

Integrative Science

bringing together
Indigenous
and
Western

scientific knowledges and ways of knowing



*Health Canada – Environmental Health Officers National Workshop,
Niagara Falls, Ontario, 29 April – 1 May 2008*

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Professor of Biology
Sydney, Nova Scotia

CAPE BRETON
UNIVERSITY



OUTLINE OF TALK



Pattern conceptual framework
for exploring our sciences

Pattern smarts

Four Big Pictures
for
Two-Eyed Seeing

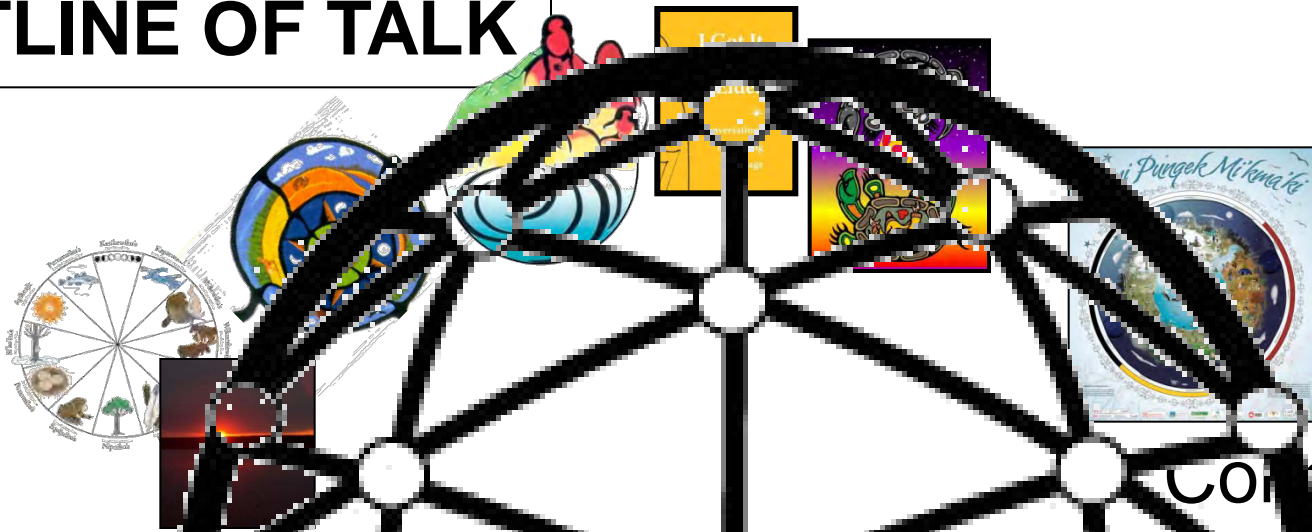
Science as
“pattern stories”

Conclusion

Introduction

Integrative Science
within an ongoing
Co-Learning Journey

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Canada Research Chairs / Chaires de recherche du Canada / Canada

Social Sciences and Humanities Research Council of Canada / Conseil de recherches en sciences humaines du Canada



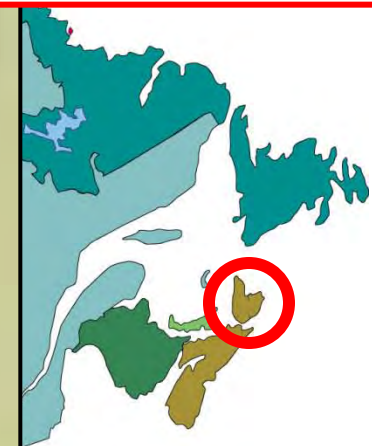
Mi'kmaq Elders





CAPE BRETON UNIVERSITY

Cape Breton Island
Unama'ki (*Land of Fog*)

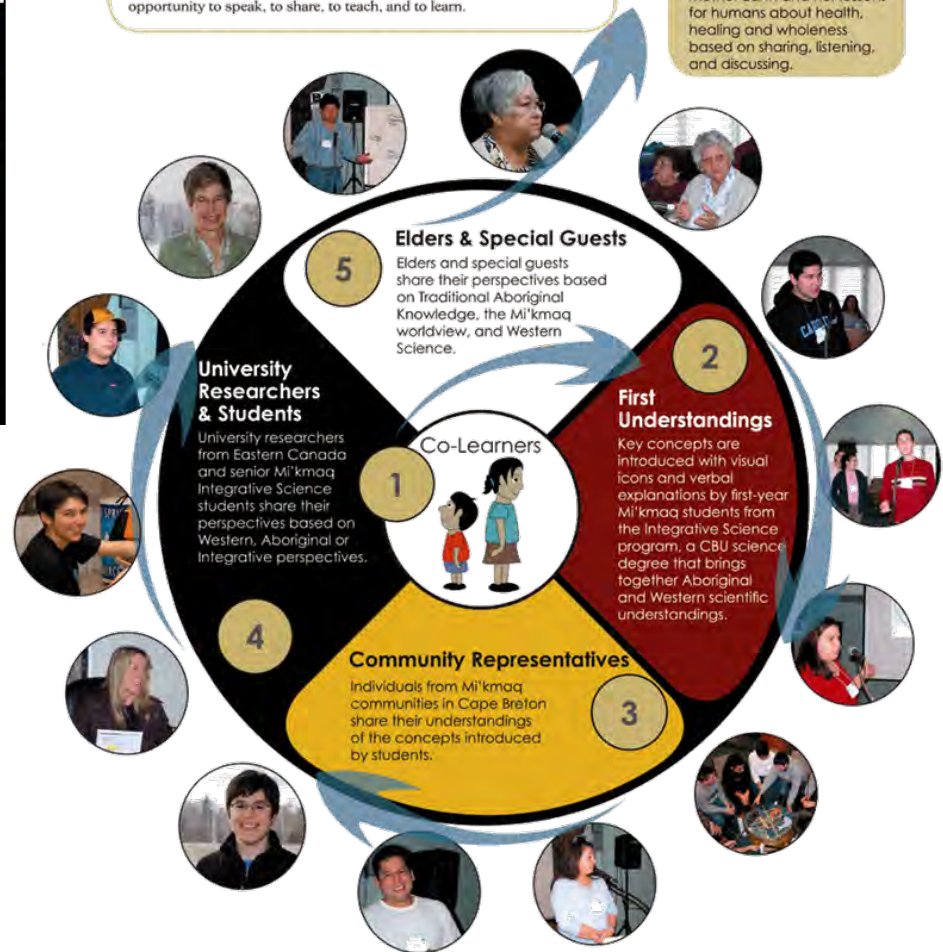


Integrative Science: a Journey of Co-Learning



Co-Learning Journey

A shared understanding of how to talk together
This visual is based on the Medicine Wheel (or Circle of Learning) which is a commonly used Aboriginal teaching tool. The visual shows that within the discussion, all have a role to play. Each person has an opportunity to speak, to share, to teach, and to learn.



The central dilemma of science education today is the teaching of science from only one cultural perspective, and in an incomplete and non-connected manner.

Gregory Cajete, PhD, scientist & educator, Univ. of New Mexico

Indigenous

Western

**12+ years: where our journey
has been and continues to be ...**

Integrative Science

**bringing together Indigenous and Western
scientific knowledges and ways of knowing**

Indigenous

Western



Artist: Basma Kavanagh

Integrative Science

SCIENCE

education, research, applications,
youth and community outreach

Indigenous

Western

“bringing our sciences together”

Integrative Science

SCIENCE

education, research, applications,
youth and community outreach

Indigenous

our sciences
our stories

Western

“bringing our knowledges together”

our worldviews

Where our co-learning journey has taken us ...

11 LESSONS LEARNED:

We need to learn to ...

1. acknowledge we need each other
2. acknowledge we are on a *learning journey*
3. learn to *co-learn*:
 - simple **Integrative Framework**
4. help institutions to help us “legitimize” TK in the minds of youth (and many others)
5. work with *living agendas*
6. use other *organic language*
7. do ... in a *creative grow forward* manner

Where our co-learning journey has taken us ...

11 LESSONS LEARNED:

We need to learn to ...

8. think *knowledge gardening* more than knowledge translation or knowledge transfer
9. weave back and forth between our knowledges, our world views, our stories
10. weave via awareness of **BIG PICTURE** understandings (knowledge orientations or maps)
11. make our knowledges, i.e. our stories, **visual**

Integrative Framework

Co-Learn both Indigenous and Western, plus:

- our roles (you and me) in “the knowing”
 - science as dynamic, pattern-based knowledge
 - visuals to facilitate cross-cultural communication
- our common ground
- our differences (and respect them)
- our journey ... forward & together

TRY HARD TO AVOID ... simply Western plus
bits and pieces of Indigenous



Science?

Western Science



photo credit: NRC

1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium											10 Ne Neon					
11 Na Sodium	12 Mg Magnesium											18 Ar Argon					
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt				36 Kr Krypton					
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium				54 Xe Xenon					
55 Cs Cesium	56 Ba Barium	57-71 Lanthanides	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium				86 Rn Radon					
87 Fr Francium	88 Ra Radium	89-103 Actinides	104 Unq Unnilquadium	105 Unp Unnilpentium	106 Unh Unnilhexium	107 Uns Unnilseptium	108 Uno Unniloctium	109 Une Unnilennium									
		57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium										
		89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium										

5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic
34 Se Selenium	35 Br Bromine	36 Kr Krypton	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium
49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth
84 Po Polonium	85 At Astatine	86 Rn Radon			
63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium
69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium	95 Am Americium	96 Cm Curium	97 Bk Berkelium
98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium

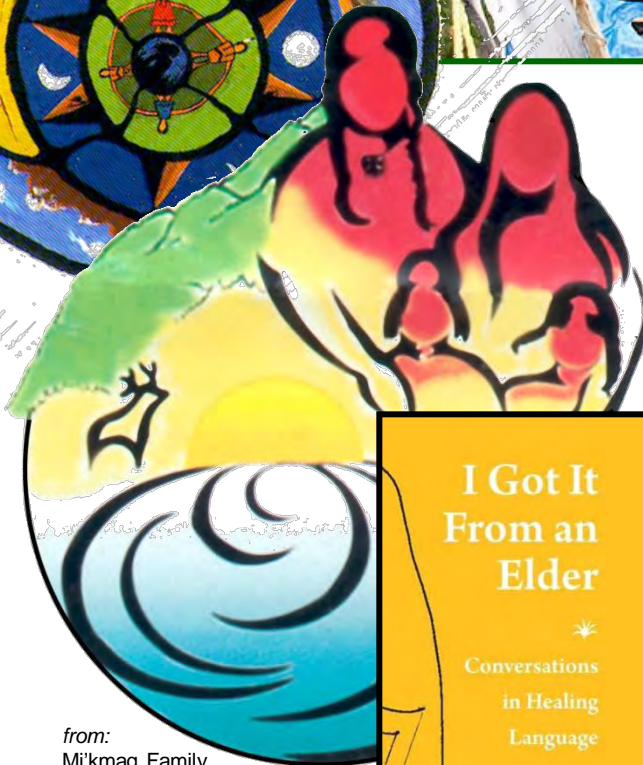
Periodic Table of the Elements

Indigenous Science

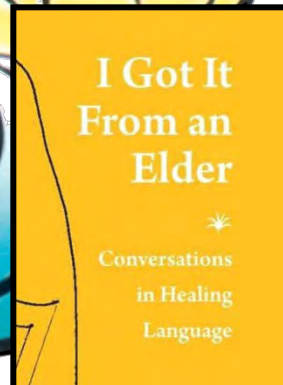
Artist: Rod Restoule
from: Into the Daylight;
C. Morrisseau, 1998



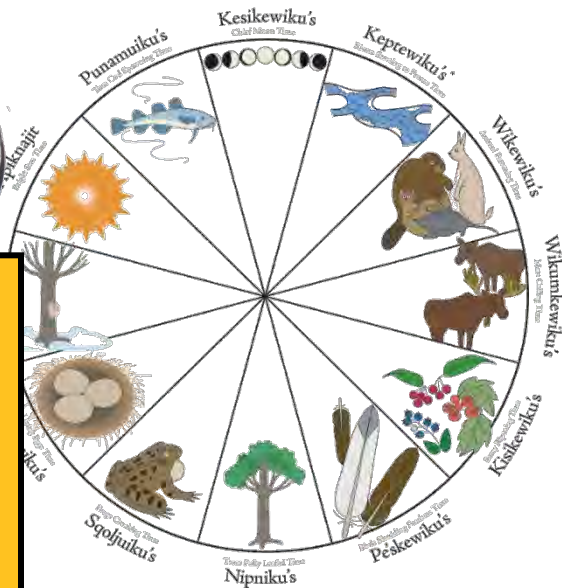
artist Gerald Gloade
Millbrook First Nation

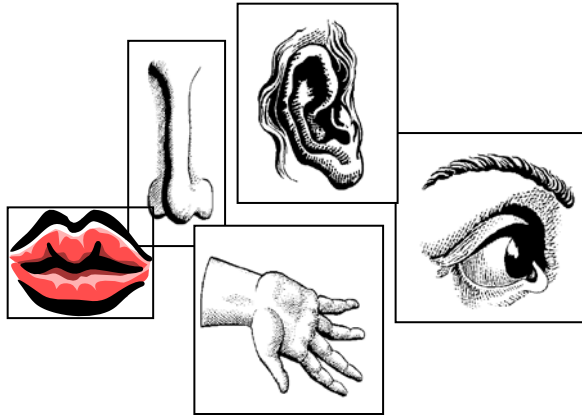


from:
Mi'kmaq Family
& Children's Services



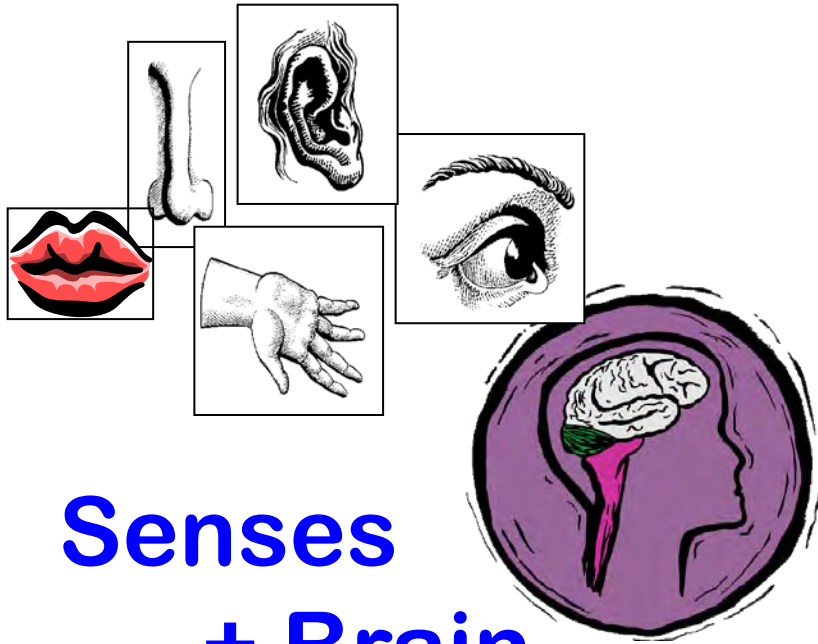
published by: Gaspereau Press Limited





Senses

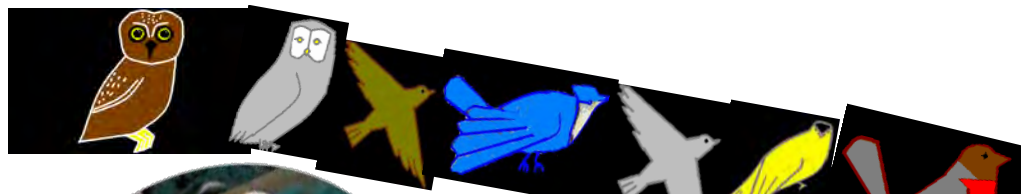




**Senses
+ Brain**

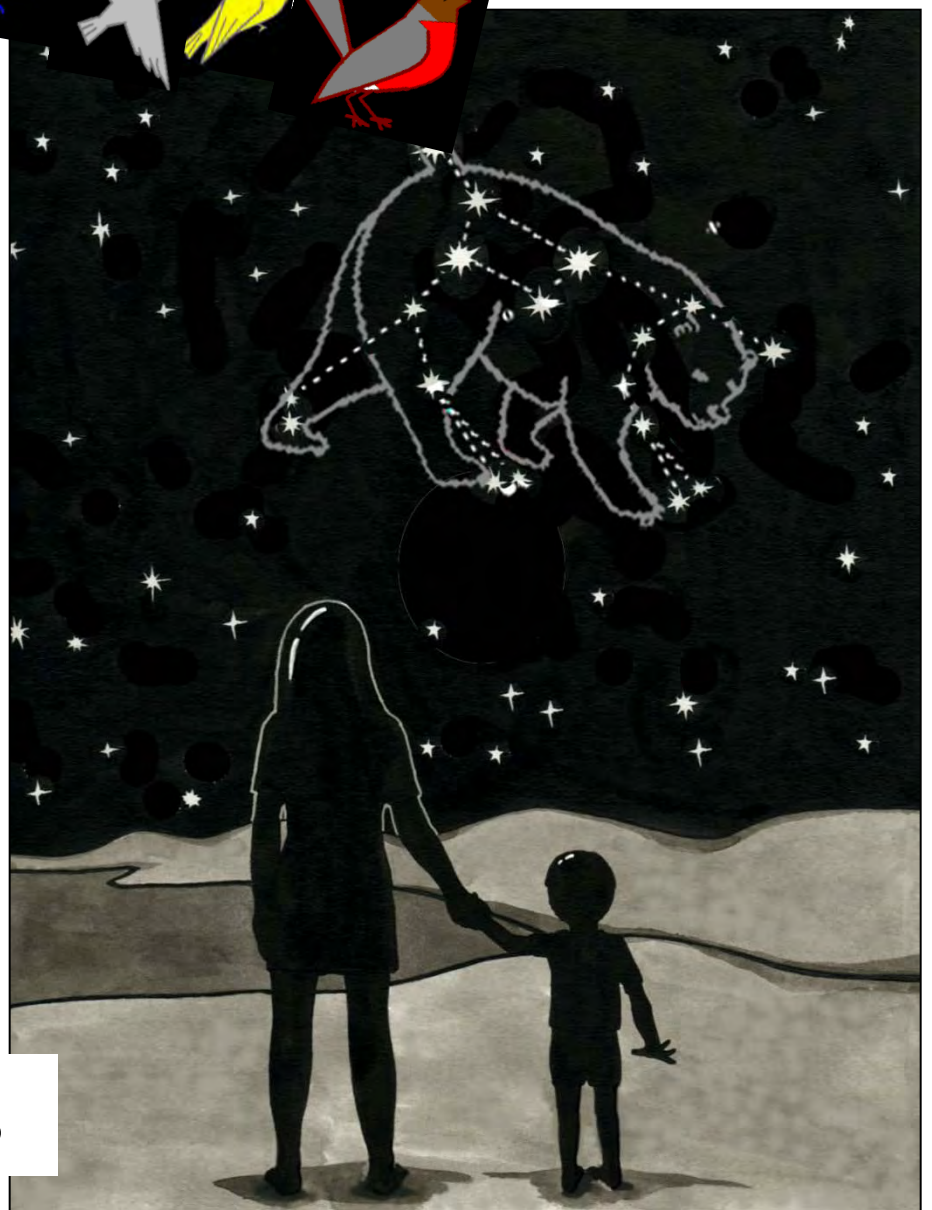
= Patterns

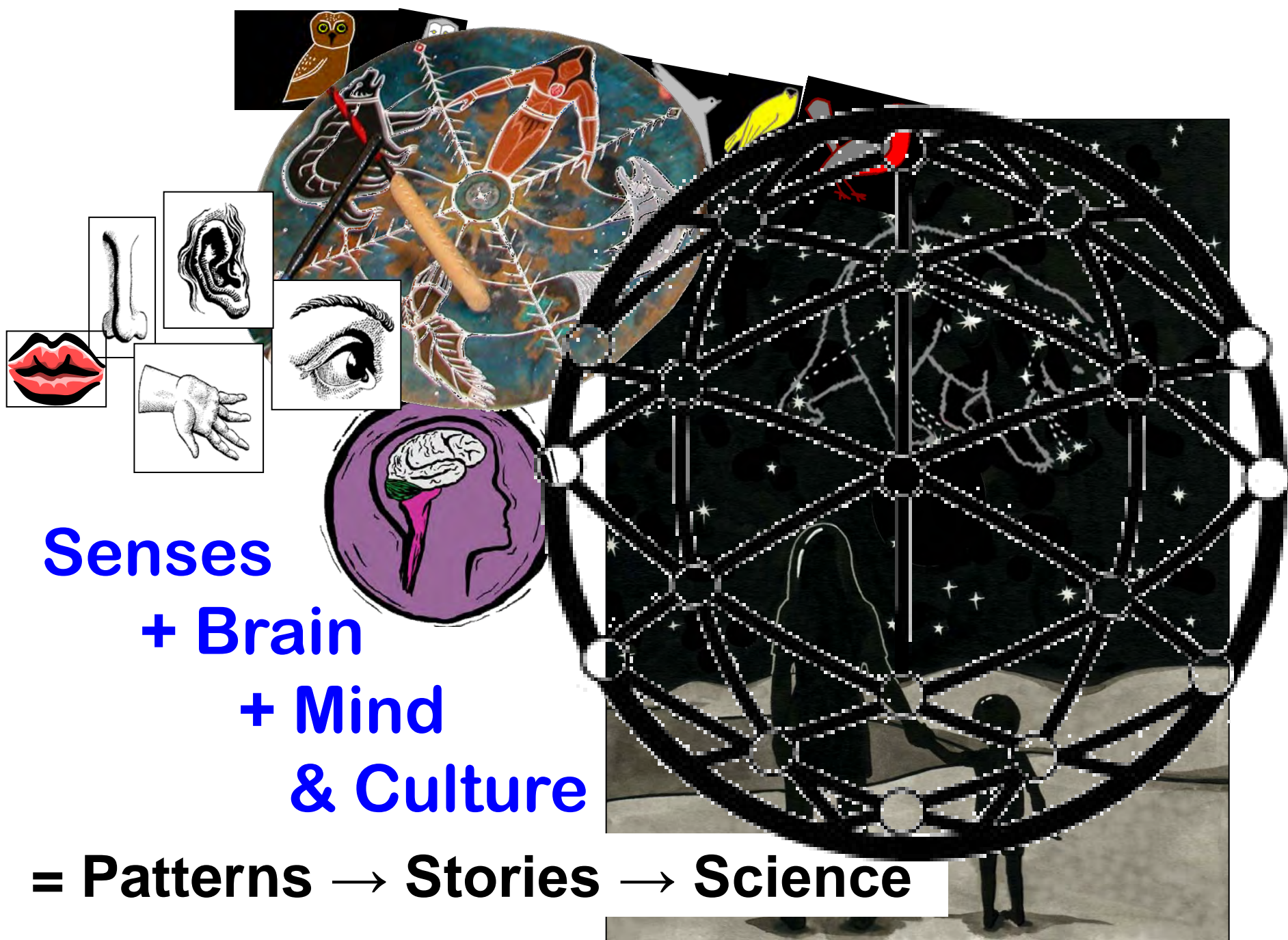




**Senses
+ Brain
+ Mind**

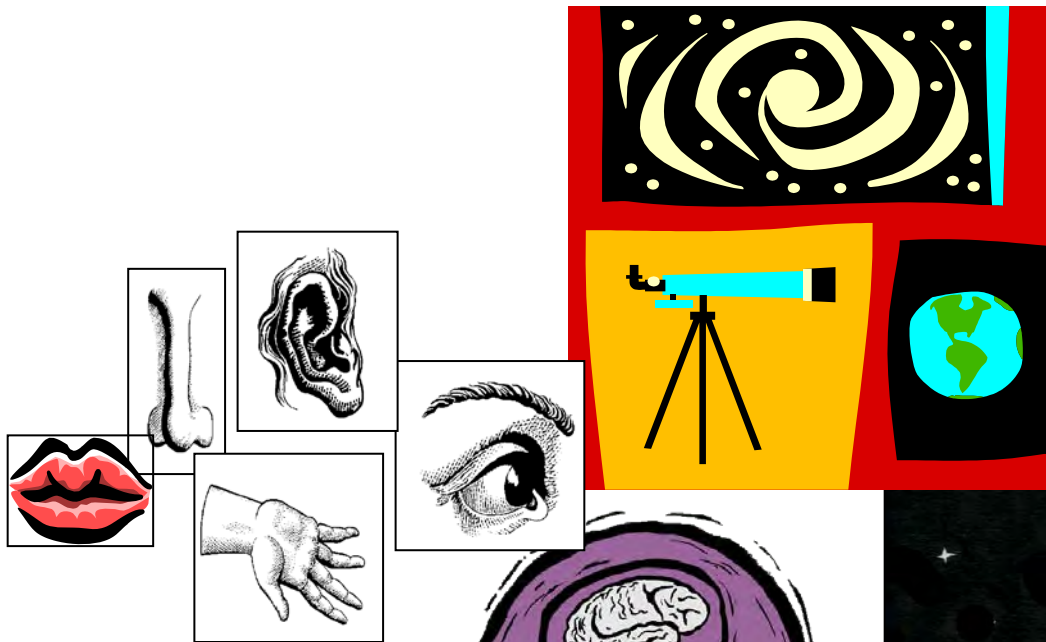
= Patterns → Stories





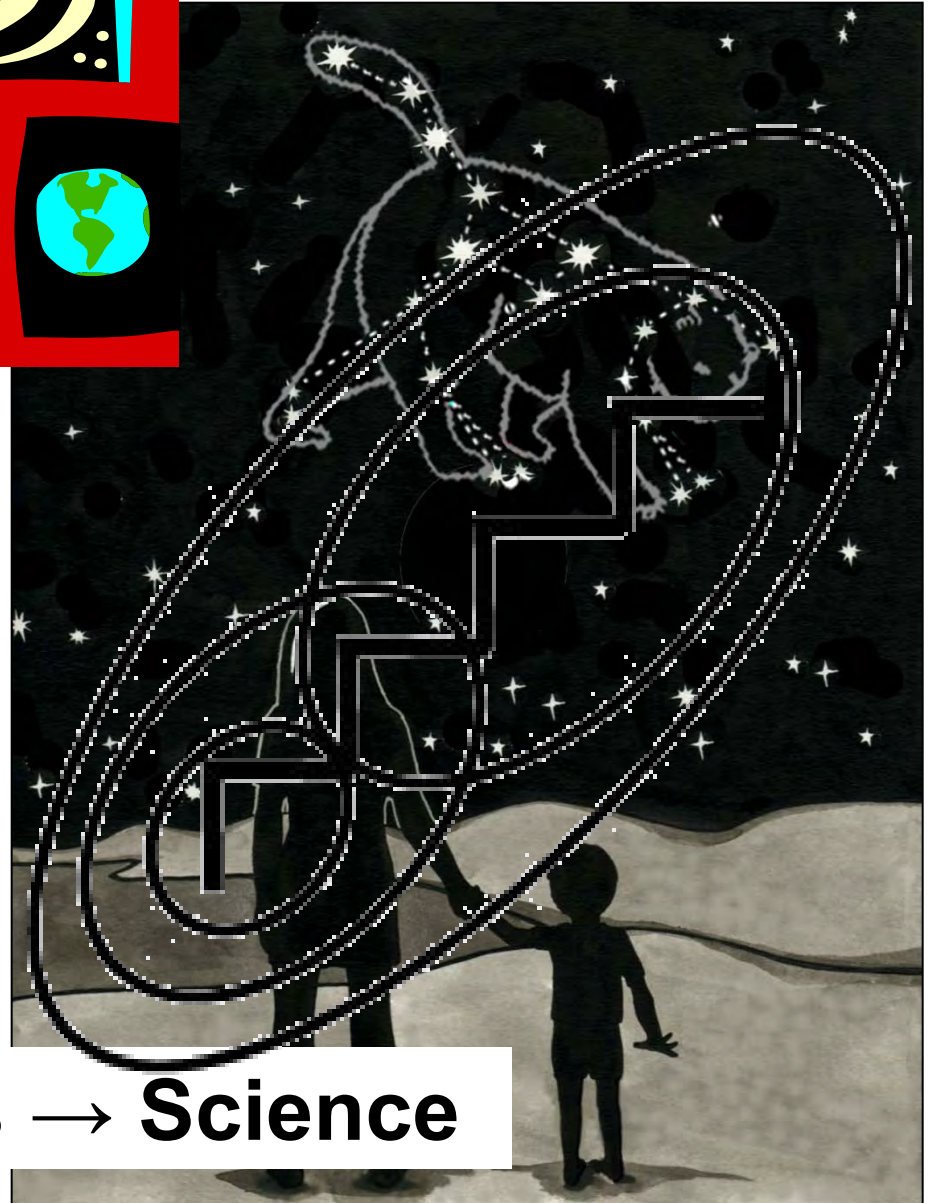
**Senses
+ Brain
+ Mind
& Culture**

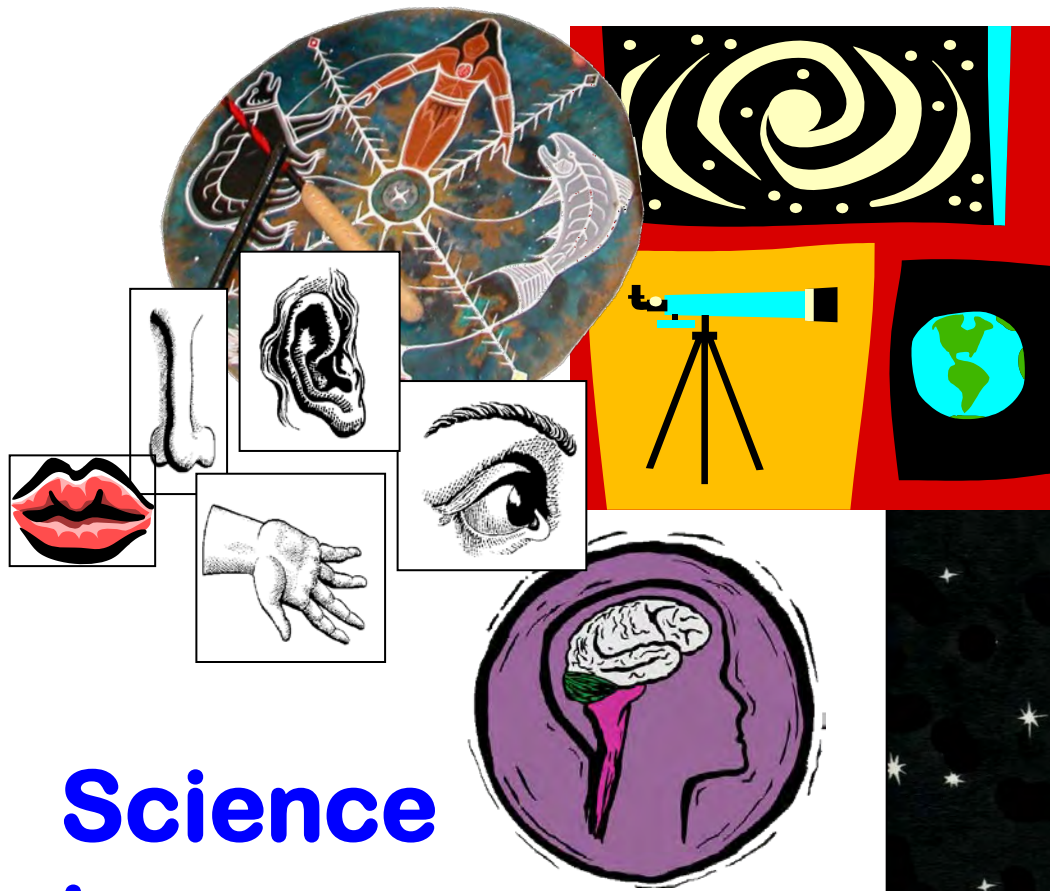
= Patterns → Stories → Science



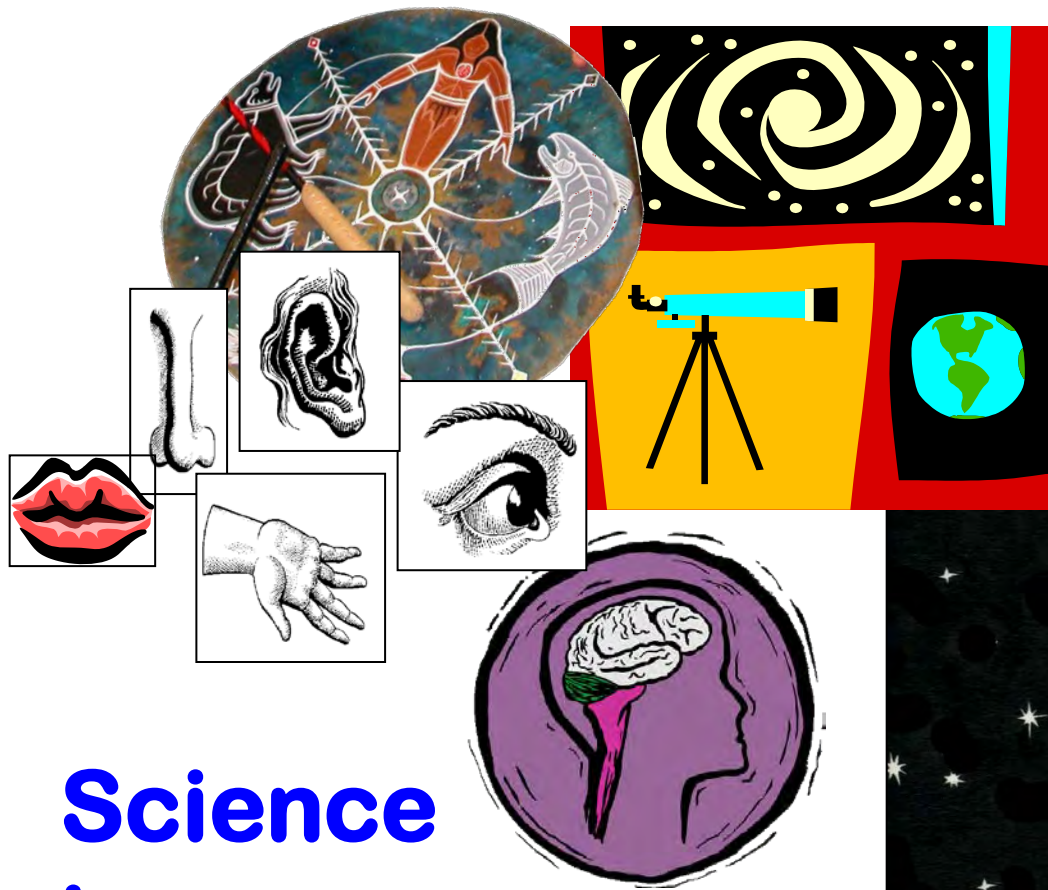
**Senses
+ Brain
+ Mind
& Culture**

= Patterns → Stories → Science





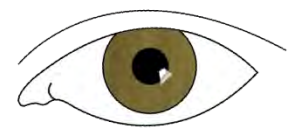
**Science
is
dynamic,
pattern-based
knowledge.**



**Science
is
dynamic,
pattern-based**

stories of our interactions with and within nature

Integrative Science ... a Journey of Co-Learning and Two-Eyed Seeing



To Co-Learn and use “Two-Eyed Seeing” we must TALK-WALK the “know, do, value” of our cultural strengths, differences, and common ground.

“Two-Eyed Seeing”

learning to see with the strengths of each & together



Indigenous



Western



Mr. Albert Marshall, Mi'kmaq Elder
Eskasoni First Nation

We must become able to put the “know, do, value” aspects of **our own science** in front of us ... like an object ... and then we must develop the abilities to look at and walk around them ... talk about them, acknowledge them, take ownership of them, understand them, and then **put them beside those of another worldview** ... to see our mutual strengths and to begin working together in a respectful manner.

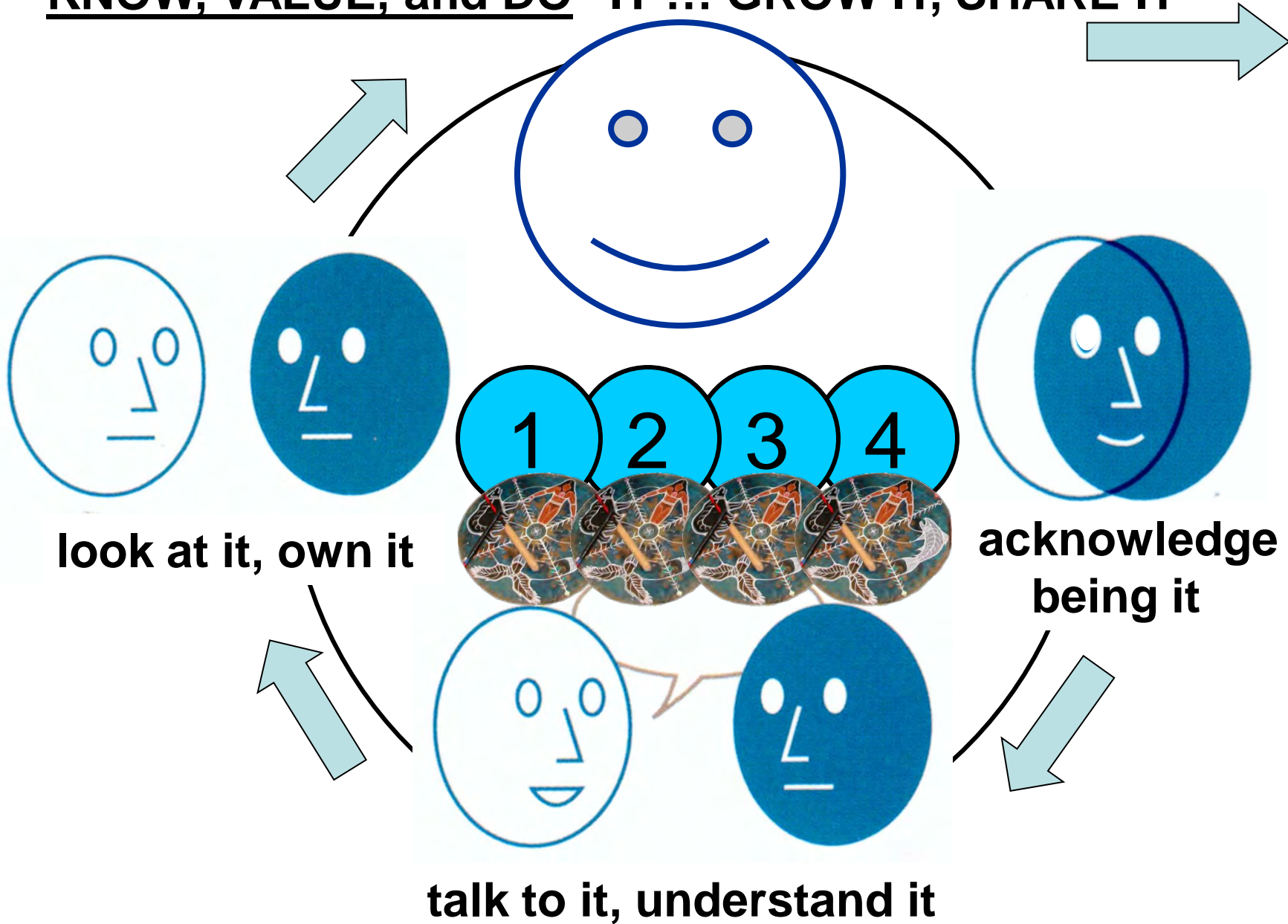
Indigenous

Two-Eyed Seeing
our SCIENCES

Western



“KNOW, VALUE, and DO” IT ... GROW IT, SHARE IT



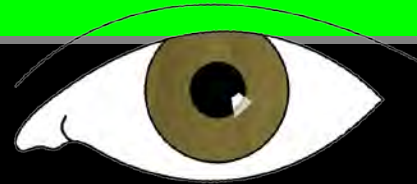
1

Two-Eyed Seeing

our key concepts & actions



- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility



- hypothesis
(making & testing)
- data collection
- data analysis
- model & theory
construction

2

Two-Eyed Seeing our languages & methodologies



Life
Love
Land

Math
&
Instruments

vigour

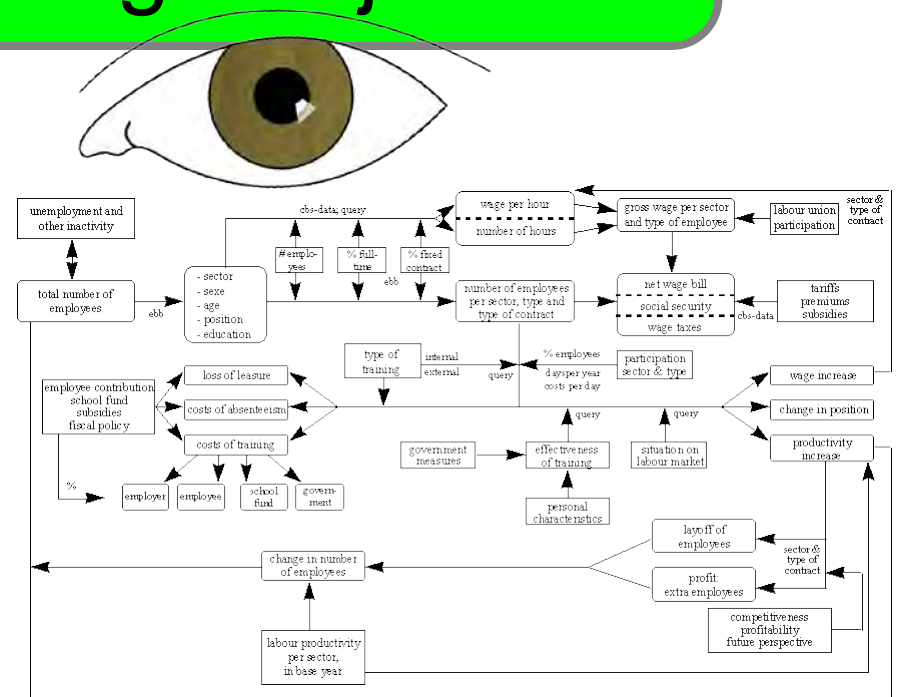
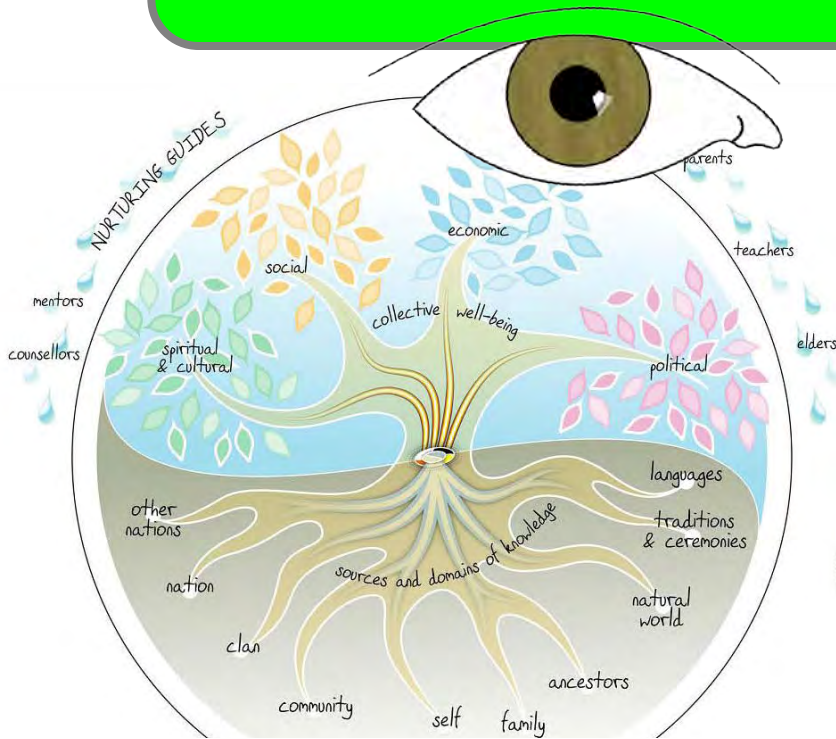
rigour

WEAVING

UN-WEAVING

3

Two-Eyed Seeing our overall knowledge objectives



from: CCL Aboriginal Learning Knowledge Centre (www.ccl-cca.ca/CCL)

from: www.leads.ac.uk

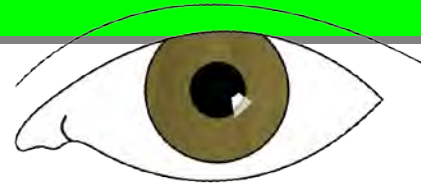
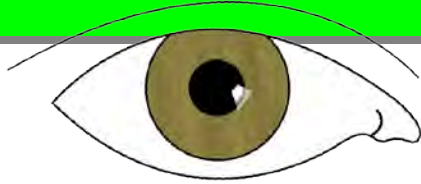
**towards resonance
of understanding
within environment**

**towards construction
of understanding
of environment**

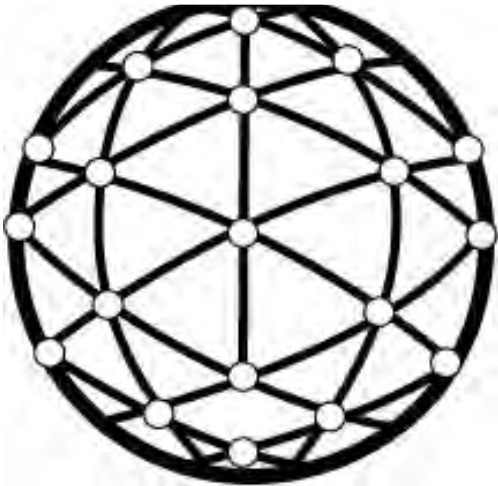
4

Two-Eyed Seeing

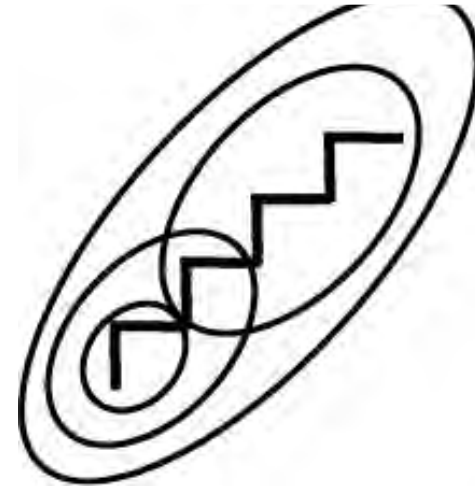
our world is



interconnective



parts & wholes



Integrative Science Co-Learning

**Go into a forest, you see the birch, maple, pine.
Look underground and all those trees are holding
hands. We as people must do the same.**

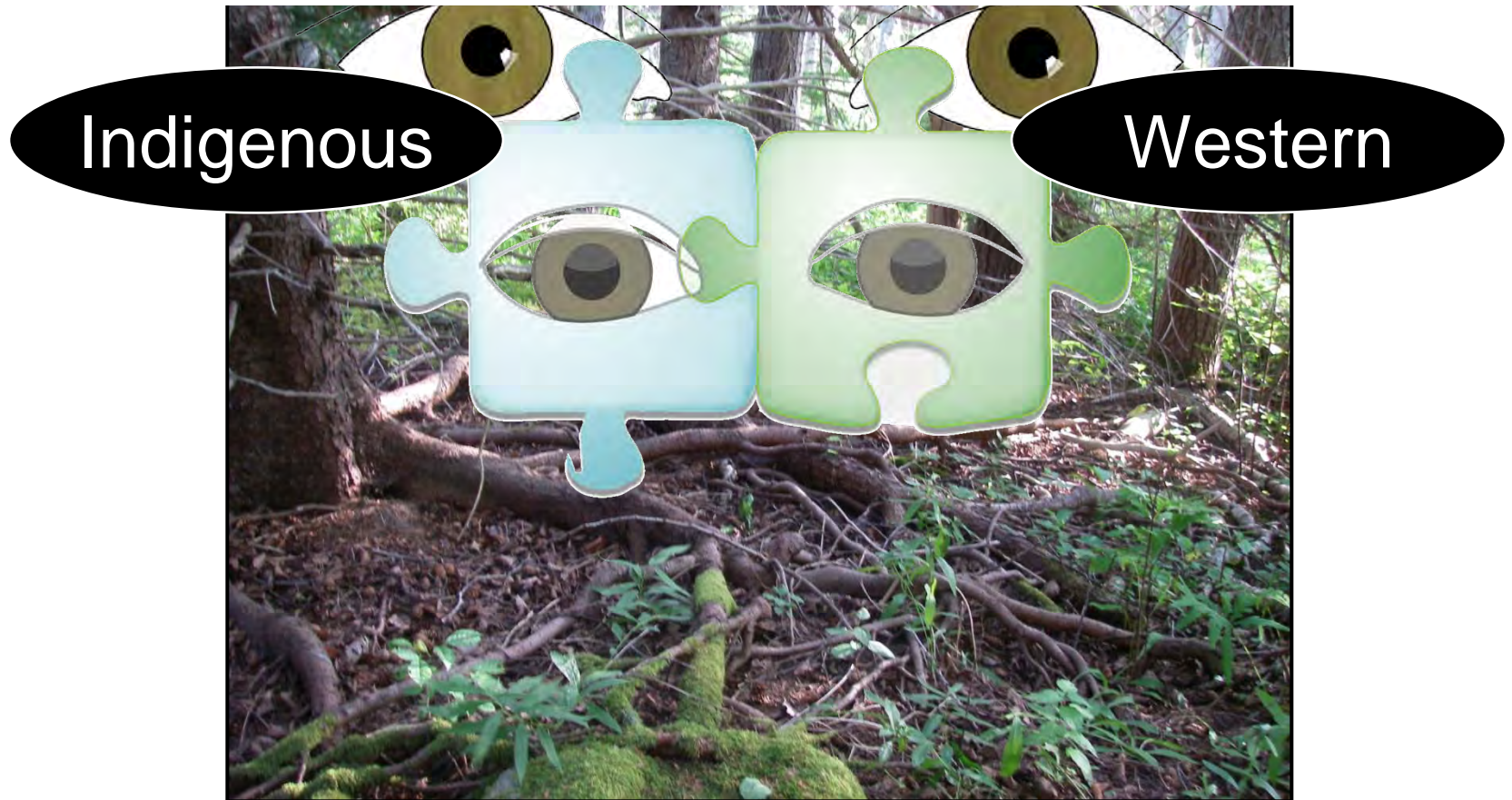
(late Mi'kmaq Chief, Spiritual Elder, and Healer Charlie Labrador)



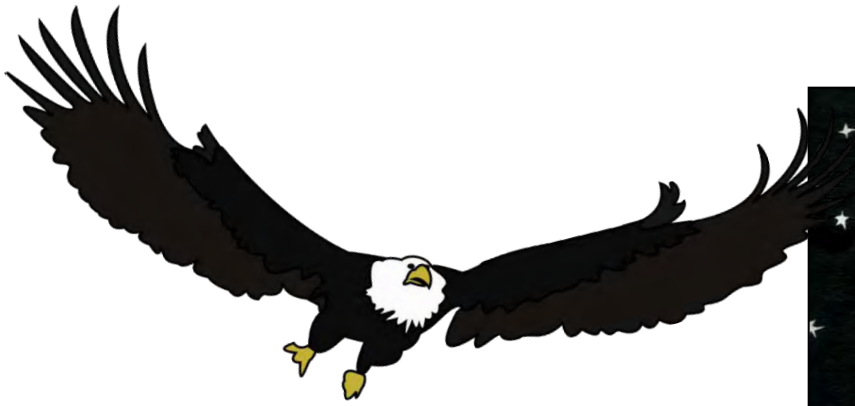
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Artist: Basma Kavanagh



Science is
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pattern-based
knowledge.

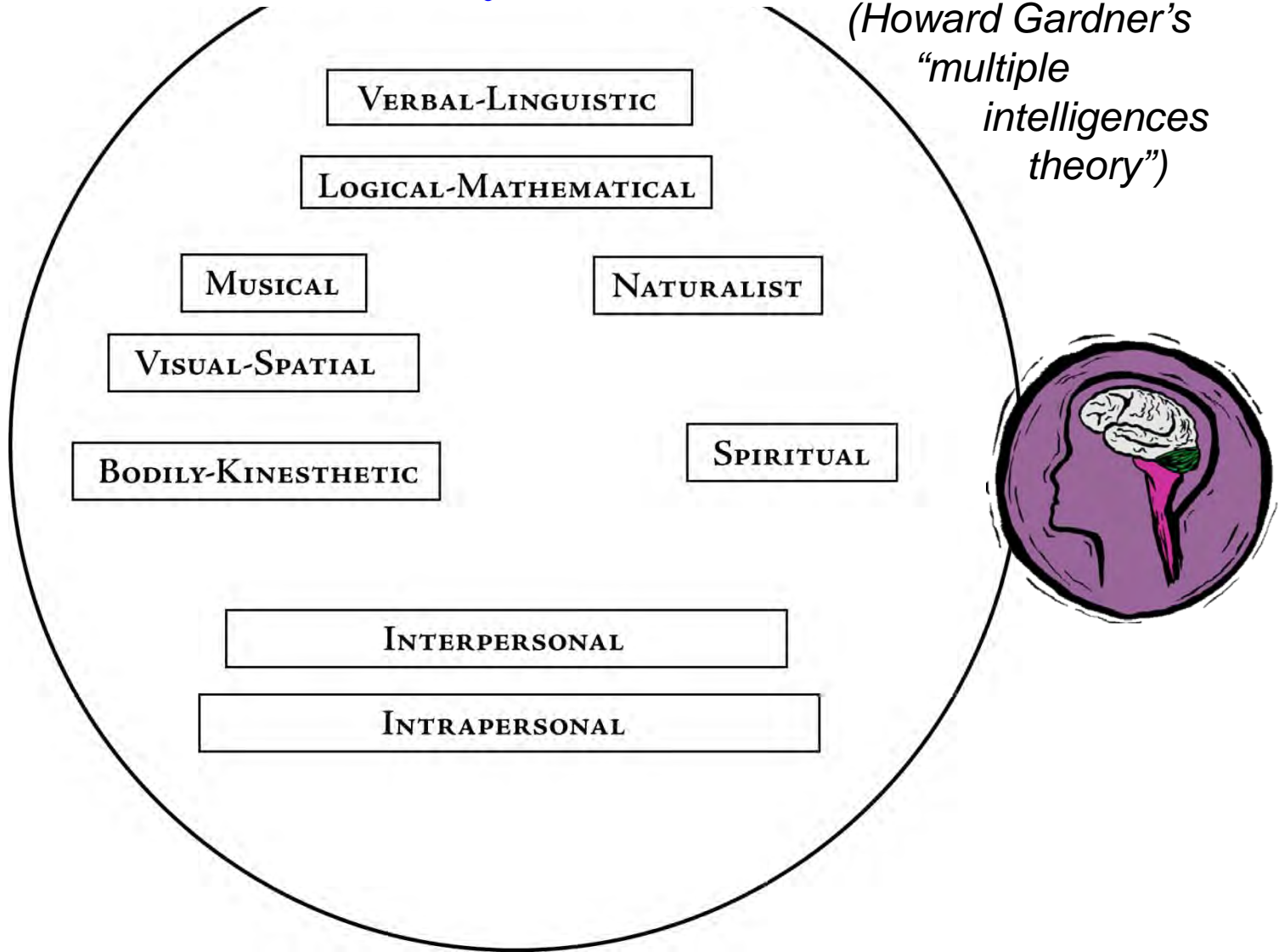


stories of our interactions with and within nature

our science stories ...

draw upon our **“pattern smarts”**

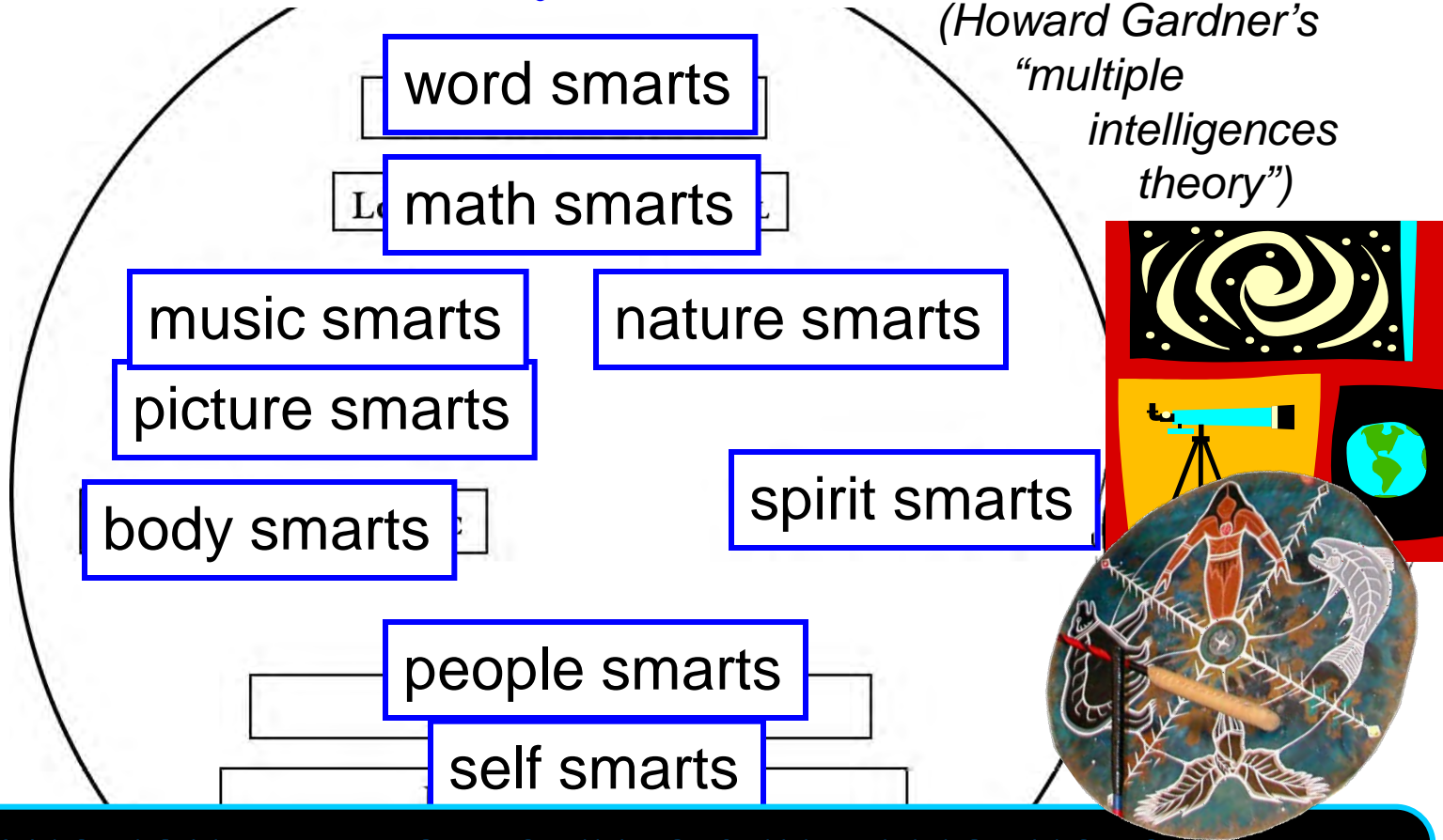
*(Howard Gardner’s
“multiple
intelligences
theory”)*



our science stories ...

draw upon our “**pattern smarts**”

(Howard Gardner’s
“multiple
intelligences
theory”)



SANCTIONED PERSPECTIVES & INTELLIGENCES:

who we are; where we are; where we were;
what we know, do and value

PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

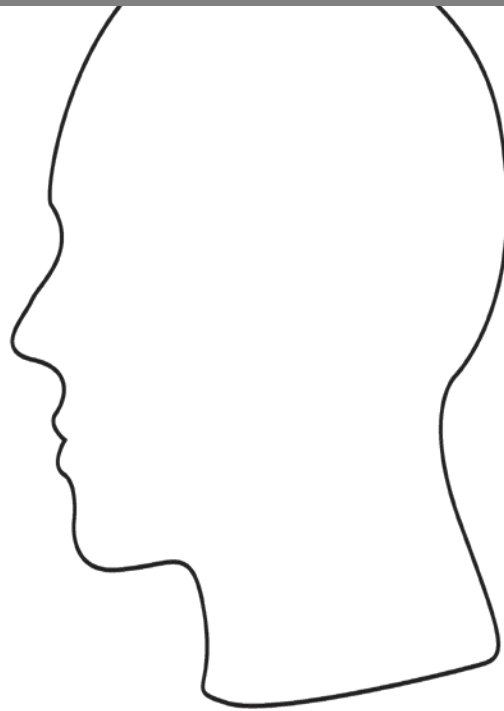


PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



PATTERN CONCEPTUAL FRAMEWORK

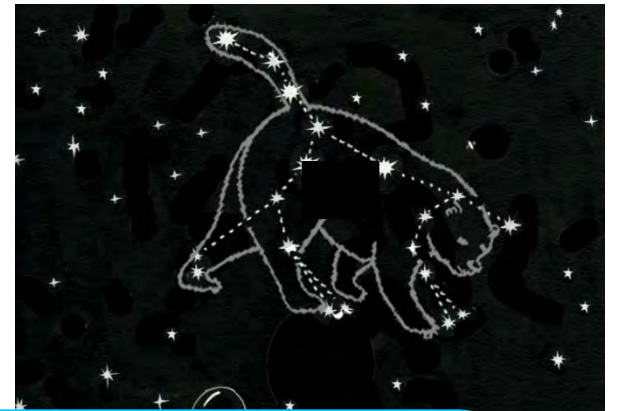
outer

inner

outer



muis / *Ursa major*



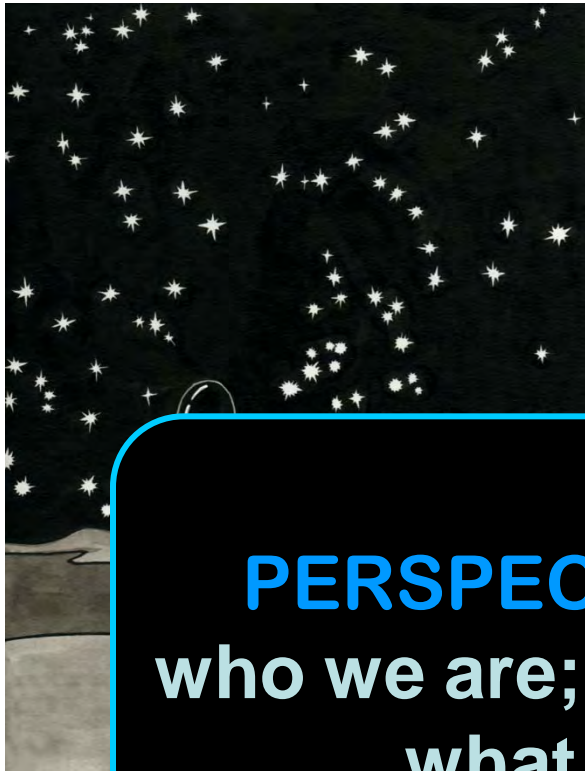
**SANCTIONED
PERSPECTIVES & INTELLIGENCES:**
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PATTERN CONCEPTUAL FRAMEWORK

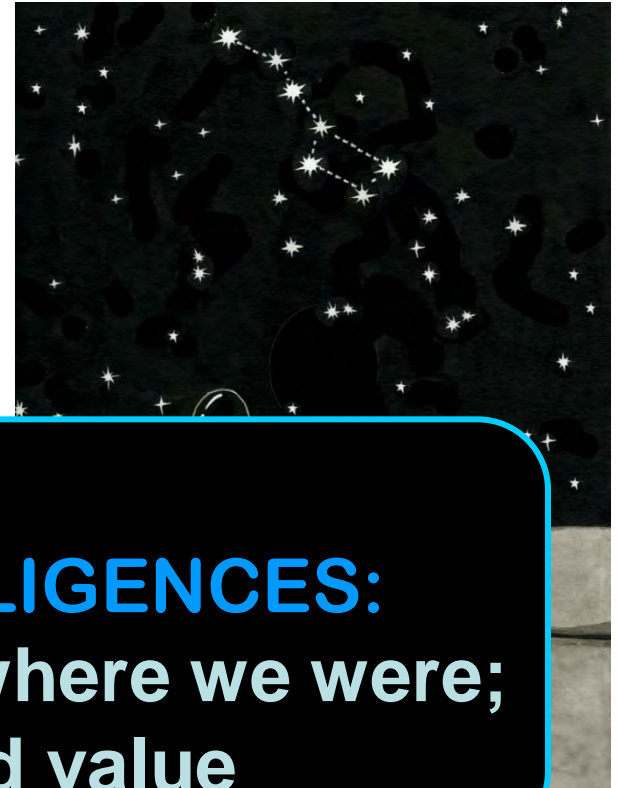
outer

inner

outer



dipper



SANCTIONED

PERSPECTIVES & INTELLIGENCES:

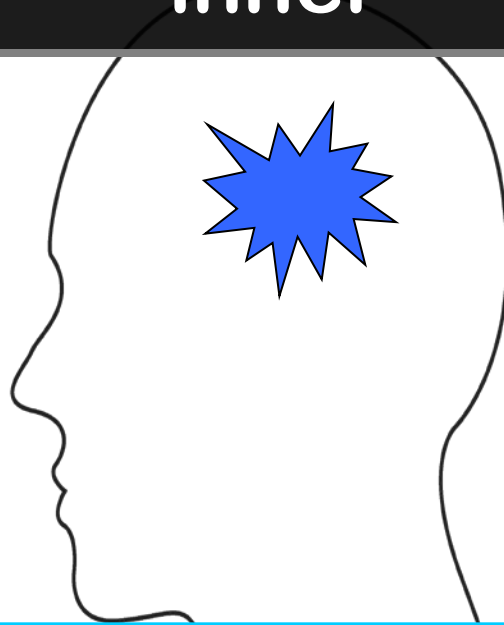
**who we are; where we are; where we were;
what we know, do and value**

PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



SANCTIONED

PERSPECTIVES & INTELLIGENCES:

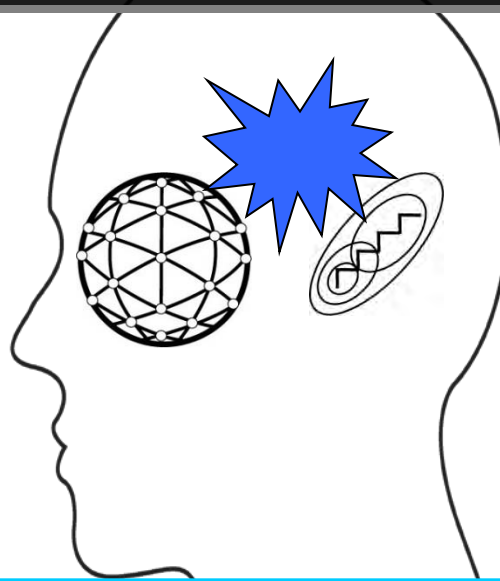
who we are; where we are; where we were;
what we know, do and value

PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



**SANCTIONED
PERSPECTIVES & INTELLIGENCES:**
who we are; where we are; where we were;
what we know, do and value

Physical Direction and Linear Time

detached &
instrumental

Western Science

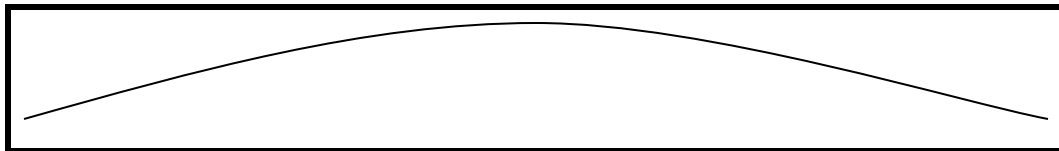
East (sunrise)

... measurement of
the time of sunrise

... for each new day
over the course of
one full year.

SYDNEY, NS												Astronomical Applications Dept.												
Location: W060 11, N46 09												U. S. Naval Observatory												
Rise and Set for the Sun for 2004												Washington, DC 20392-5420												
Zone: 4h West of Greenwich																								
Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.												
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set										
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m										
01	0743	1625	0724	1705	0639	1748	0540	1830	0447	1910	0413	1945	0413	1956	0443	1930	0522	1839	0600	1740	0642	1646	0723	1617
02	0743	1626	0723	1706	0637	1749	0538	1831	0445	1911	0412	1946	0414	1955	0444	1929	0523	1837	0601	1738	0644	1644	0724	1616
03	0743	1627	0722	1708	0635	1750	0536	1833	0444	1912	0412	1947	0415	1955	0446	1927	0524	1835	0602	1736	0645	1643	0725	1616
04	0743	1628	0720	1709	0634	1752	0534	1834	0442	1913	0411	1947	0415	1955	0447	1926	0525	1833	0604	1734	0646	1642	0727	1616
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31	0725	1703			0542	1829			0413	1944			0442	1931	0520	1840			0641	1647			0743	1625

X



y

Physical Direction and Linear Time

detached &
instrumental

Western Science

Two-Eyed Seeing
our key concerns & actions



- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility



- hypothesis
(making & testing)
- data collection
- data analysis
- model & theory
construction



Location: W060 11, N46 09

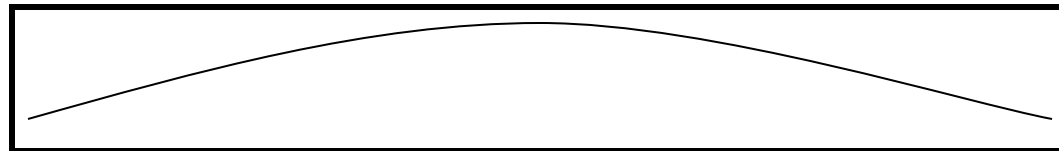
SYDNEY, NS
Rise and Set for the Sun for 2004

Astronomical Applications Dept.
U. S. Naval Observatory
Washington, DC 20392-5420

Zone: 4h West of Greenwich

Day	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
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31	0725	1703			0542	1829			0413	1944			0442	1931	0520	1840			0641	1647			0743	1625

X



y

Quantification



detached & instrumental

Western Science

Two-Eyed Seeing
our key concerns & actions



- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility



- hypothesis
(making & testing)
- data collection
- data analysis
- model & theory
construction



A scientist uses a liquid chromatography-mass spectrometry system to quantify toxins in biological samples. This instrument rapidly and selectively detects minute quantities of a wide range of contaminants. Analytical methods based on this technology are used in laboratories worldwide.

www.nrc-cnrc.gc.ca/multimedia/picture/life/nrc-imb_natural_toxins_e.html

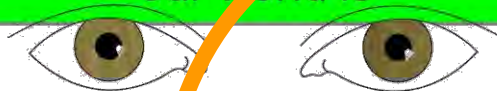
Categorization



detached & instrumental

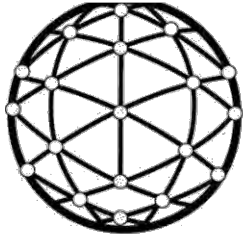
Western Science

Two-Eyed Seeing
our world is



interconnective

parts & wholes



Universe: Visible Matter (levels of organization - biology)

- Universe
- super clusters (Local)
- clusters (Local Group)
- galaxies (Milky Way)
- star systems (Sun)
- planet Earth
- ecosystems
- communities
- population
- organisms
- organ system
- organs
- tissues
- cells
- organelles
- molecules & minerals
- atoms (natural elements #1-92; artificial elements #93 & higher)
- baryons (neutrons & protons)
- fundamental particles (quarks & leptons)

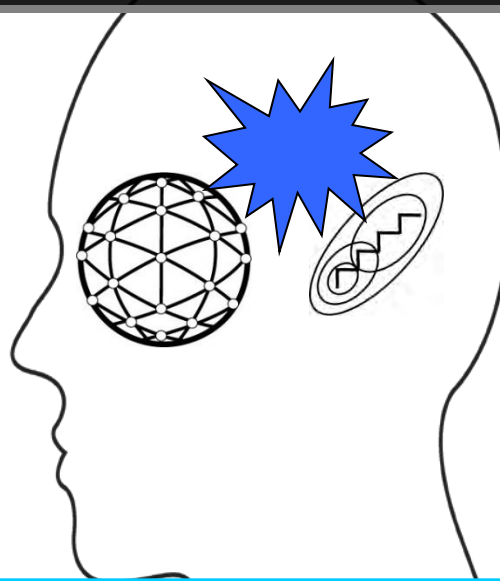
Setford, Steve. 1996. Science Facts. Firefly Books Ltd., Willowdale, ON. (pp. 36-37)

PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



SYDNEY, NS
 Rise and Set for the Sun for 2004
 Zone: 4h West of Greenwich

Astronomical Applications Dept.
 U. S. Naval Observatory
 Washington, DC 20391-3420

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.												
Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set											
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31	0725	1703			0542	1829			0413	1944			0442	1931	0520	1840			0441	1647			0743	1625

SANCTIONED
PERSPECTIVES & INTELLIGENCES:
 who we are; where we are; where we were;
 what we know, do and value

**participatory &
creative choice**



**Wjipenuk Etek
Lnuimlkikno'ti
- Spirit of the East -**

East (sunrise)

**... a place of
beginnings and
enlightenment**

**... where new
knowledge can be
created or received
to bring about
harmony or right
relations.**


**participatory &
creative choice**



**Wjipenuk Etek
Lnuimlkikno'ti
- Spirit of the East -**

Two-Eyed Seeing
our key concepts & actions

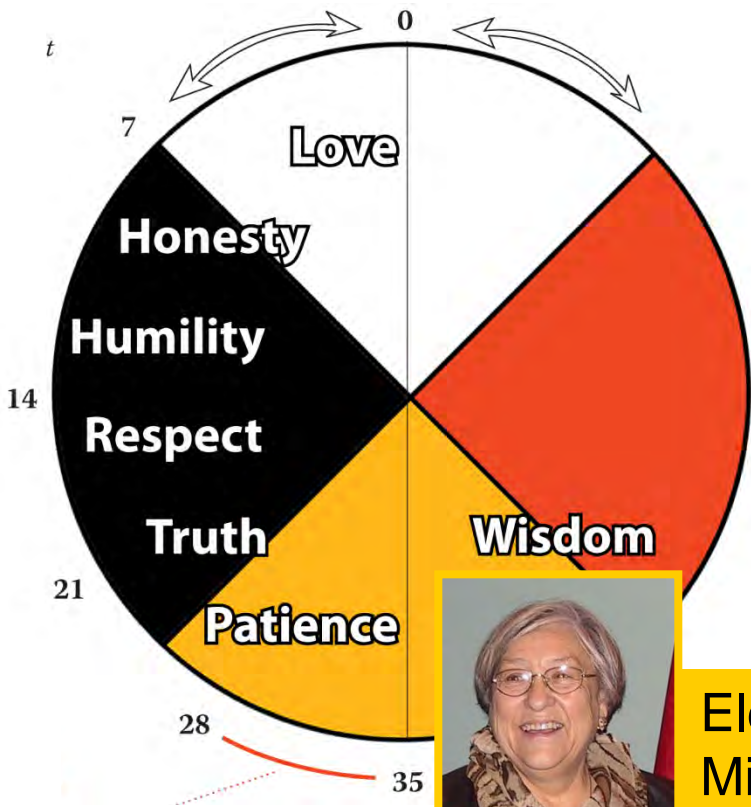
- 
- respect
 - relationship
 - reverence
 - reciprocity
 - ritual (ceremony)
 - repetition
 - responsibility

- 
- hypothesis
(making & testing)
 - data collection
 - data analysis
 - model & theory
construction



participatory & creative choice

Mi'kmaq SACRED TEACHINGS
7 Stages of Life with the 7 Gifts



Elder Murdena Marshall, MEd
Mi'kmaq Elder & Spiritual Leader
Eskasoni First Nation

**JOURNEY OF LIFE:
Seven Sacred Gifts
offered ... up to
you to accept or not**

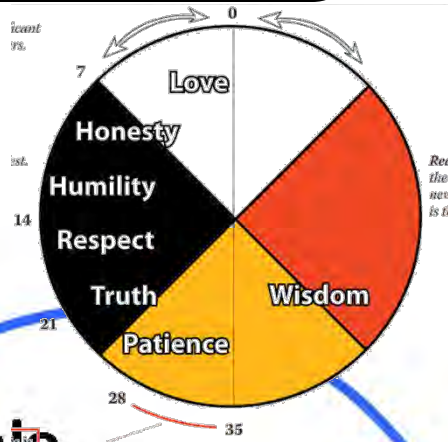
Two-Eyed Seeing our key concepts & actions

- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility

- hypothesis
(making & testing)
- data collection
- data analysis
- model & theory
construction

participatory & creative choice

Indigenous Science



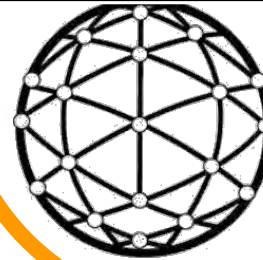
Sacred Circle

- cosmic order and unity of all
- change, balance, wholeness
- relationship, interconnectiveness, and harmony
- patterns and shapes in Nature
- time as continual recurrence of natural patterns and cycles, i.e. constant flux
- reality as passing from generation to generation via storytelling and participation in ceremony

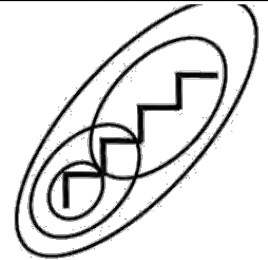
Two-Eyed Seeing
our world is



interconnective



parts & wholes



**participatory &
creative choice**

Indigenous Science



psychology



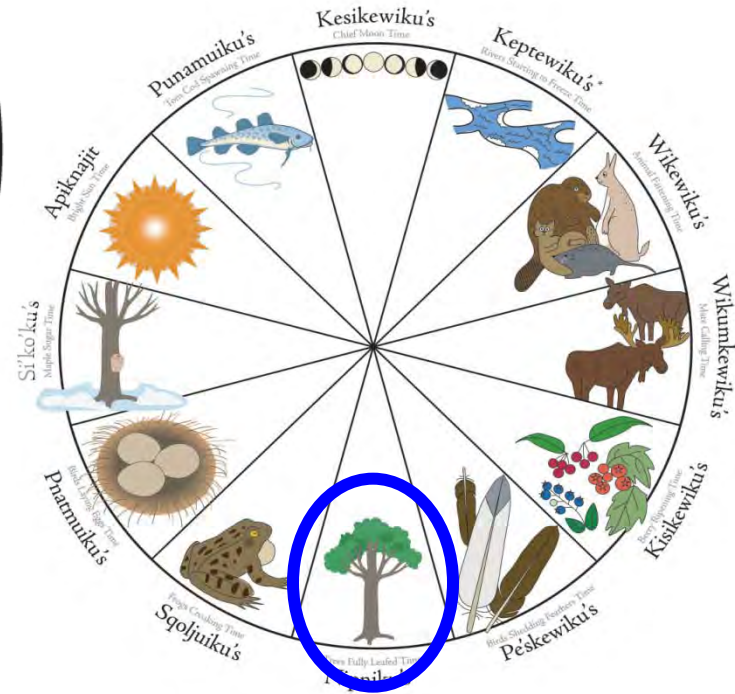
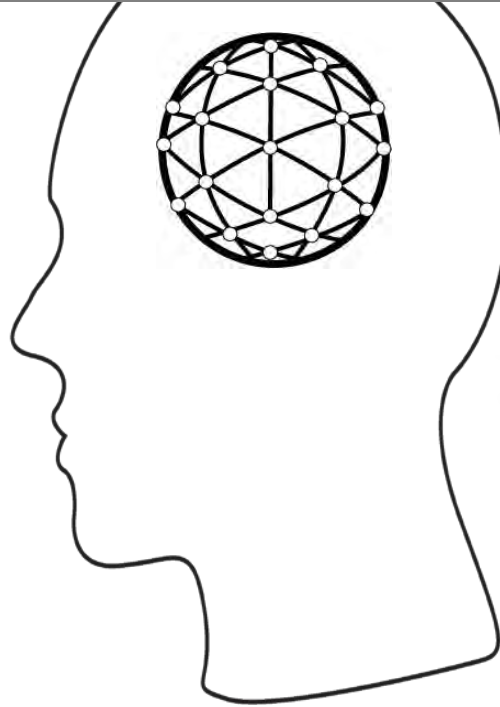
creative thinking,
transformative
learning,
sustainable living
for
ecosystem health
stewardship

PATTERN CONCEPTUAL FRAMEWORK

outer

inner

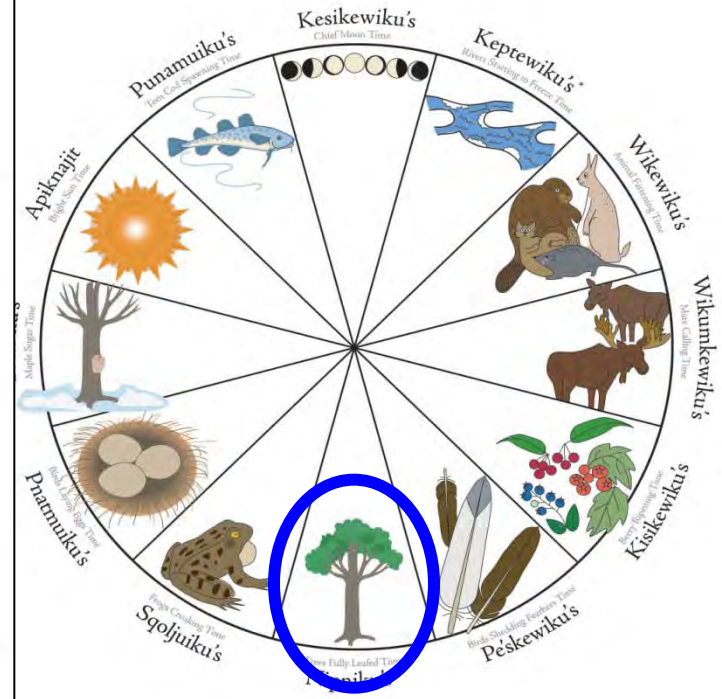
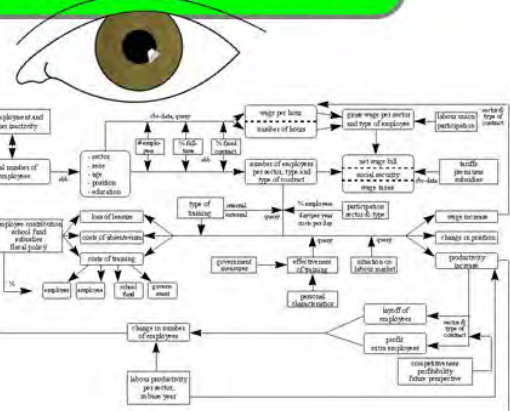
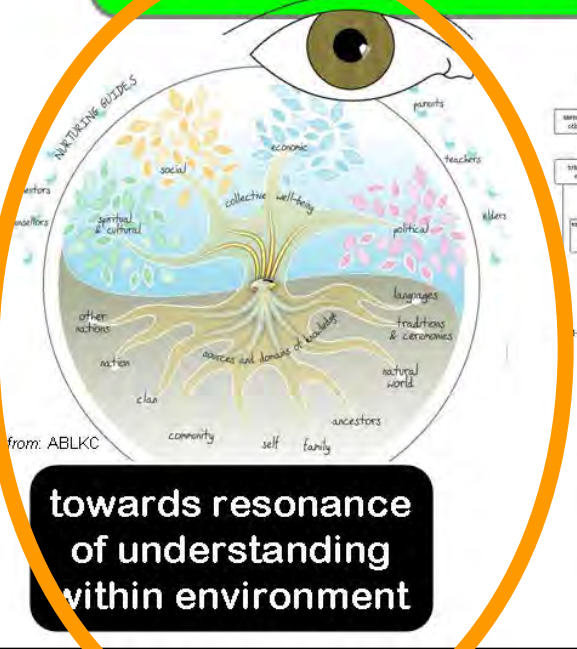
outer



PATTERN CONCEPTUAL FRAMEWORK

outer

Two-Eyed Seeing
our overall knowledge objectives



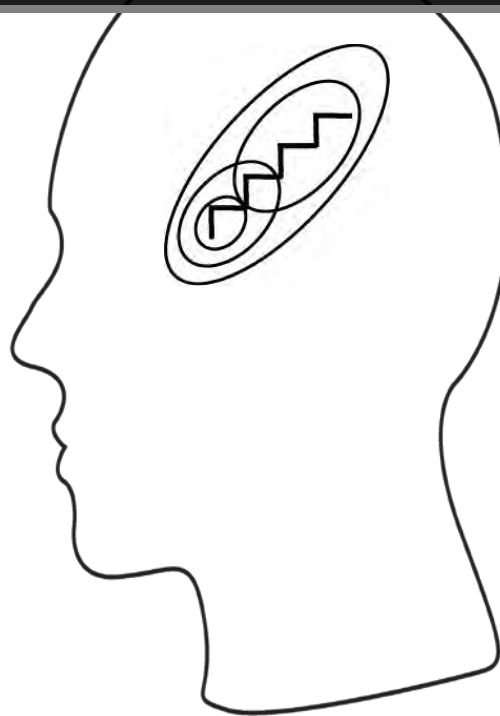
PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

X



June

... in honour of
"Juno", the
Roman Queen
of the Gods

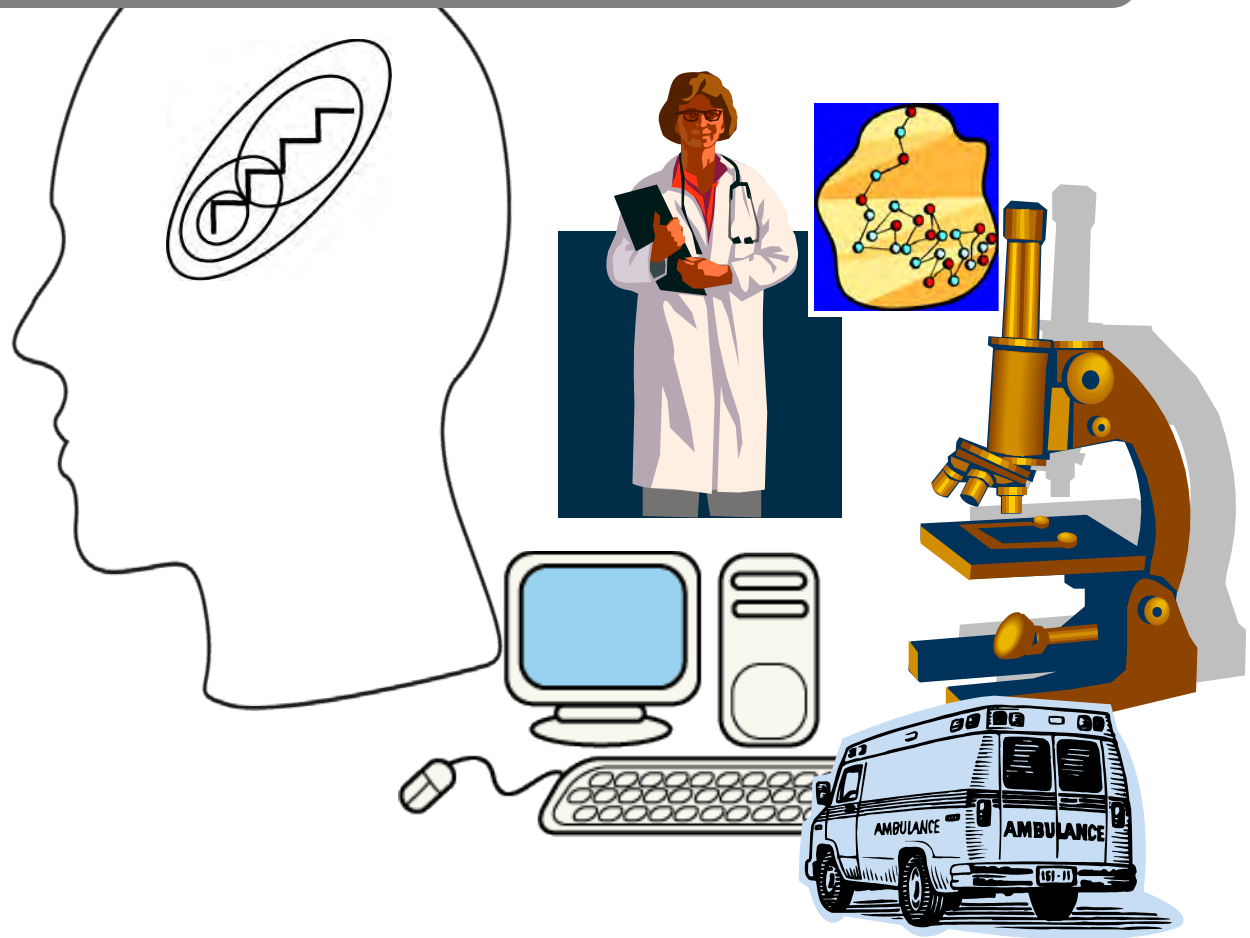
PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

“human health”



PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

Two-Eyed Seeing
our languages & methodologies



Life
Love
Land

vigour

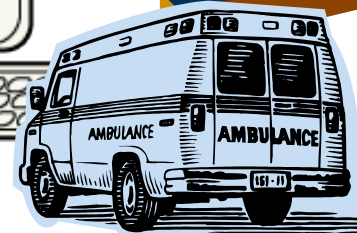
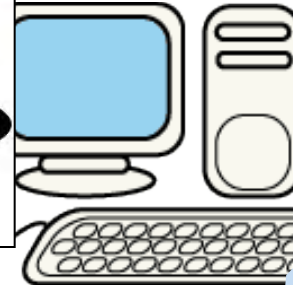
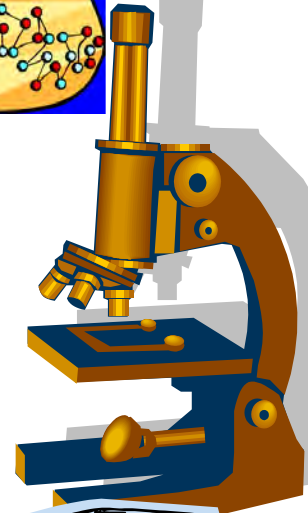
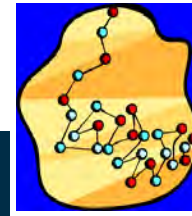
WEAVING



Math
&
Instruments

rigour

UN-WEAVING



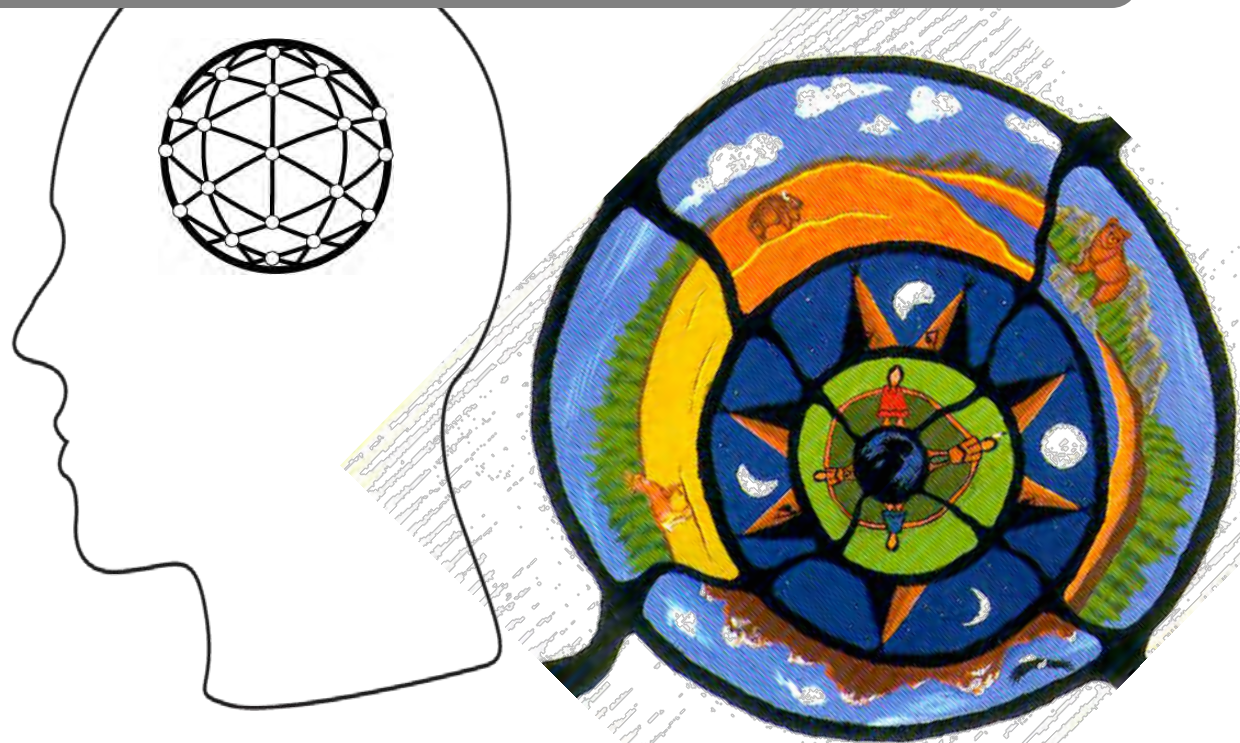
PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

“human health”



Artist: Rod Restoule
from: Into the Daylight;
C. Morrisseau, 1998

PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

Two-Eyed Seeing
our languages & methodologies



Life
Love
Land

vigour

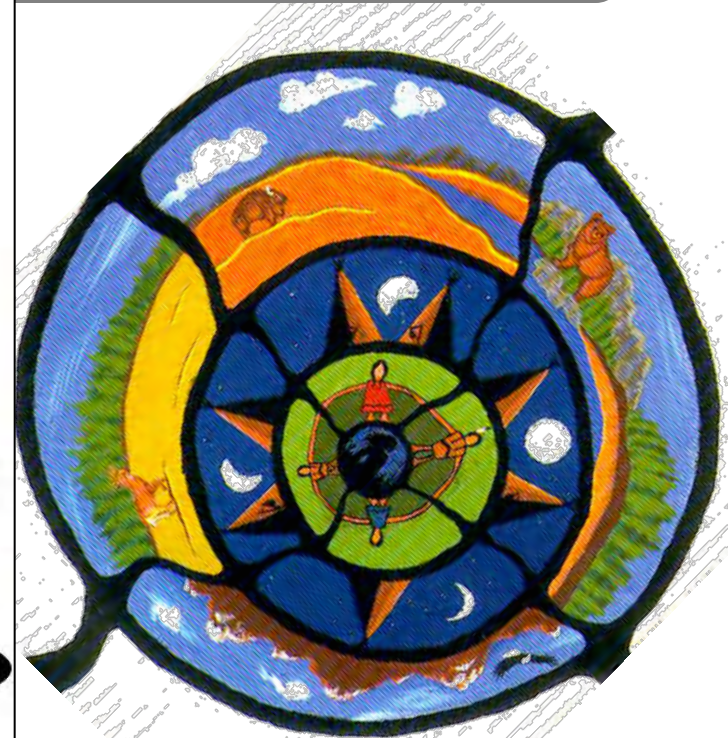
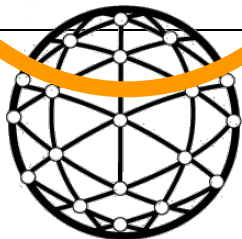
WEAVING



Math
&
Instruments

rigour

UN-WEAVING

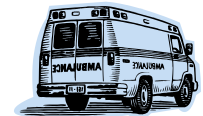
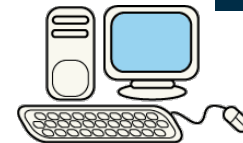
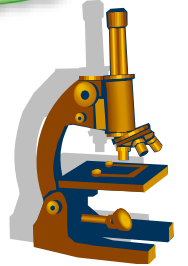
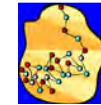


Artist: Rod Restoule
from: Into the Daylight;
C. Morrisseau, 1998

Indigenous Science

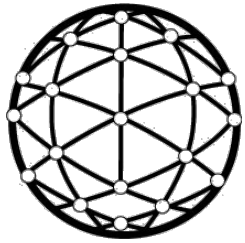
medicine

Mother
Earth



Artist: Rod Restoule
from: Into the Daylight;
C. Morrissette, 1998

Indigenous Science

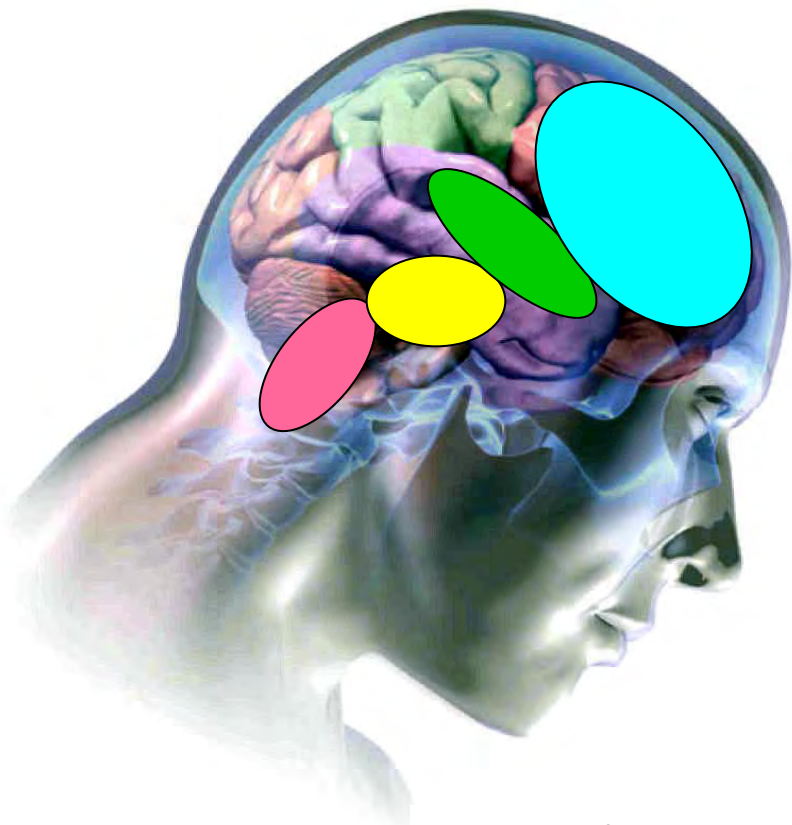
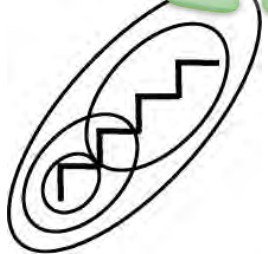


Mother
Earth



EARLY
CHILD
DEVELOPMENT

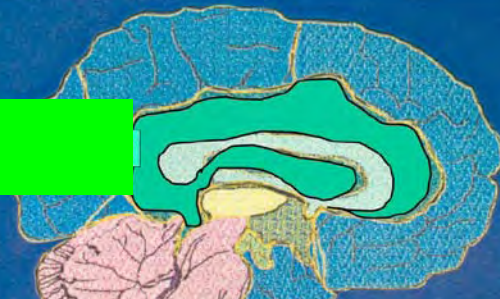
from:
Mi'kmaq Family
& Children's
Services



neocortex



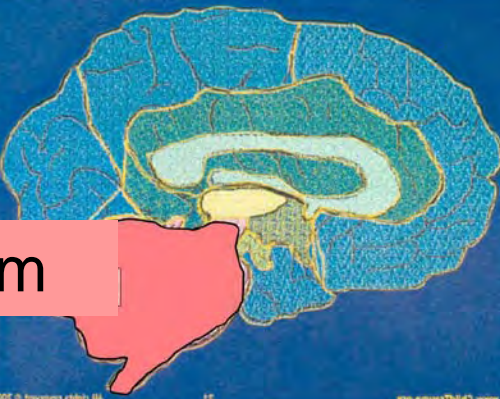
limbic



diencephalon

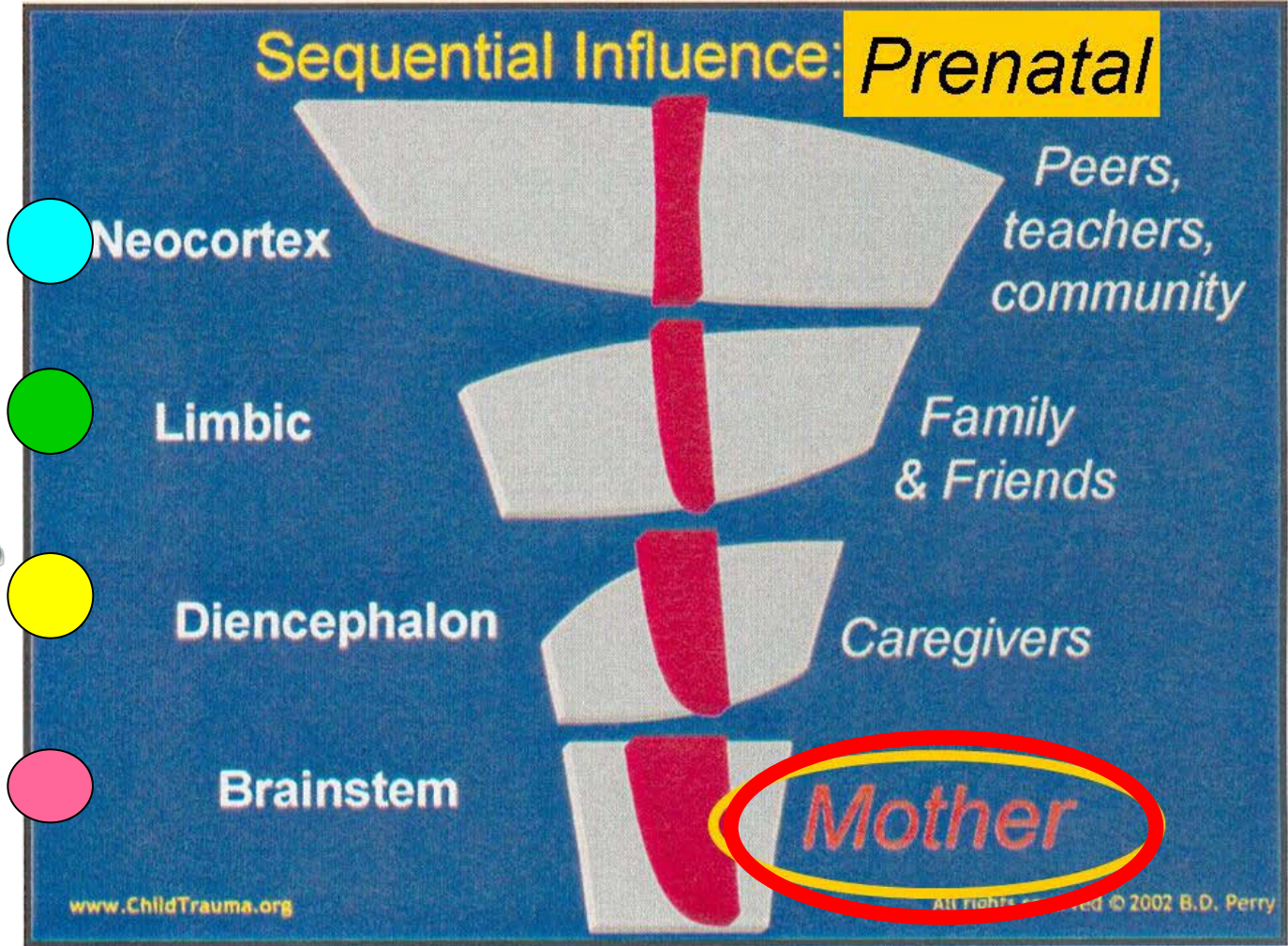
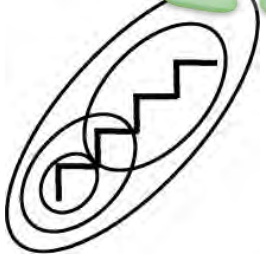


brain stem

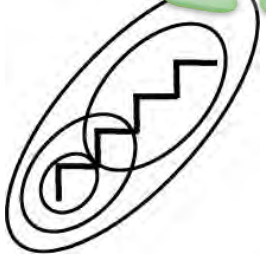


adapted from: www.childtrauma.org

neuropsychology



neuropsychology



● Neocortex

● Limbic

● Diencephalon

● Brainstem

Sequential Influence: **Birth - One**

Peers,
teachers,
community

Family
& Friends

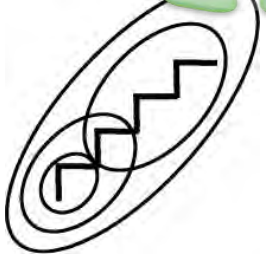
Caregivers

Mother

www.ChildTrauma.org

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neuropsychology



Neocortex



Limbic



Diencephalon



Brainstem

Sequential Influence: **One - Three**

Peers,
teachers,
community

**Family
& Friends**

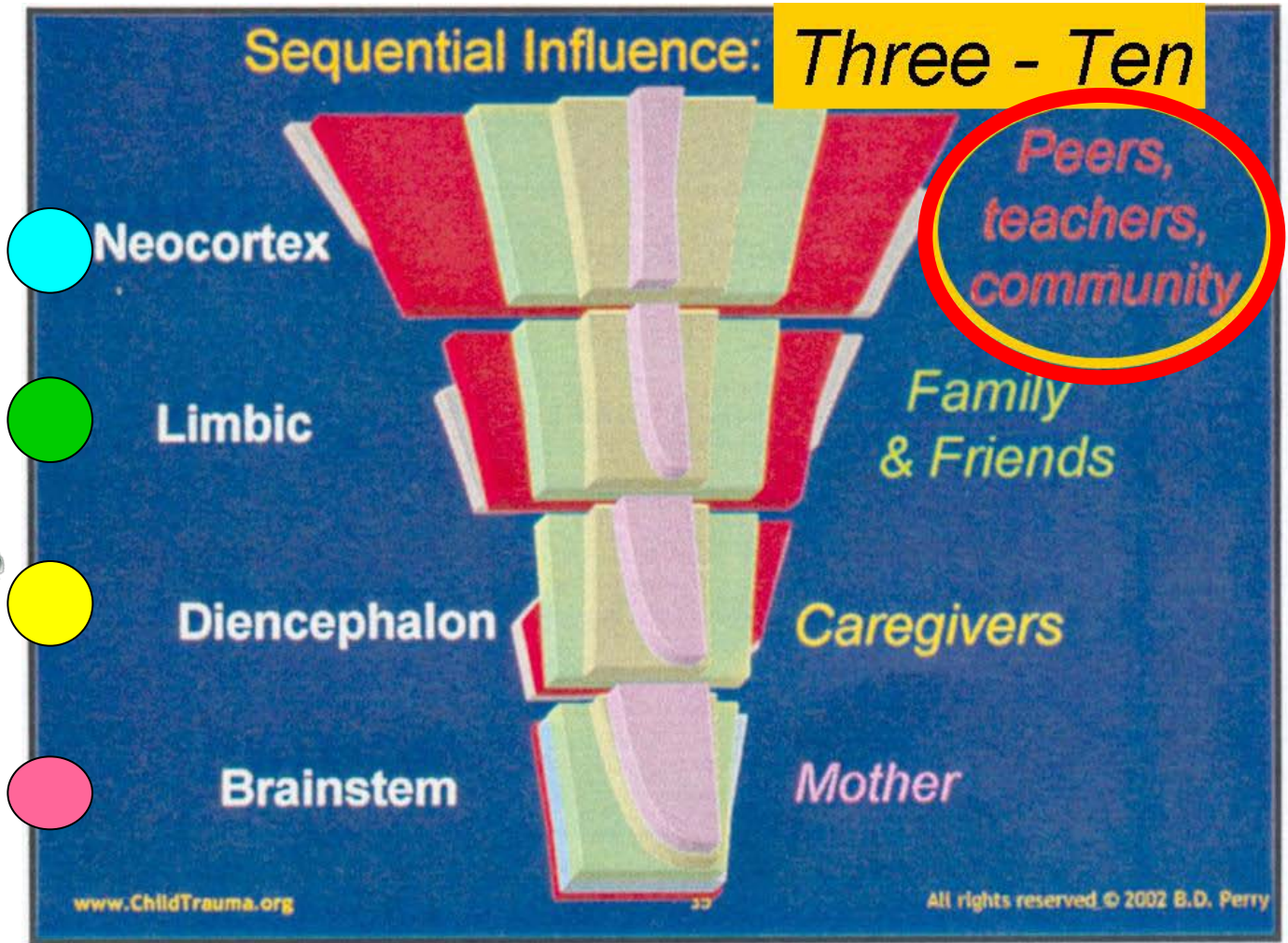
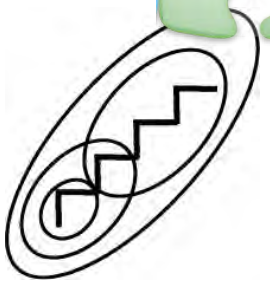
Caregivers

Mother

www.ChildTrauma.org

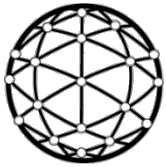
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neuropsychology



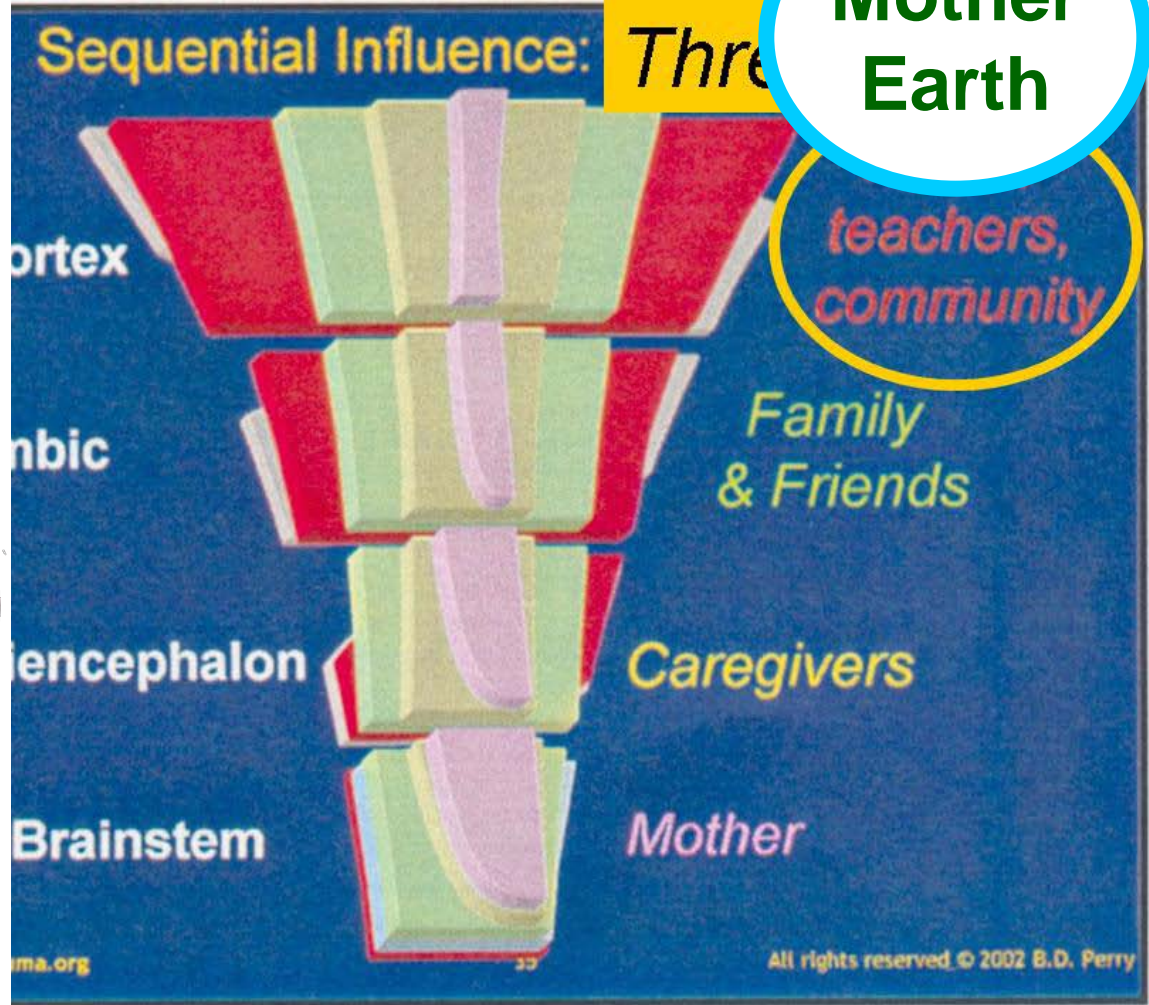


Indigenous Science



from:
Mi'kmaq Family
& Children's
Services

neuropsychology

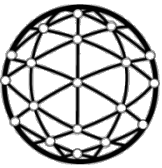


Mother Earth

adapted from: www.childtrauma.org



Indigenous Science



Elder Murdena Marshall, MEd
Mi'kmaq Elder & Spiritual Leader
Eskasoni First Nation

neuropsychology

linguistics

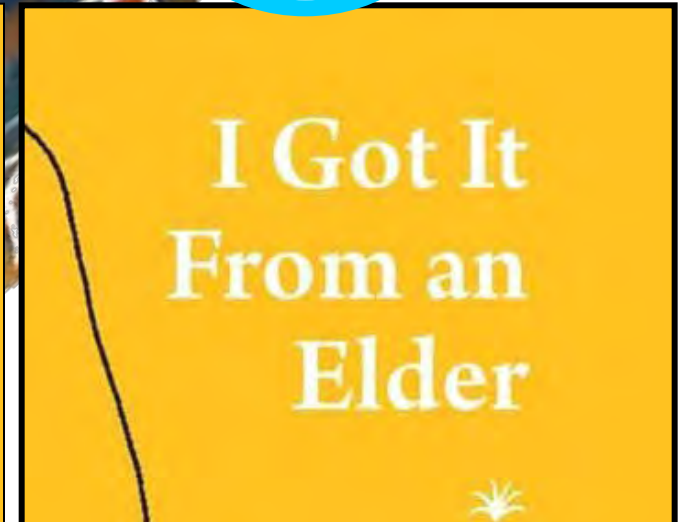
Love



I Got It
From an
Elder
*
Conversations
in Healing
Language

MARILYN IWAMA
MURDENA MARSHALL
ALBERT MARSHALL
IVAR MENDEZ
CHERYL BARTLETT

authors:
Marilyn Iwama
Murdena Marshall
Albert Marshall
Ivar Mendez
Cheryl Bartlett



I Got It
From an
Elder

Conversations
in Healing
Language

published by Gaspereau Press Limited; artwork by Alan Syliboy

Two-Eyed Seeing

our languages & methodologies



Indigenous Science

medicine

Mother Earth

Indigenous Science

neuropsychology

Mother Earth

Sequential Influence: *Three*

ortex

mbic

encephalon

teachers, community

Family & Friends

Caregivers

Mother

Adapted from: www.childtrauma.org

Indigenous Science

neuropsychology

linguistics

Love

I Got It From an Elder

Conversations in Healing Language

authors: Marilyn Iwama, Murdena Marshall, Albert Marshall, Ivar Mendez, Cheryl Bartlett

Elder Murdena Marshall, MEd
Mi'kmaq Elder & Spiritual Leader
Eskasoni First Nation

published by Gaspereau Press Limited; artwork by Alan Syliboy

International Year of Astronomy



Indigenous



Western

“bringing our astronomies together”



Patterns in Stars



GERALD GLOADE

“Reflections”

artist Gerald Gloade
Millbrook First Nation

Patterns on Earth

The Celestial Bear

Stansbury Hagar. 1900.
Journal of American Folklore
Vol. 13(9).

Source



Elder Lillian Marshall
Potlotek First Nation

Sana Kavanagh
Cape Breton University



Mi'kmaq of Nova Scotia ...
specific individuals and communities unnamed



The Celestial Bear
Author(s): Stansbury Hagar
Source: *The Journal of American Folklore*, Vol. 13, No. 49, (Apr. - Jun., 1900), pp. 92-103
Published by: University of Illinois Press on behalf of American Folklore Society
Stable URL: <http://www.jstor.org/stable/533799>
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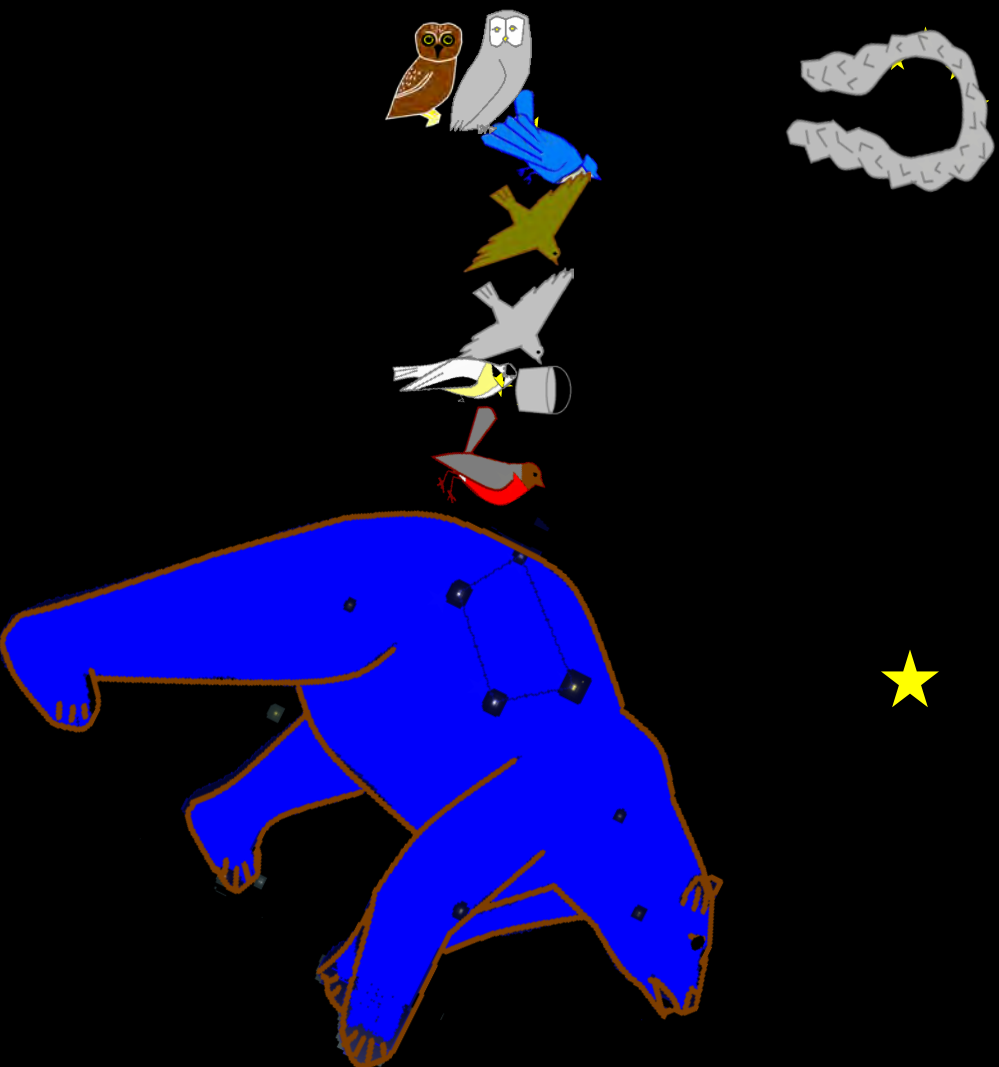
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The Great Bear Muin

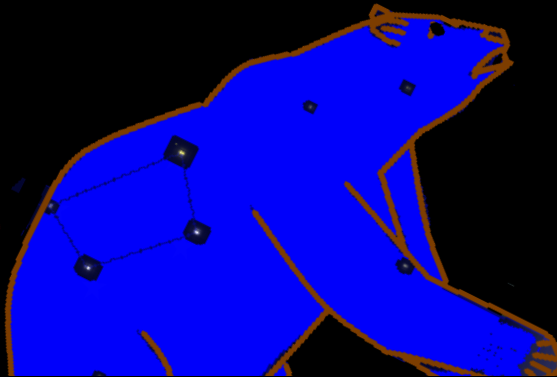
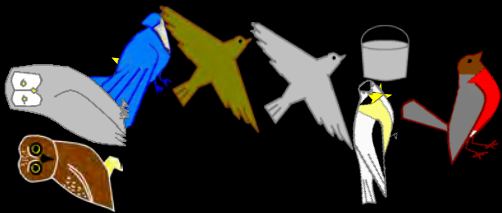
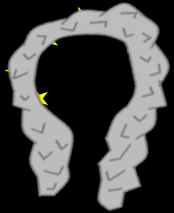
patterns
and
meta-patterns
in our natural
world



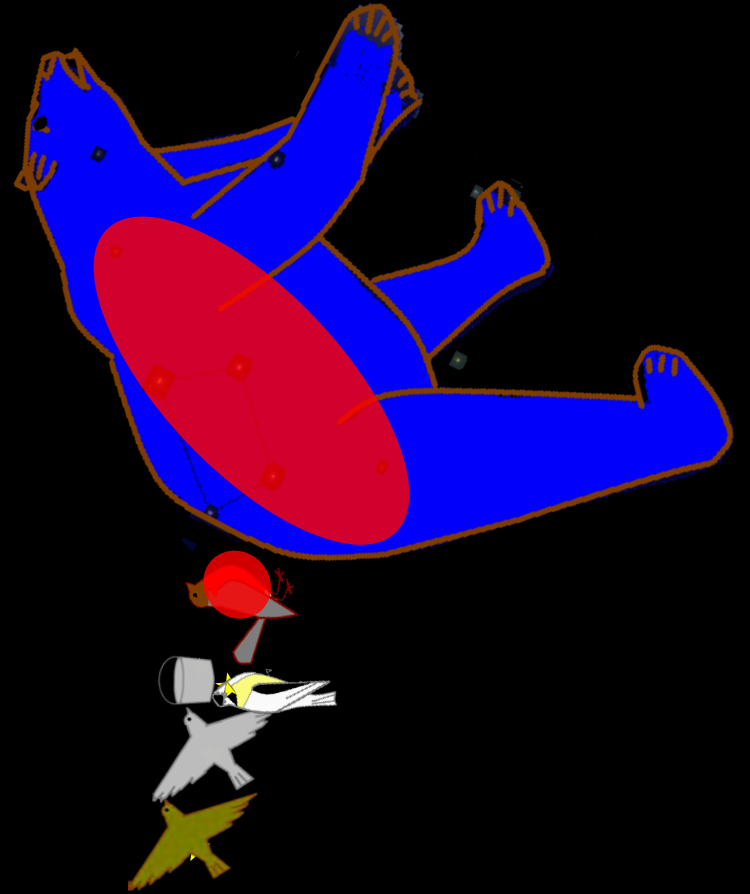
★ Polaris



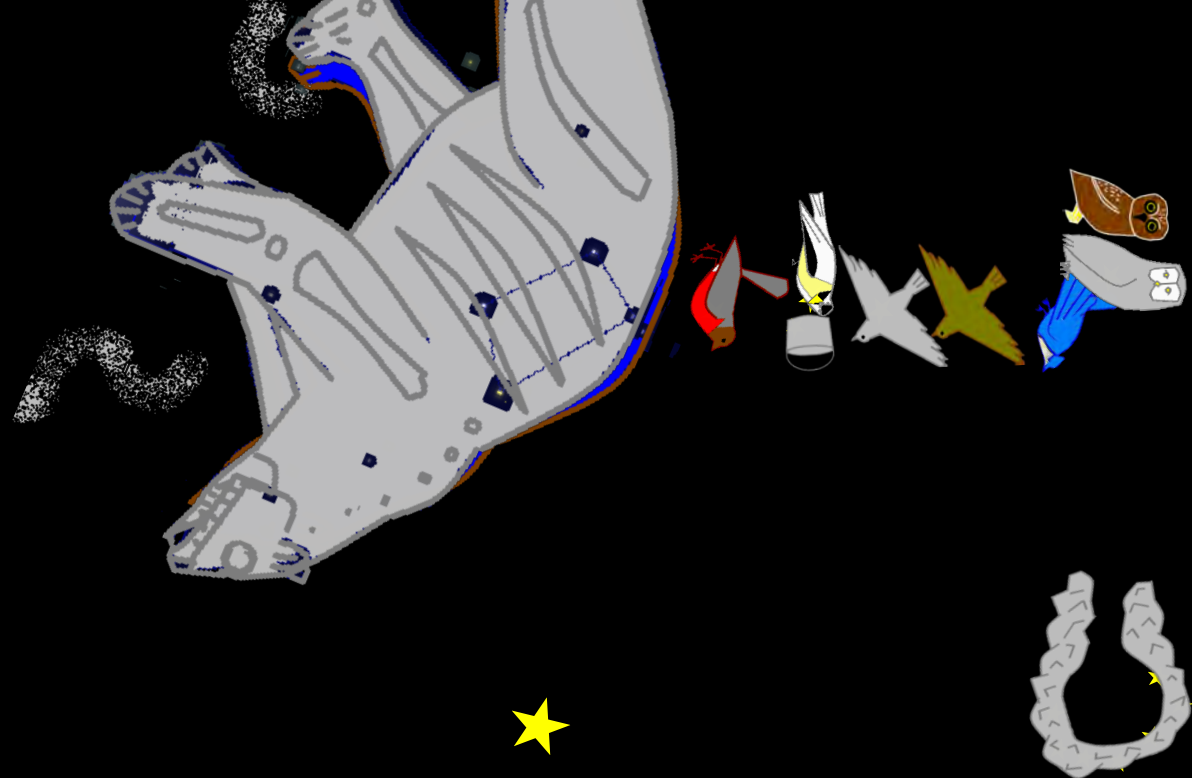
Mid Spring



Mid Summer

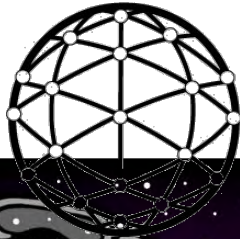


Mid Autumn



Mid Winter

Indigenous Science



Great Bear Night Sky Story

Two-Eyed Seeing our key concepts & actions



- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility



- hypothesis
(making & testing)
- data collection
- data analysis
- model & theory
construction



Integrative Science

1 **Two-Eyed Seeing**
our key concepts & actions

- respect
- relationship
- reverence

- hypothesis (making & testing)
- data collection

2 **Two-Eyed Seeing**
our languages & methodologies

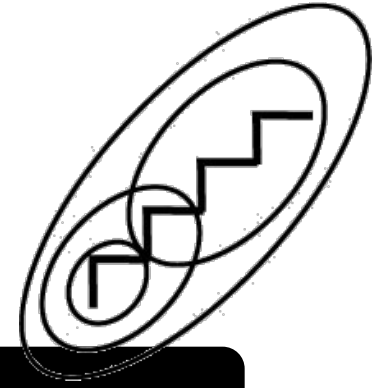
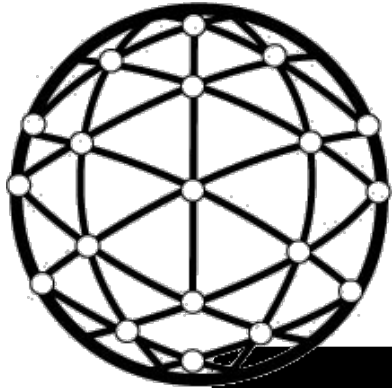
3 **Two-Eyed Seeing**
our overall knowledge objectives

4 **Two-Eyed Seeing**
our world is

- interconnective
- parts & wholes



stories of our interactions with and within nature



“bringing our sciences together”

Indigenous Science



images from: Aboriginal organizations/artists, various sources



Western Science



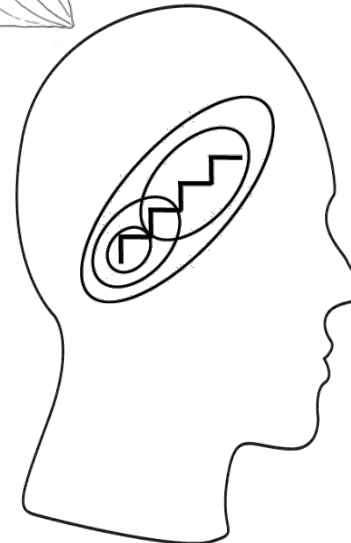


stories of our interactions with and within nature

what our “pattern stories” (re)generate



subject - object



cogno-
centric &
detached

disconnectedness

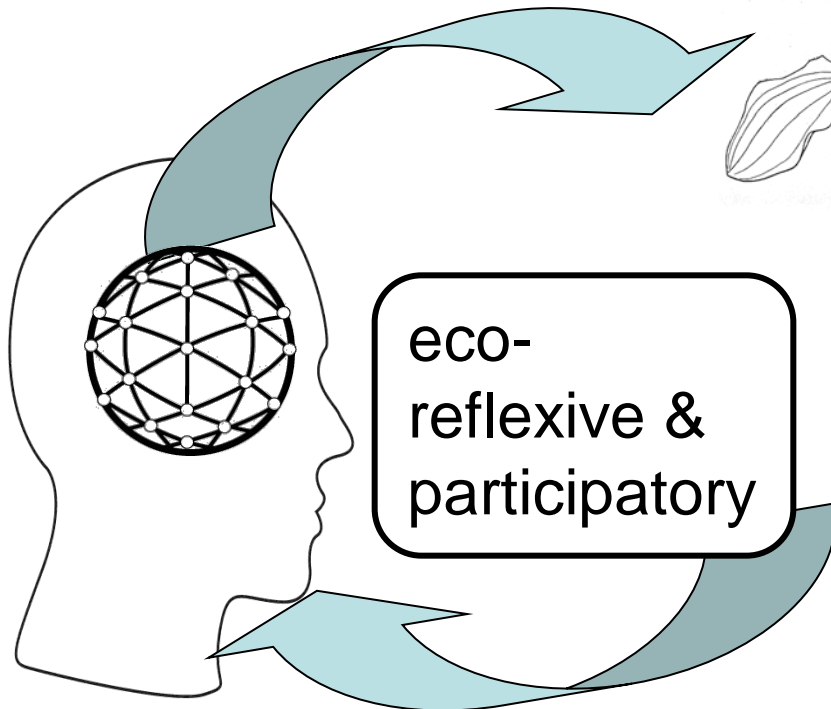
stories of our interactions with and within nature

what our “pattern stories” (re)generate

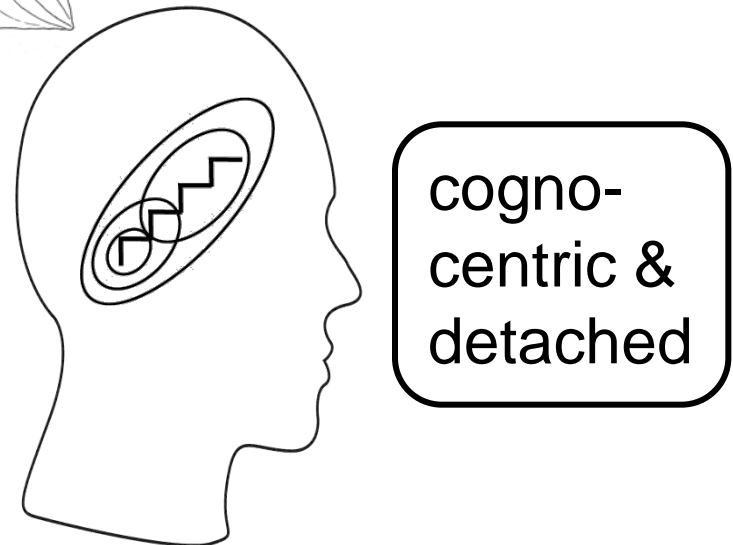


subject-subject

subject - object



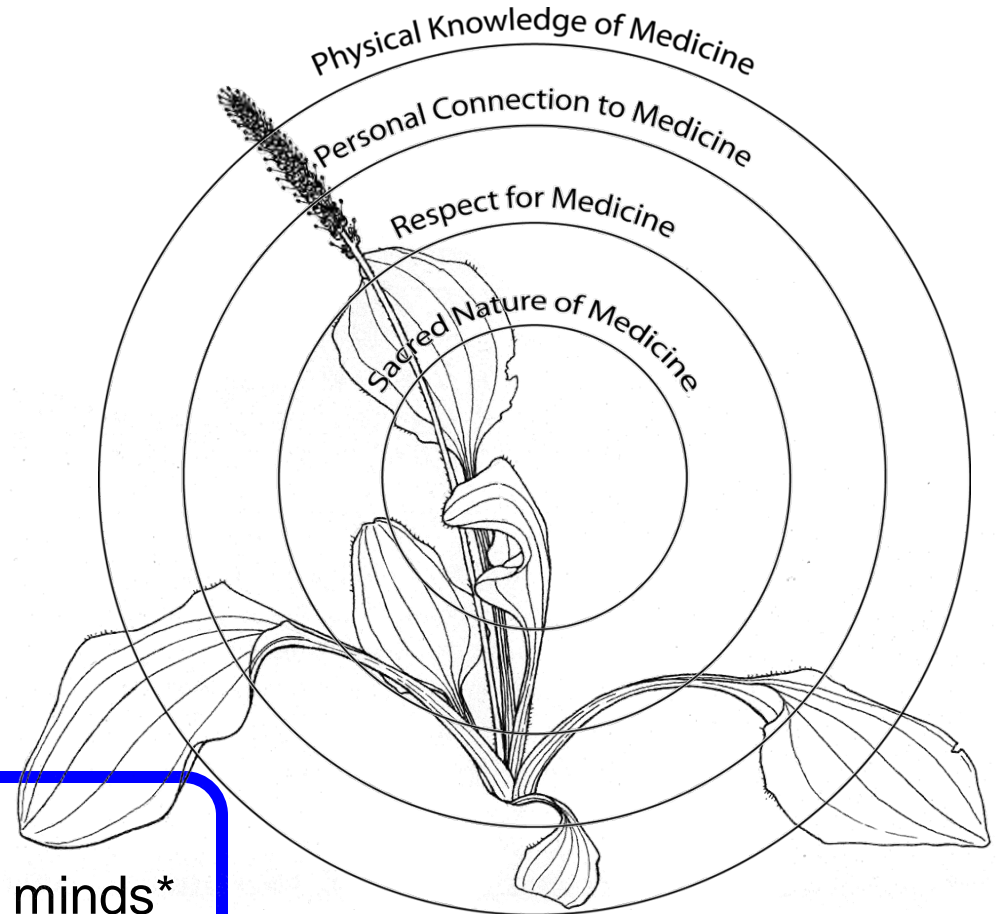
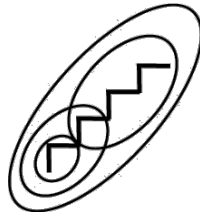
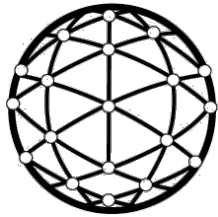
connectedness



disconnectedness

stories of our interactions with and within nature

**Science is
dynamic,
pattern-based
knowledge.**

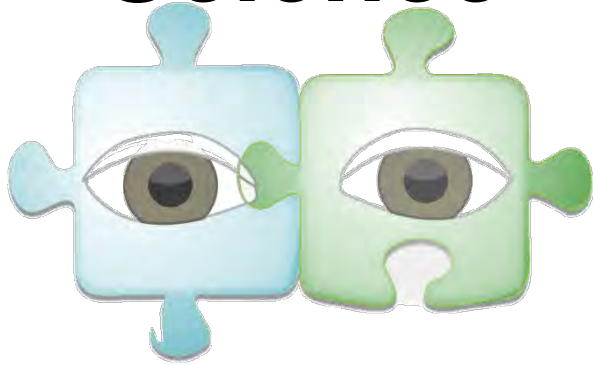


PATTERNS ...

- spirits within ecosystem-wide minds*
- ideas in brain-based minds

* Sheridan, J. and Longboat, D. 2006. The Haudenosaunee imagination and the ecology of the sacred. *Space and Culture* 9(4), 365-381.

Integrative Science



Pemi Pungek Mi'kma'ki

This poster is dedicated to all Mi'kmaq Elders.

This poster is one in a series made by the Institute for Integrative Science and Health at Cape Breton University and Mi'kmaq First Nations Elders of Cape Breton. Integrative Science brings together Indigenous and Western scientific knowledges and ways of knowing for science education.

This poster is called Pemi Pungek Mi'kma'ki, which means one continuous year in the Mi'kmaq traditional territory. On the outside, it shows the four seasons and the 12 months of the year. On the inside, it shows the land, water, and sky over a full year. The pictures of plants, animals, and weather show the order of changing events in nature. The pictures of people show when to do traditional and modern activities. Read this poster in a circle to see the cycle of the seasons. Spring is on the left, summer is on the bottom, fall is on the right, and winter is at the top.

University of
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CHR ISC

Mi'kmaq Debert

NSERC CSRG

CAPE BRETON UNIVERSITY

Canada Research Chairs / Chaires de recherche du Canada

Social Sciences and Humanities Research Council of Canada / Conseil de recherches en sciences humaines du Canada



Wela'ioq / Thank you



Mi'kmaq Elders

