverb.guru/view/026245030458617259

Statistics on Postal Services for 2015 (Jan - Dec) - Policies and Regulations - Infocomm Development Authority of Singapore. (2016). Ida.gov.sg. Retrieved from https://www.ida.gov.sg/Policies-and-Regulations/Industry-and-Licensees/Standards-and-Quality-of-Service/Quality-of-Service/Postal-Services/Statistics-on-Postal-Services-for-2015-Jan-Dec

Statistics on Telecom Services for 2015 (Jan - Jun) - Tech Scene & News - Infocomm Development Authority of Singapore. (2016). Ida.gov.sg. Retrieved from https://www.ida.gov.sg/Tech-Scene-News/Facts-and-Figures/Telecommunications/Statistics-on-Telecom-Services/Statistics-on-Telecom-Services-for-2015-Jan-Jun

Statistics on Telecom Services for 2015 (Jul - Dec) - Tech Scene & News - Infocomm Development Authority of Singapore. (2016). Ida.gov.sg. Retrieved from https://www.ida.gov.sg/Tech-Scene-News/Facts-and-Figures/Telecommunications/Statistics-on-Telecom-Services/Statistics-on-Telecom-Services-for-2015-Jul-Dec

THAM, I. (2015). 90% of mobile apps could be in breach of Singapore privacy law. The Straits Times. Retrieved from http://www.straitstimes.com/tech/90-of-mobile-apps-could-be-in-breach-of-singapore-privacy-law

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