

# SCIENCE as “dynamic pattern-based knowledge”:

including diverse cultures,  
engaging diverse learners



*National Planning Conference  
Ottawa, Ontario, 4-6 June 2008*

actüa

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Canada Research Chair in Integrative Science  
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Sydney, Nova Scotia

CAPE BRETON  
UNIVERSITY

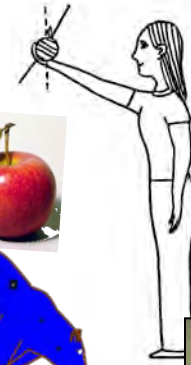
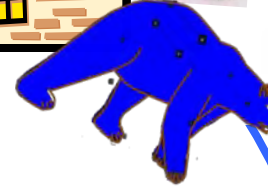
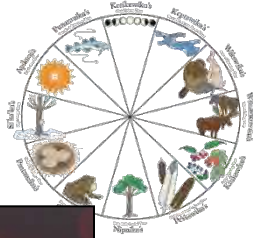


# ABSTRACT

## **Workshop/Presentation Outline:**

A view of science as “dynamic pattern-based knowledge about our interactions with and within nature” enables learner-friendly recognition and discussion of different cultures’ sciences and scientific ways of knowing. To facilitate understandings and applications of such a view, the presentation will outline human “pattern smarts” and then explore, via examples, a conceptual framework for “pattern recognition, transformation, and expression”. The presentation will emphasize the Western and Indigenous sciences. Recognizing the strengths in each and being able to use them together has come to be referred to as “Two-Eyed Seeing” by the small group of university scientists and First Nations’ Mi’kmaq Elders who have been involved in a co-learning journey in Cape Breton, Nova Scotia, for the past 12+ years. Key individuals in this group created and continue to nourish the “Integrative Science” initiative at Cape Breton University. Integrative Science brings together Indigenous and Western scientific knowledges and ways of knowing for the purposes of science education, research, applications, and outreach to youth and community.

# OUTLINE OF TALK



Pattern conceptual framework  
for exploring our sciences

Pattern smarts

Four Big Pictures  
for  
Two-Eyed Seeing

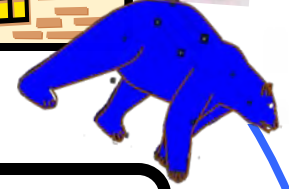
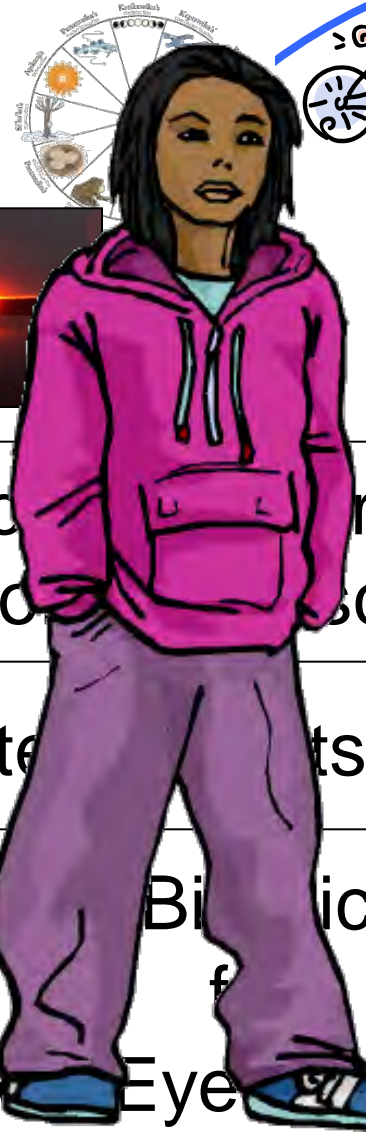
Science as  
“pattern stories”

**Integrative Science**  
within an ongoing  
Co-Learning Journey

Conclusion

Introduction

# OUTLINE OF TALK



## CURIOSITY

- confidence
- creativity
- critical thinking

actüa

Conclusion

Introduction

Active Science

in an ongoing Learning Journey

Science as “pattern stories”

Pattern co... for explor...

Patte... ts

R... Bi... pictures

T... Eye... eing

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

Canada Foundation for Innovation / Fondation canadienne pour l'innovation

CAPE BRETON UNIVERSITY

Merrim Theatre of Nova Scotia

Membertou Elementary

CIHR IRSC / Canadian Institutes of Health Research / Instituts de recherche en santé du Canada

Mi'kmaq College Institute / Mi'kmaq Espi Kina'matno'kuom

INSTITUTE FOR INTEGRATIVE SCIENCE & HEALTH

IWK Health Centre Foundation

IAPH

ATLANTIC ABORIGINAL Health Research Program

Mi'kmaq Elders

NOVA SCOTIA Health Research FOUNDATION

SABLE OFFSHORE ENERGY INCORPORATED

UNAMA'KI INSTITUTE OF NATURAL RESOURCES

KECCA / Knowledge: Education and Cultural Consultant Associates

NSERC CRSNG

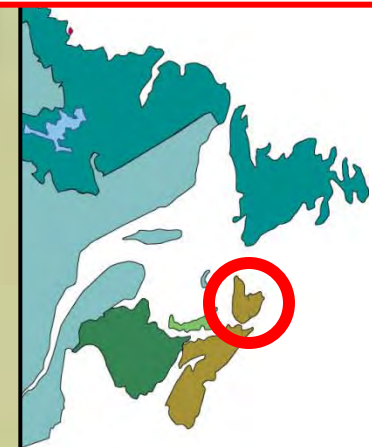
Mi'kmawey Debert

Eskasoni Detachment / Royal Canadian Mounted Police / Gendarmerie royale du Canada



# CAPE BRETON UNIVERSITY

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

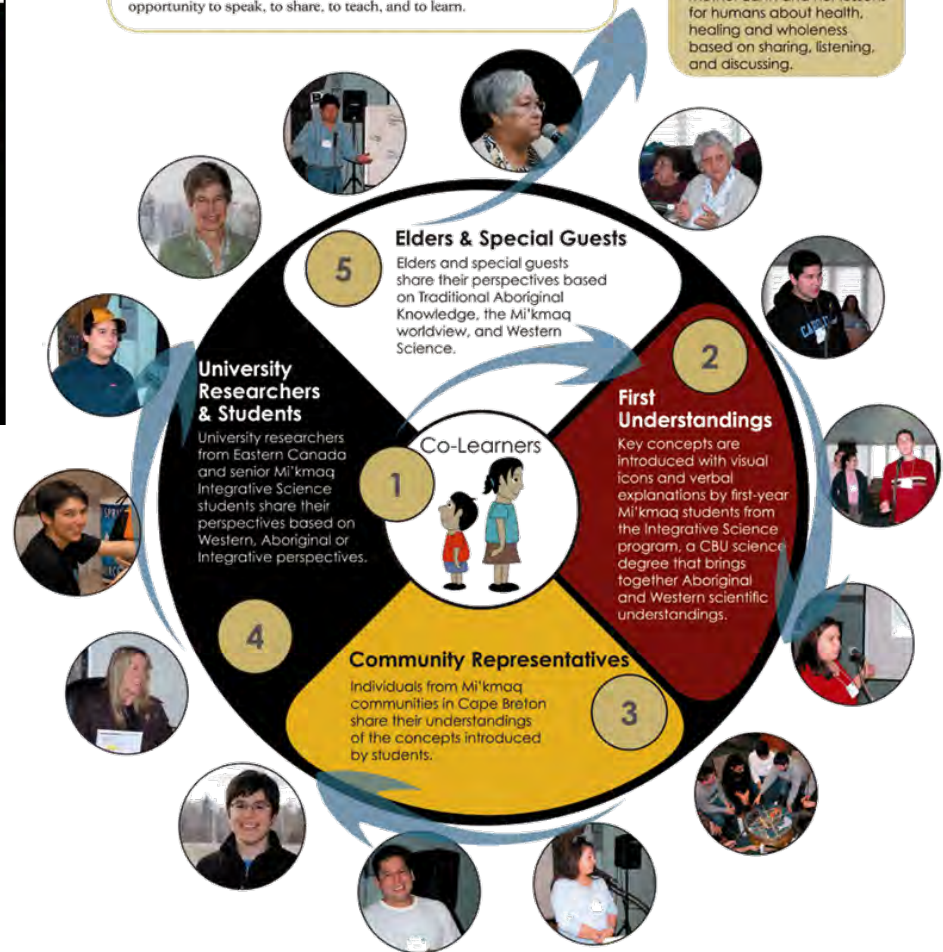


# Integrative Science: a Journey of Co-Learning



**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.

**6**  
 Each participant gains some new understandings of Mother Earth and her lessons for humans about health, healing and wholeness based on sharing, listening, and discussing.





**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**

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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**

# Some key LESSONS LEARNED over 12+ years of working together

**Acknowledge: it is a co-learning journey  
and we need to learn to ...**

- do in a *creative grow forward* manner
- think *knowledge gardening* more than knowledge translation or knowledge transfer
- **weave** back and forth between our knowledges, our world views, our stories
- **weave** via awareness of **BIG PICTURE** understandings (knowledge orientations or maps)
- make our knowledges, i.e. our stories, **visual**



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



# Science?

(what and variations)



Artist: Basma Kavanagh



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



stories of our interactions with and within nature

photo credit: NRC



# Western Science

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									
		89 La Lanthanum	90 Ce Cerium	91 Pr Praseodymium	92 Nd Neodymium	93 Pm Promethium	94 Sm Samarium										
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photo credit: NRC



# Western Science

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# Indigenous Science



Life  
Love  
Land

Language



images from: Aboriginal organizations/artists, various sources

# Indigenous Science



Life  
Love  
Land  
Language

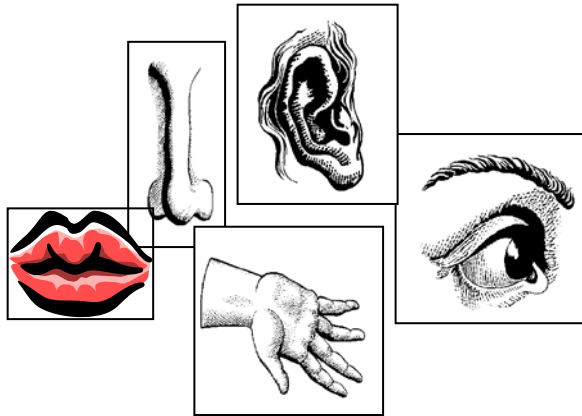
images from: Aboriginal organizations/artists, various sources



# Science?

(as cultural stories)

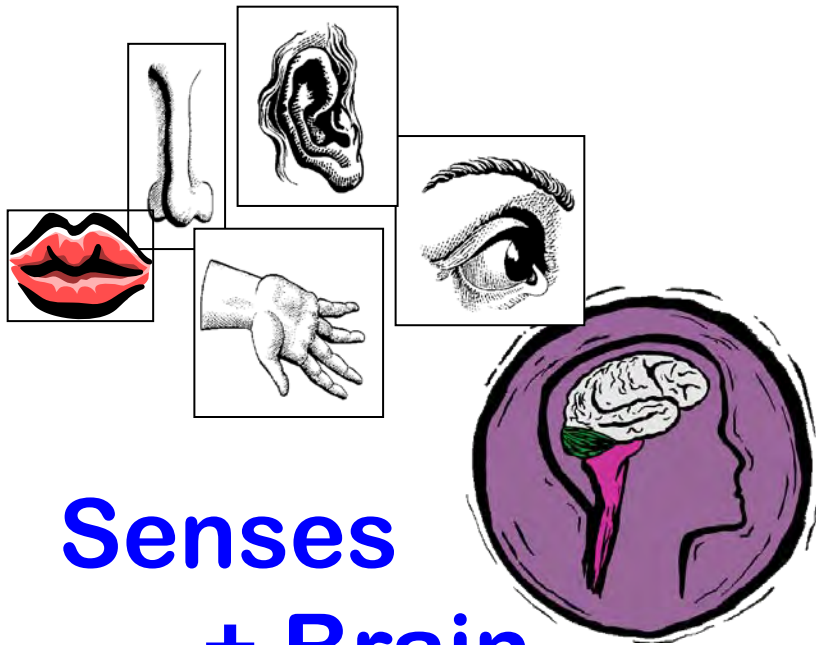
Artist: Basma Kavanagh



# Senses



Artist: Basma Kavanagh



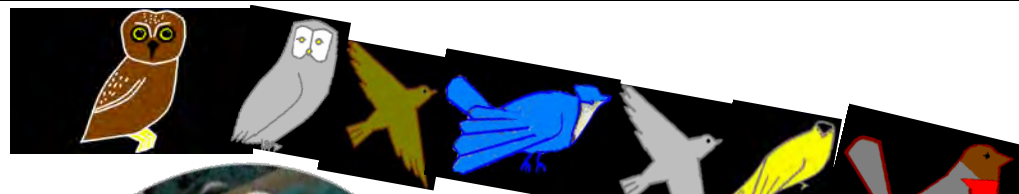
**Senses  
+ Brain**

**= Patterns**





Artist: Basma Kavanagh

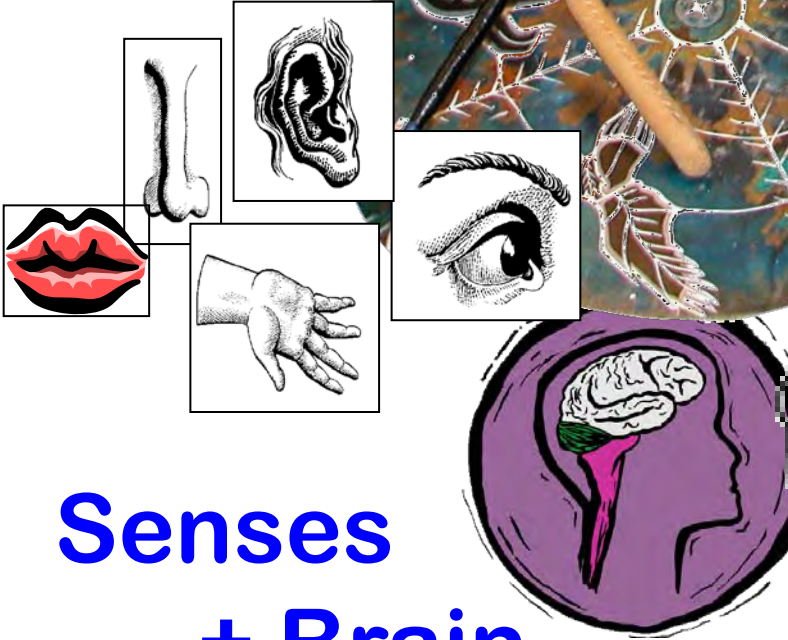


**Senses  
+ Brain  
+ Mind**

**= Patterns → Stories**

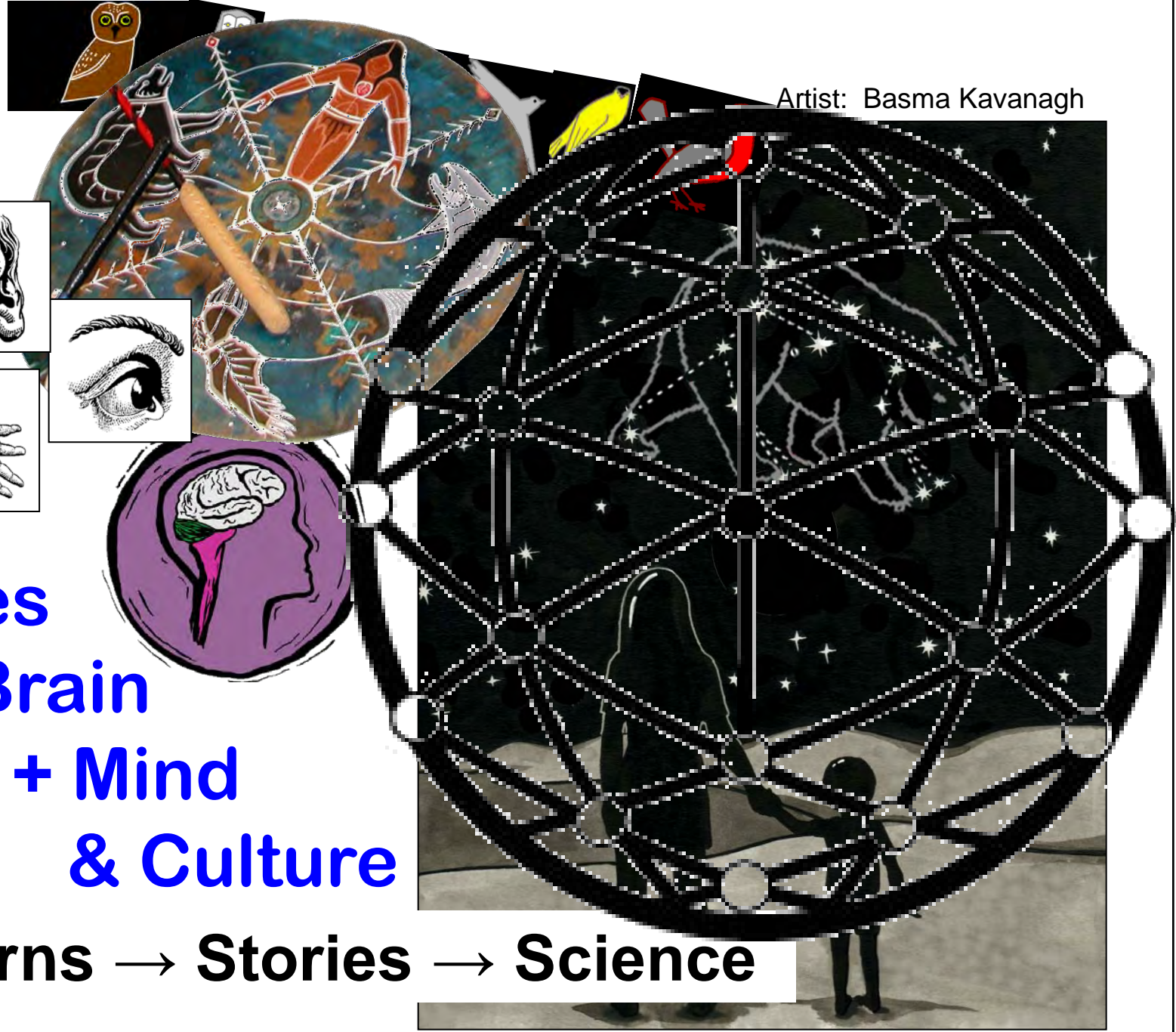


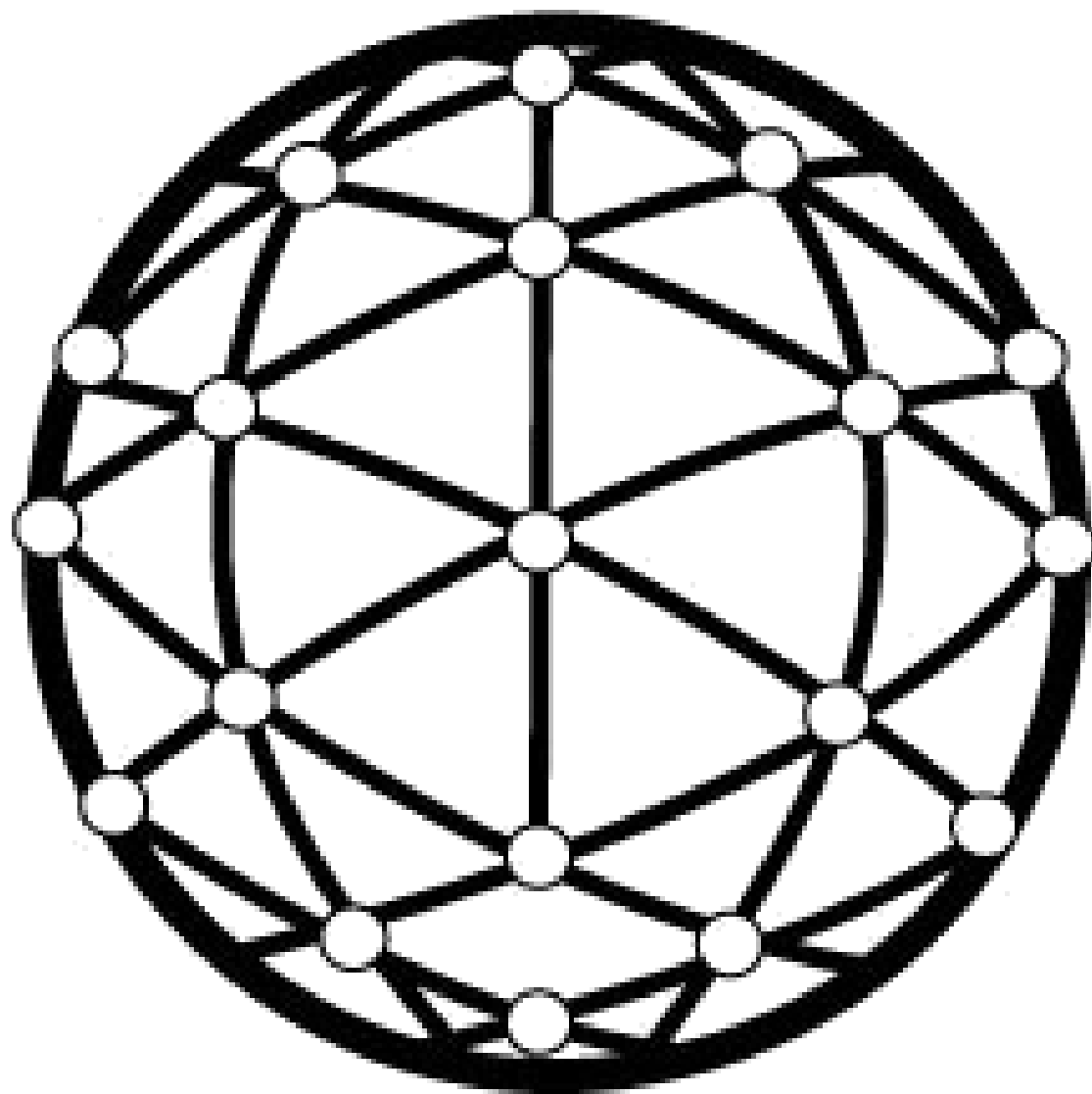
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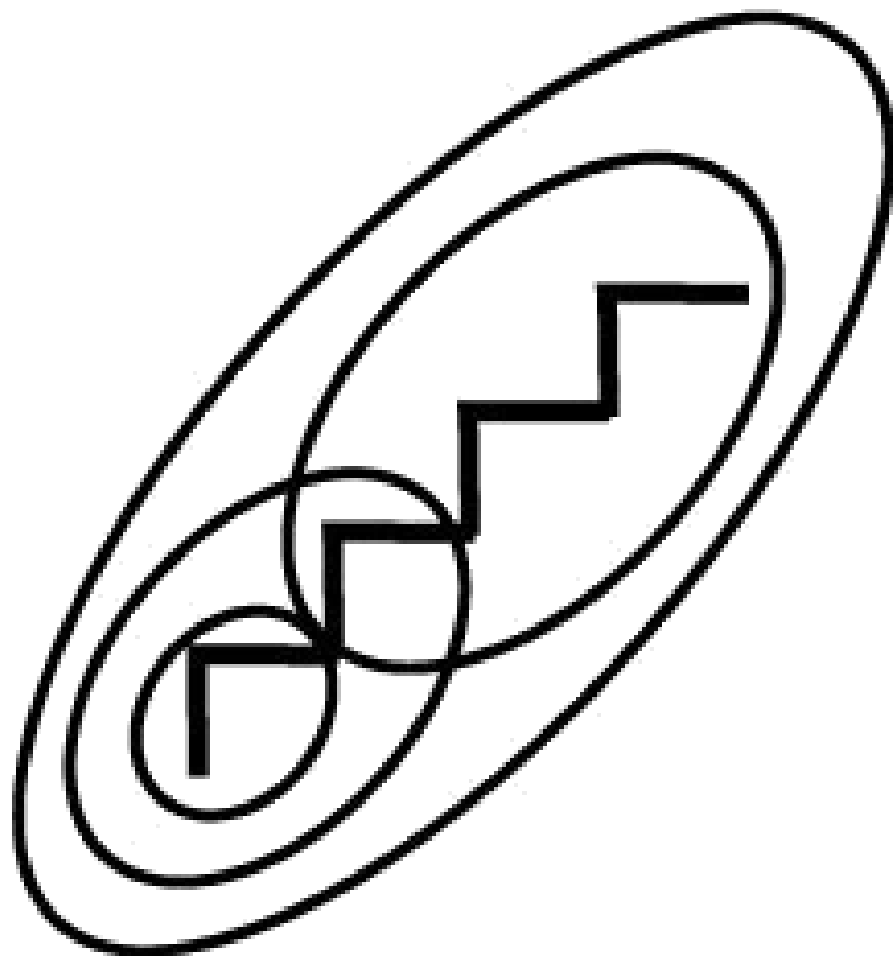


**Senses  
+ Brain  
+ Mind  
& Culture**

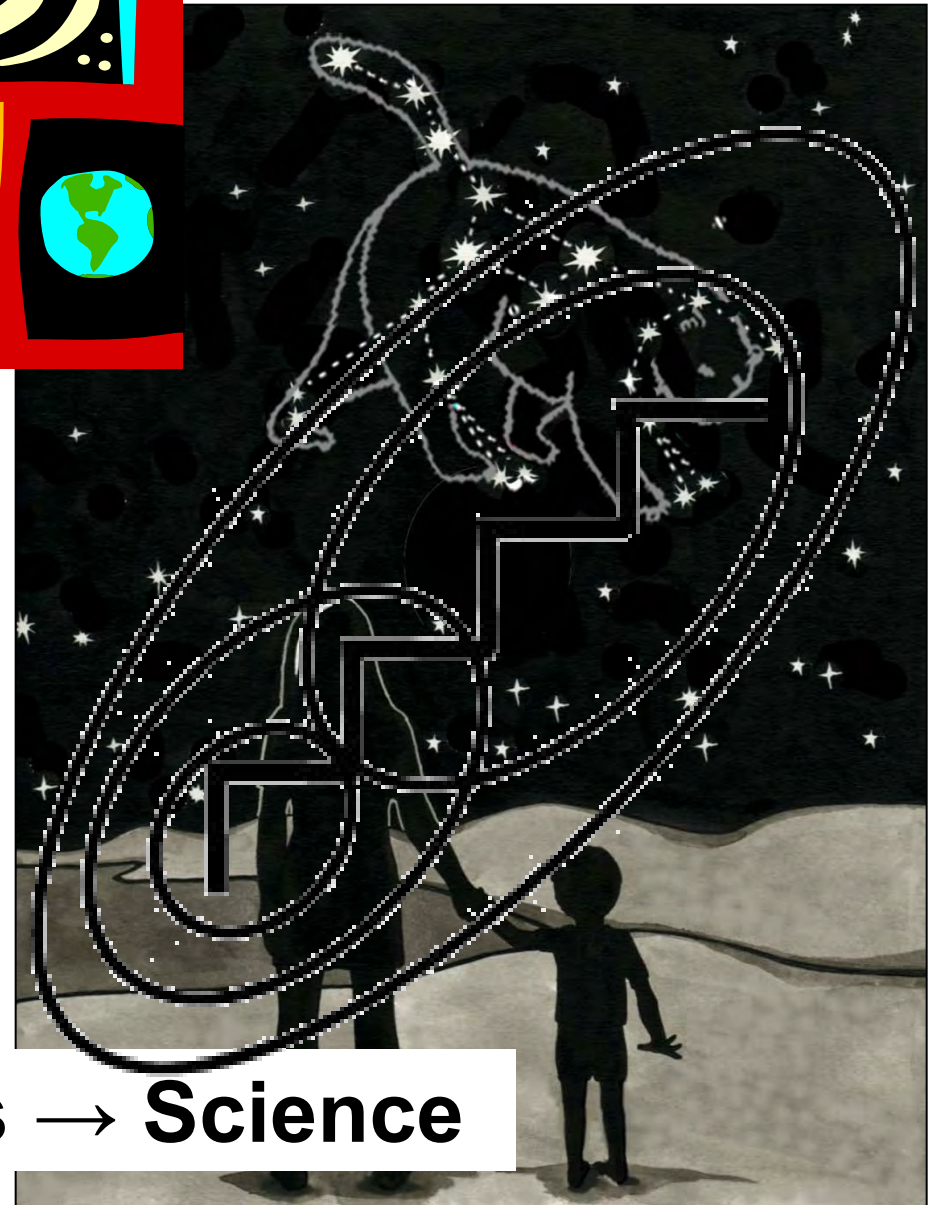
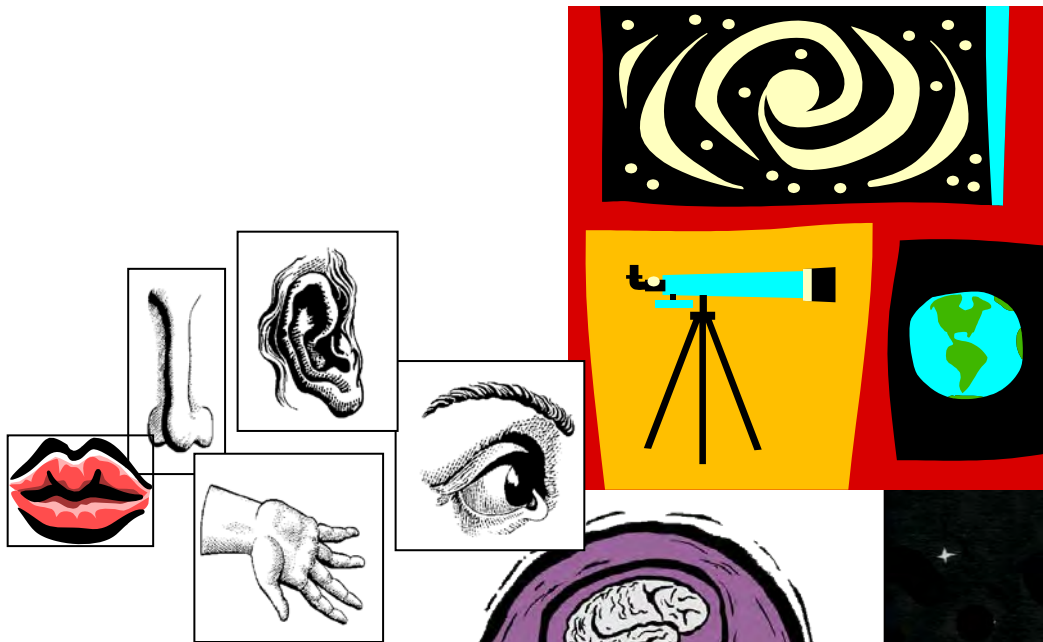
**= Patterns → Stories → Science**





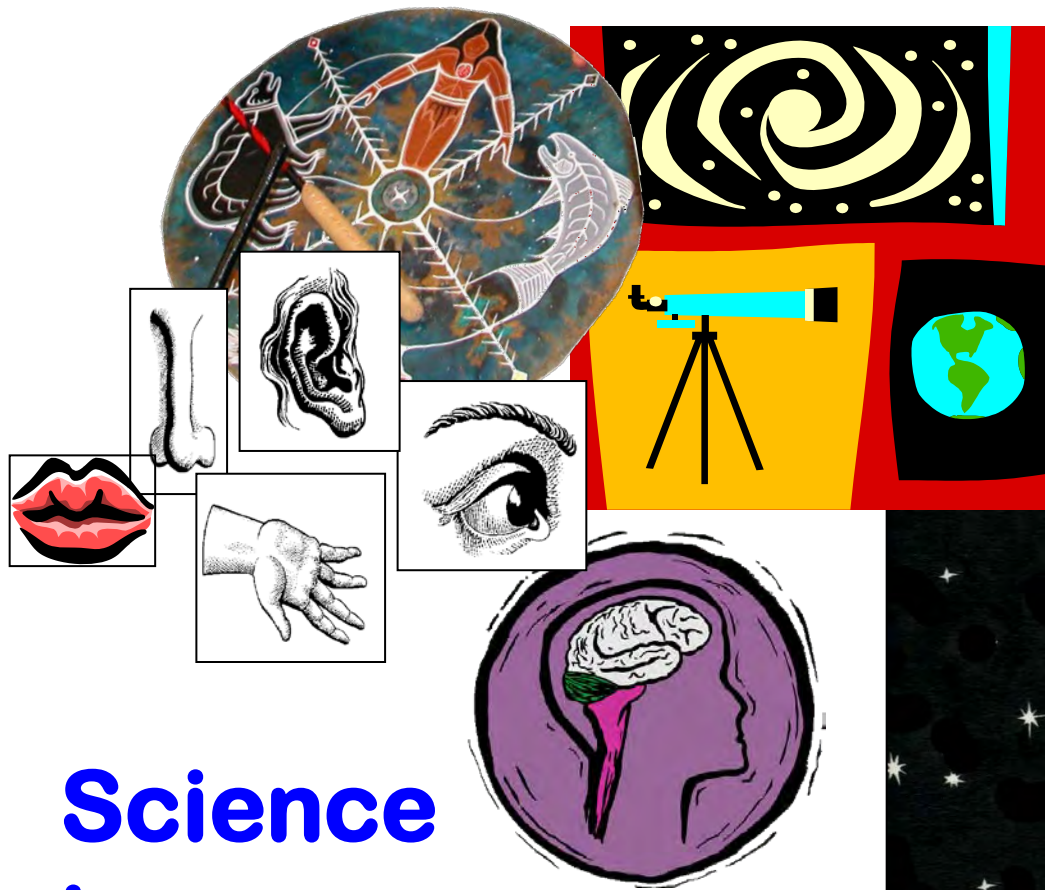


Artist: Basma Kavanagh



**Senses  
+ Brain  
+ Mind  
& Culture  
= Patterns → Stories → Science**

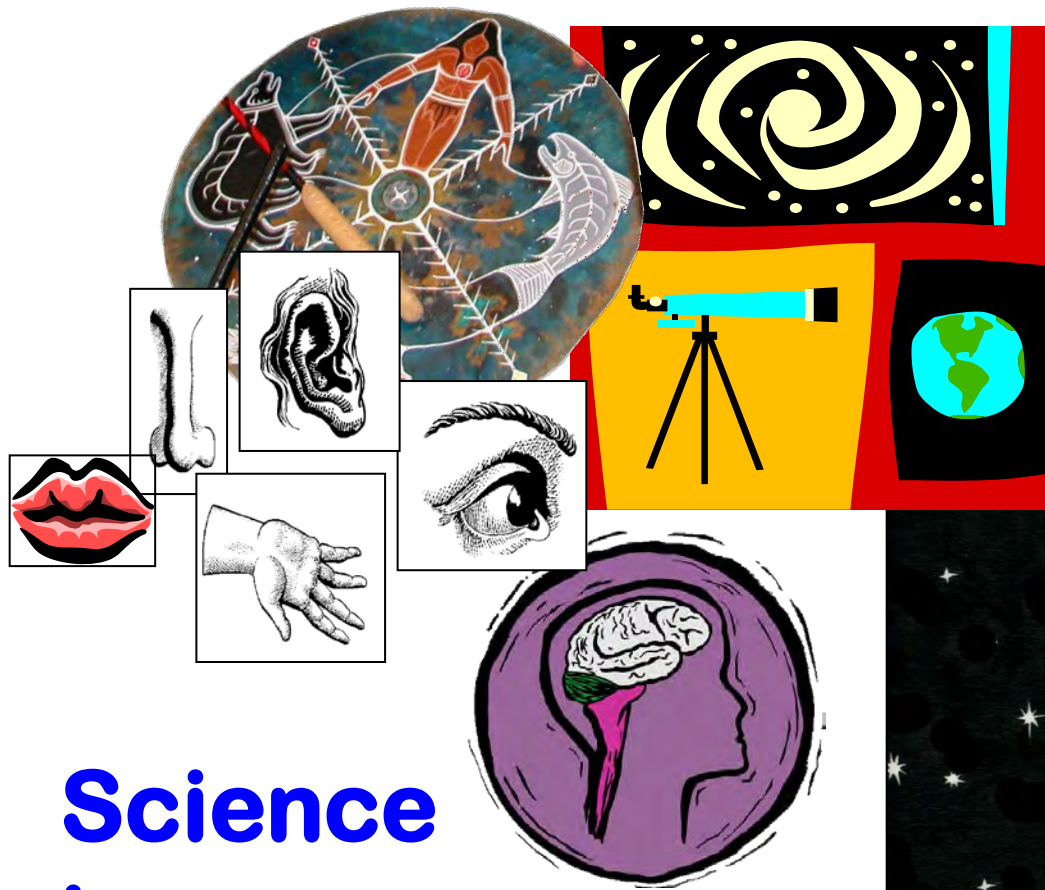
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**Science  
is  
dynamic,  
pattern-based  
knowledge.**



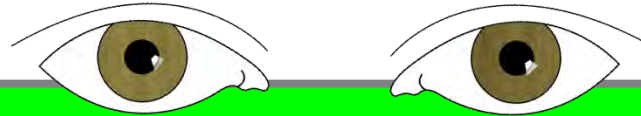
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**Science  
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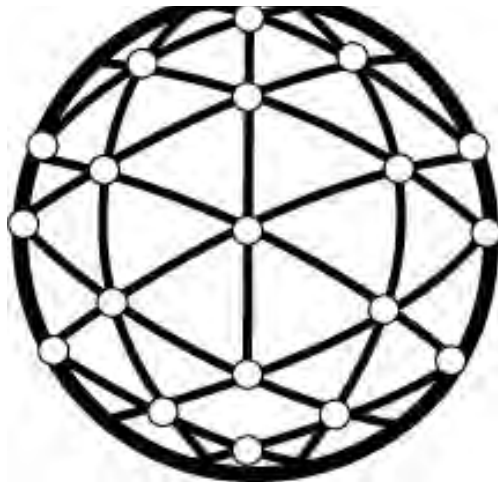
**stories of our interactions with and within nature**

how we see “relational assemblages”  
(stories, things, places)

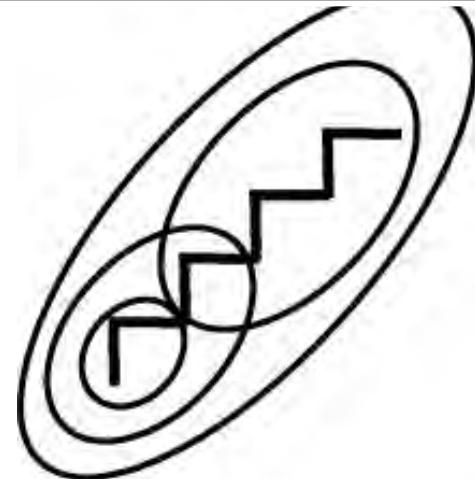


# NATURAL WORLD

**interconnective**



**parts & wholes**





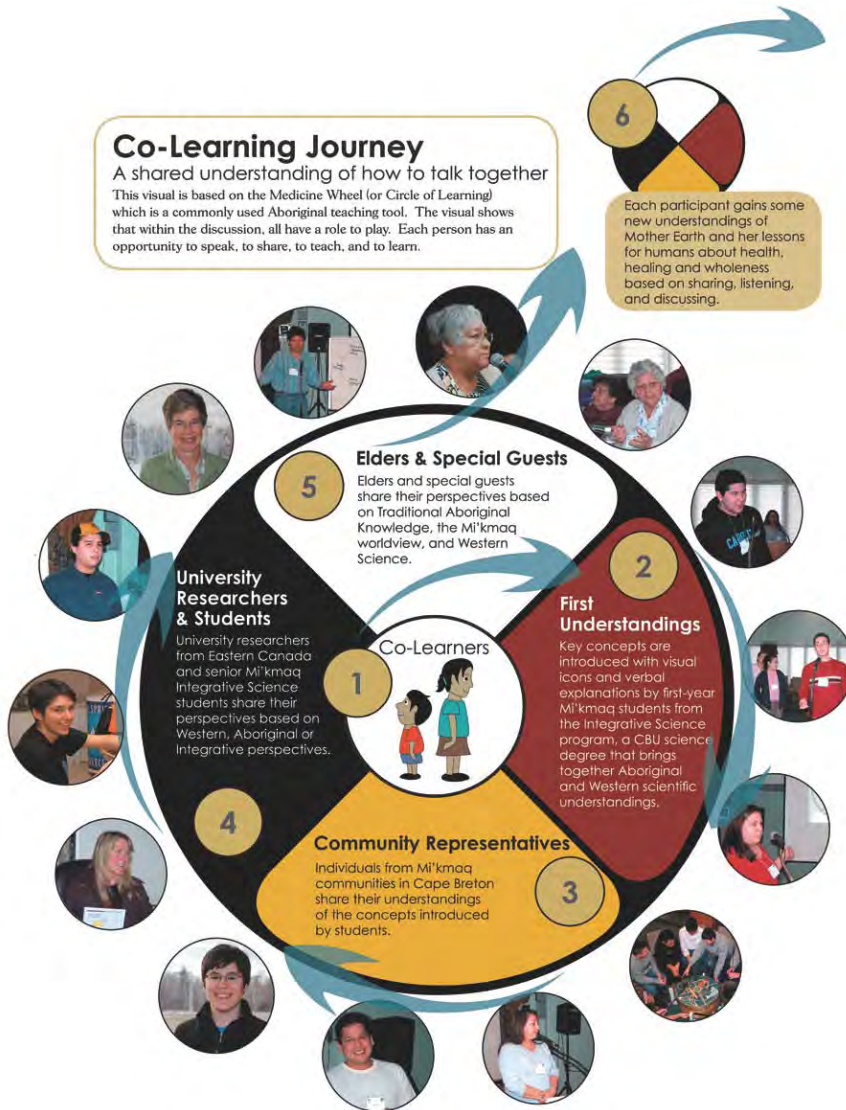
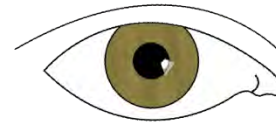
# Integrative Science ... a Journey of Co-Learning and Two-Eyed Seeing

## 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.



Each participant gains some new understandings of Mother Earth and her lessons for humans about health, healing and wholeness based on sharing, listening, and discussing.



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

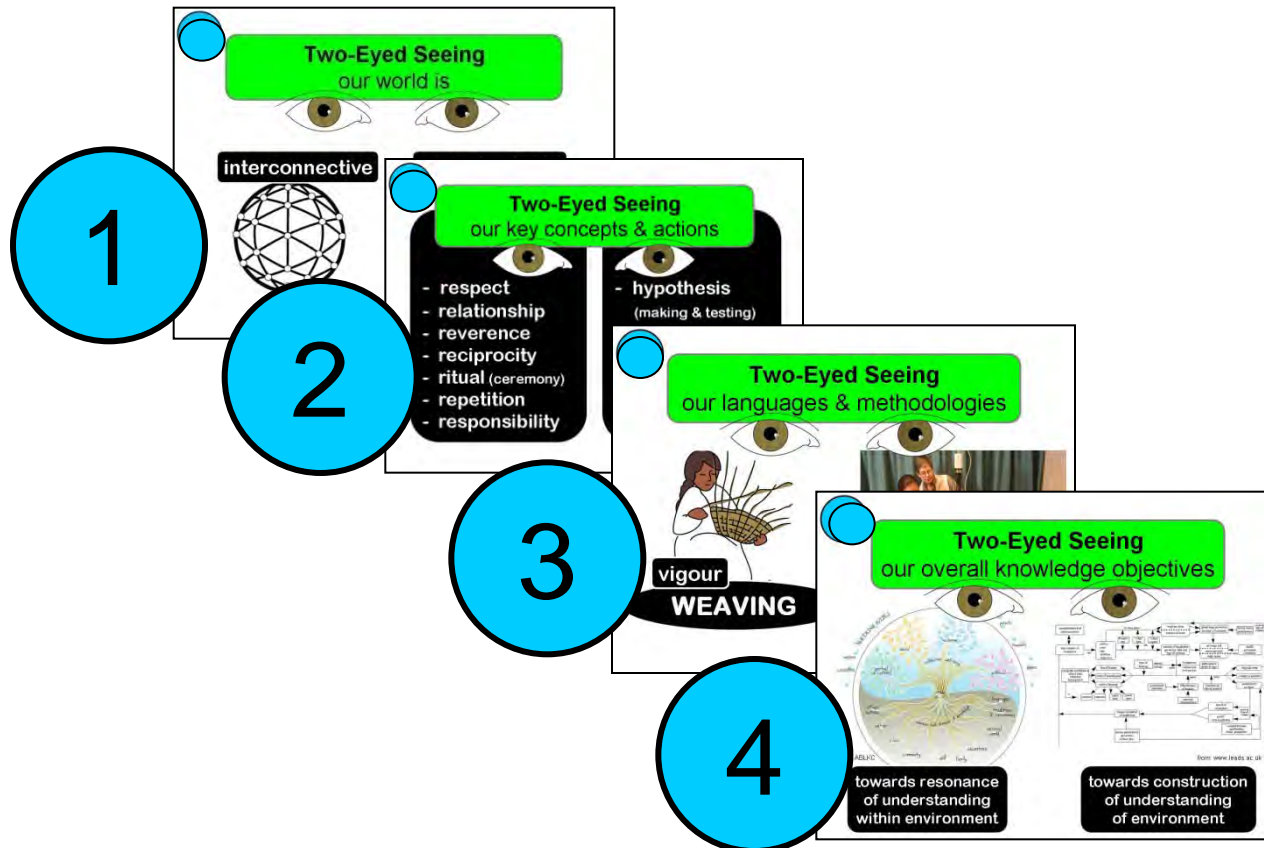


Mr. Albert Marshall, Mi'kmaq Elder  
Eskasoni First Nation

# “Two-Eyed Seeing”

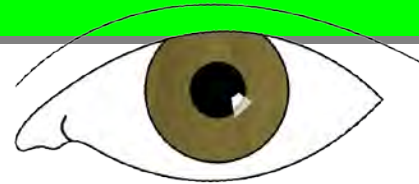
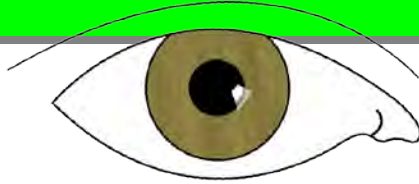
learning to see with the strengths of each & together

## FOUR “BIG PICTURE” UNDERSTANDINGS

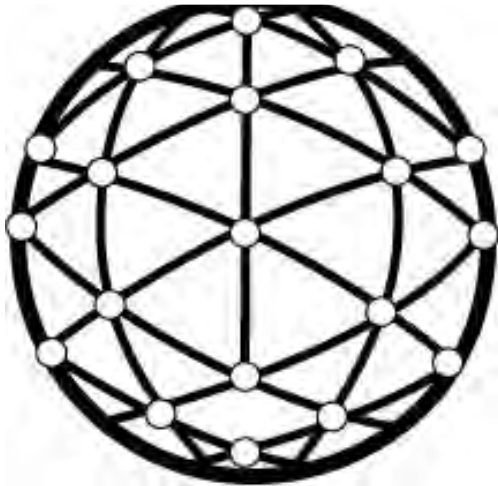


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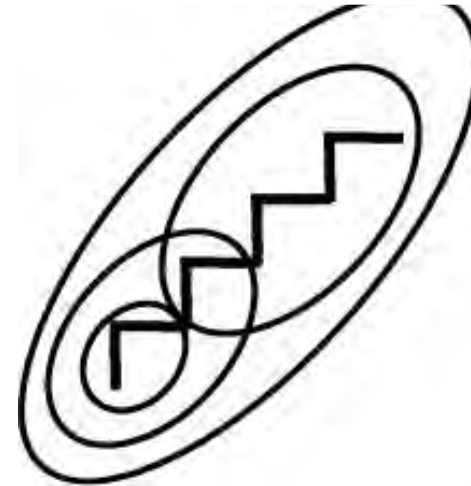
# Two-Eyed Seeing our world



**interconnective**



**parts & wholes**



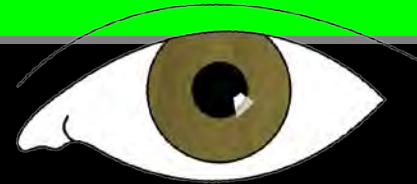
2

## 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

3

# Two-Eyed Seeing our languages & methodologies



Life  
Love  
Land

Math  
&  
Instruments

vigour

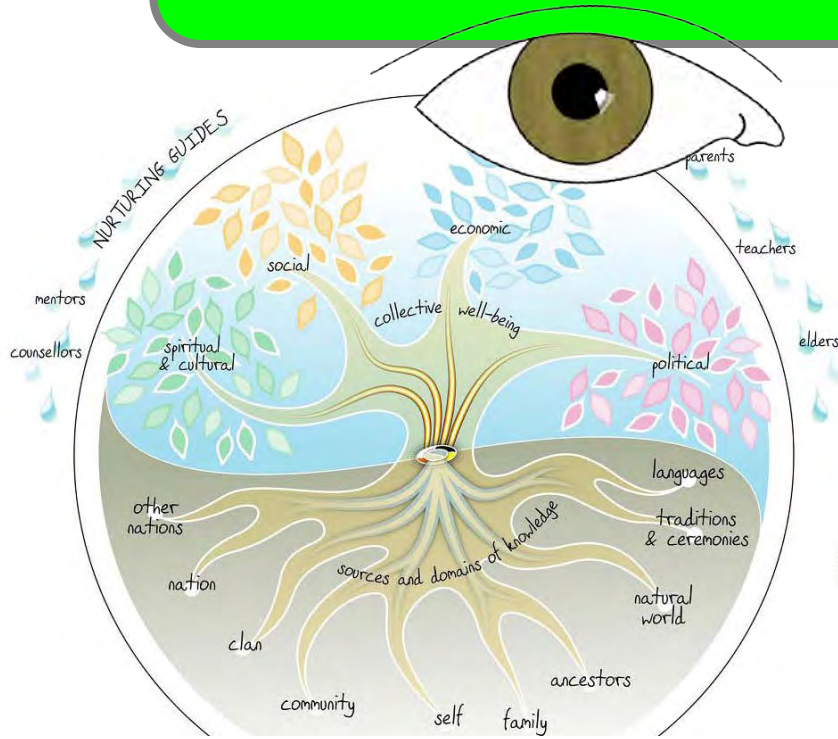
rigour

**WEAVING**

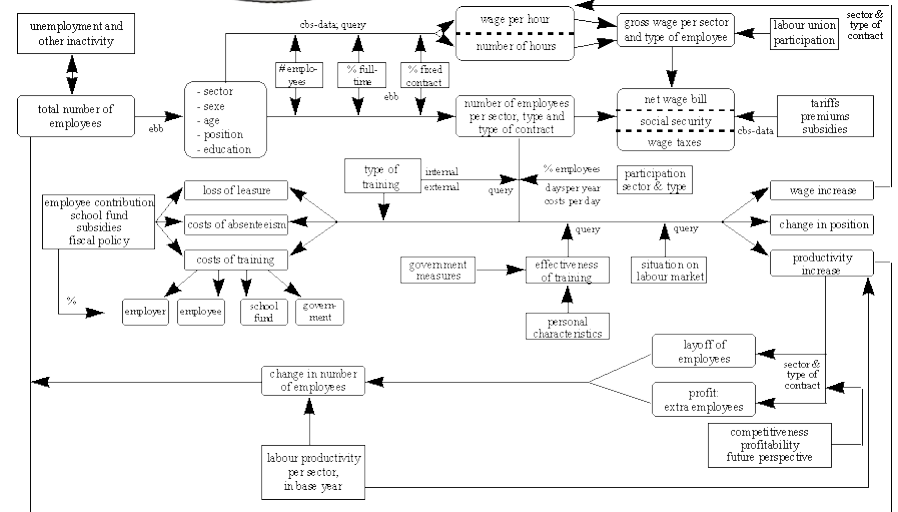
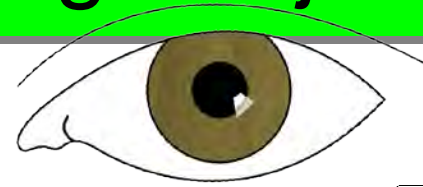
**UN-WEAVING**

4

# Two-Eyed Seeing our overall knowledge objectives



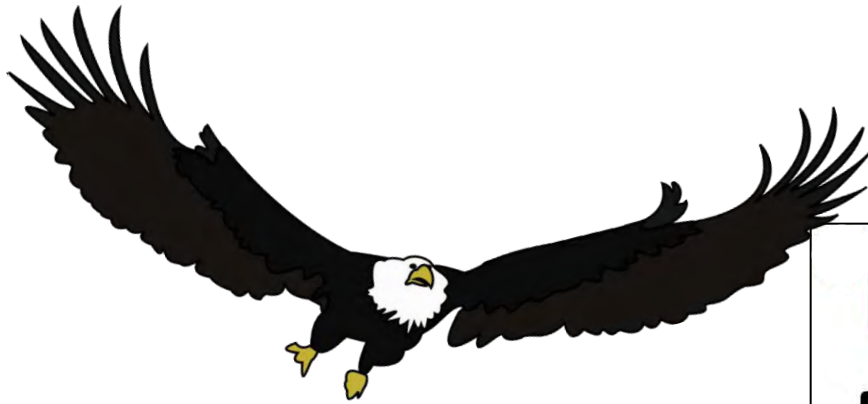
from: CCL Aboriginal Learning Knowledge Centre ([www.ccl-cca.ca/CCL](http://www.ccl-cca.ca/CCL))



from: [www.leads.ac.uk](http://www.leads.ac.uk)

**towards resonance  
of understanding  
within environment**

**towards construction  
of understanding  
of environment**



# Four Big Pictures for Two-Eyed Seeing

**Two-Eyed Seeing**  
our world is

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

- respect
- relative
- reciprocal
- ritual
- respectful
- responsive

- hypothesis

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

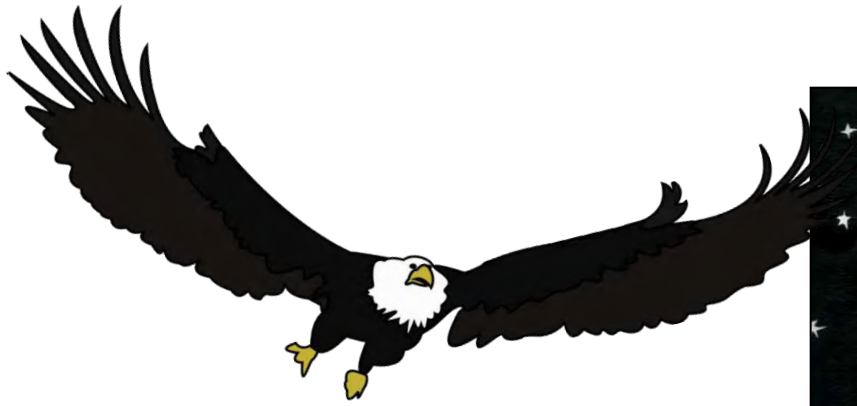
**Two-Eyed Seeing**  
our overall knowledge objectives

towards resonance of understanding within environment

towards construction of understanding of environment

stories of our interactions with and within nature





Artist: Basma Kavanagh

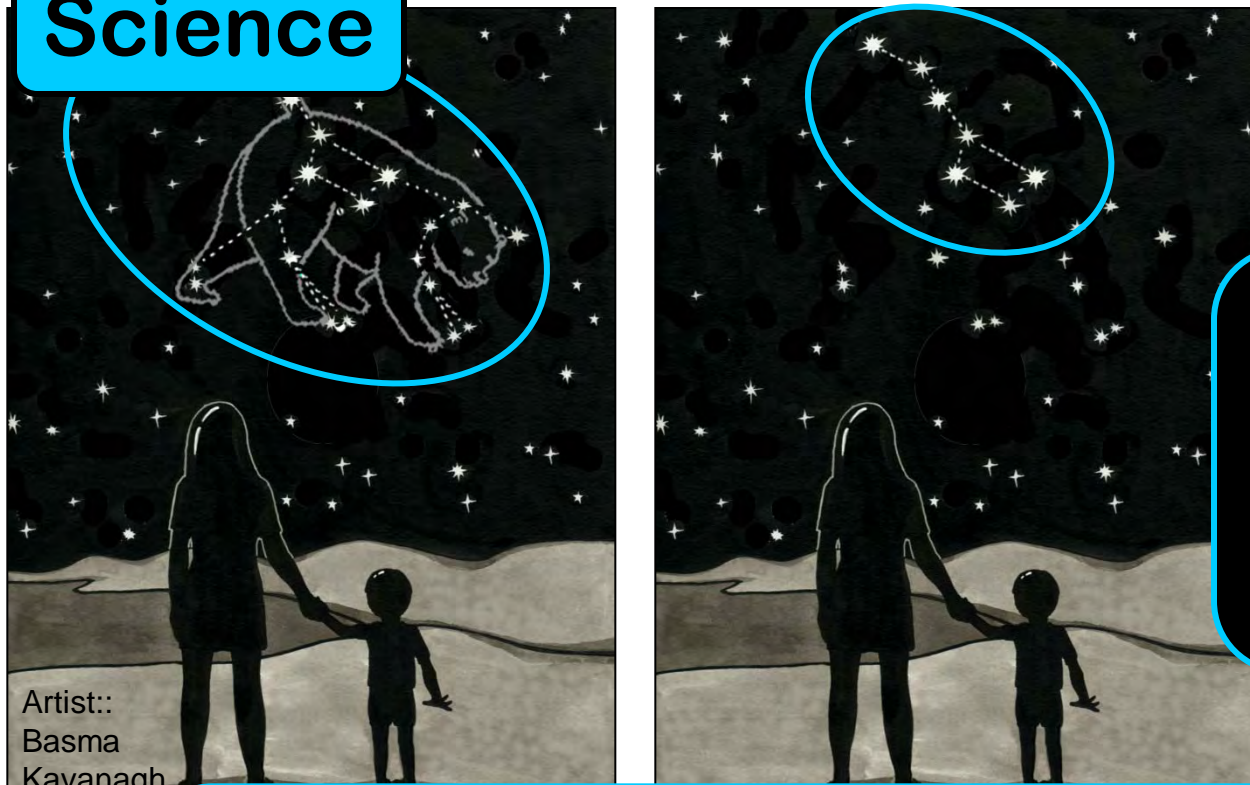
Science is  
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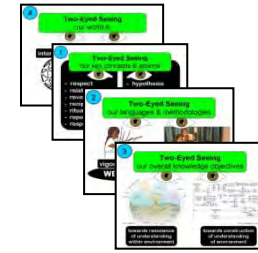
stories of our interactions with and within nature

# stories of our interactions with and within nature

## Science



Artist:  
Basma  
Kavanagh

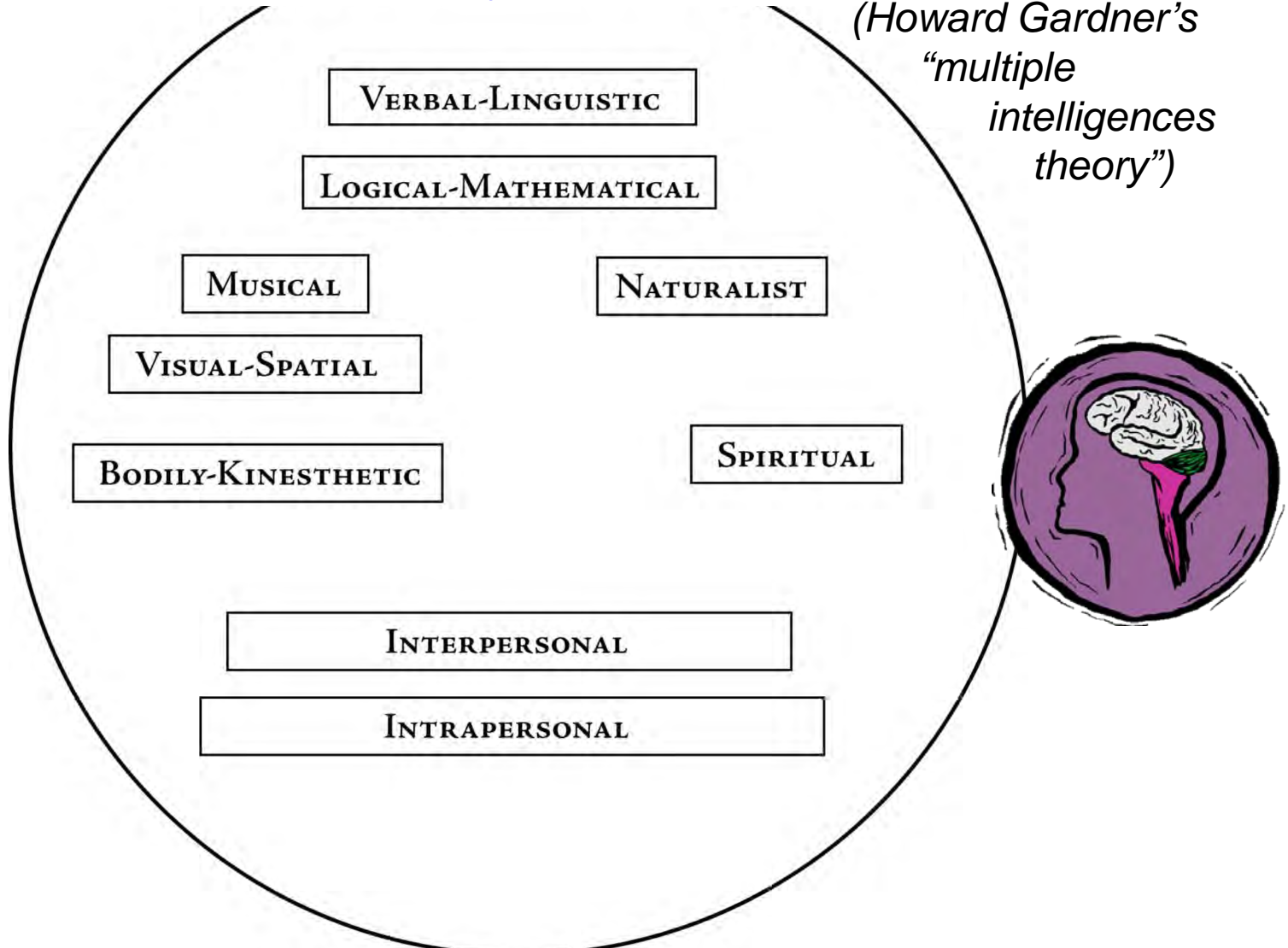
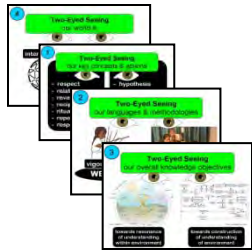


the patterns  
that we see  
within nature  
reflect our ...

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

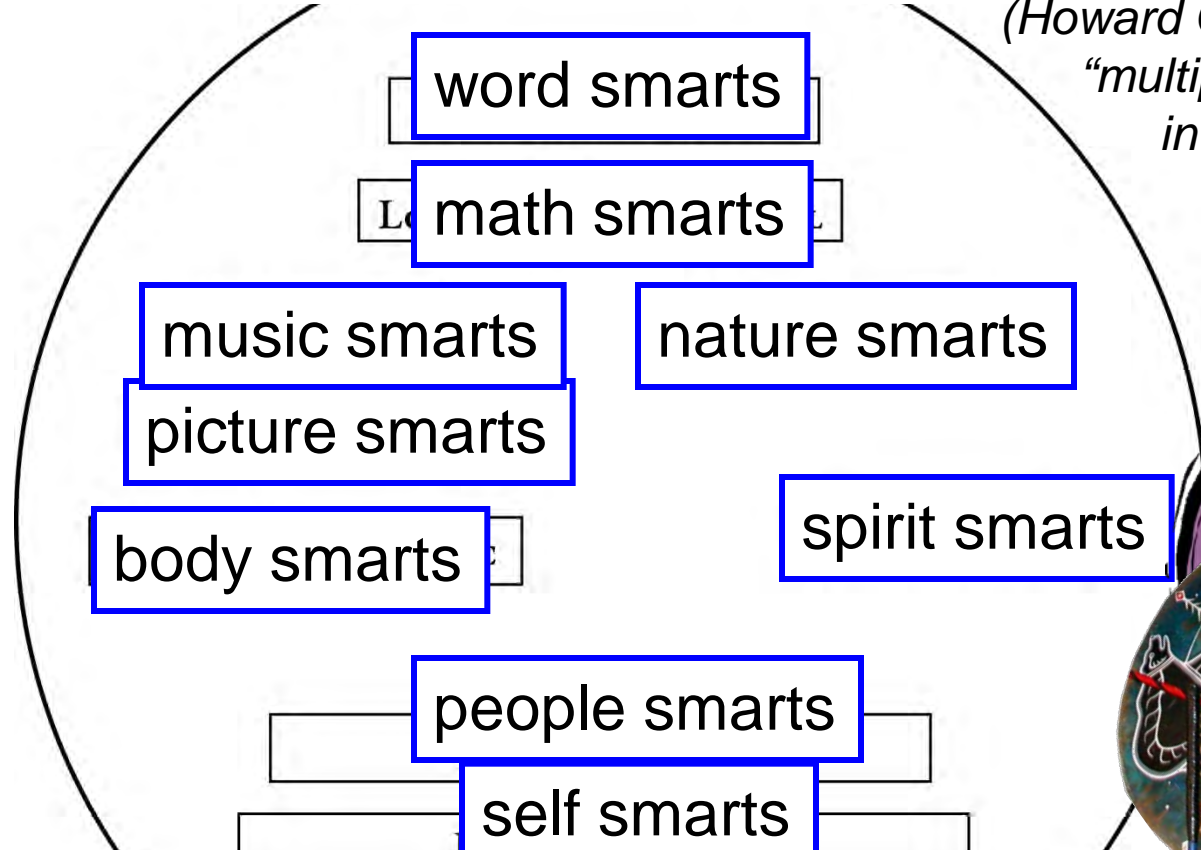
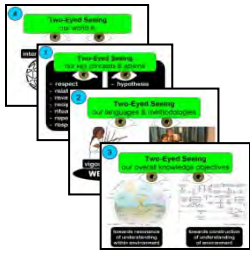
# our science stories ... draw upon our **“pattern smarts”**

(Howard Gardner’s  
“multiple  
intelligences  
theory”)



# our science stories ... draw upon our "pattern smarts"

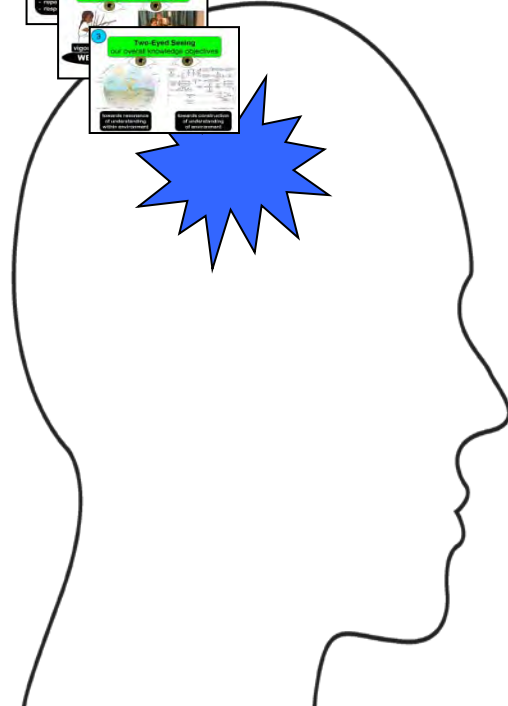
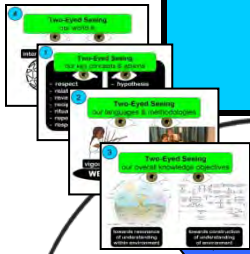
(Howard Gardner's  
"multiple  
intelligences  
theory")



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

**“pattern smarts”**

**sanctioned world views, methodologies,  
perspectives, and intelligences**

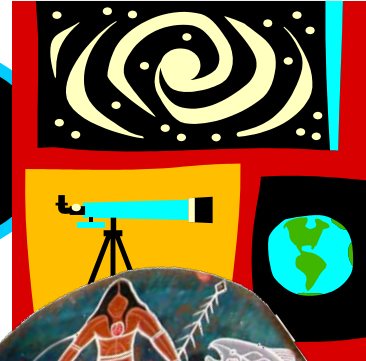


**KNOW**

**VALUE**

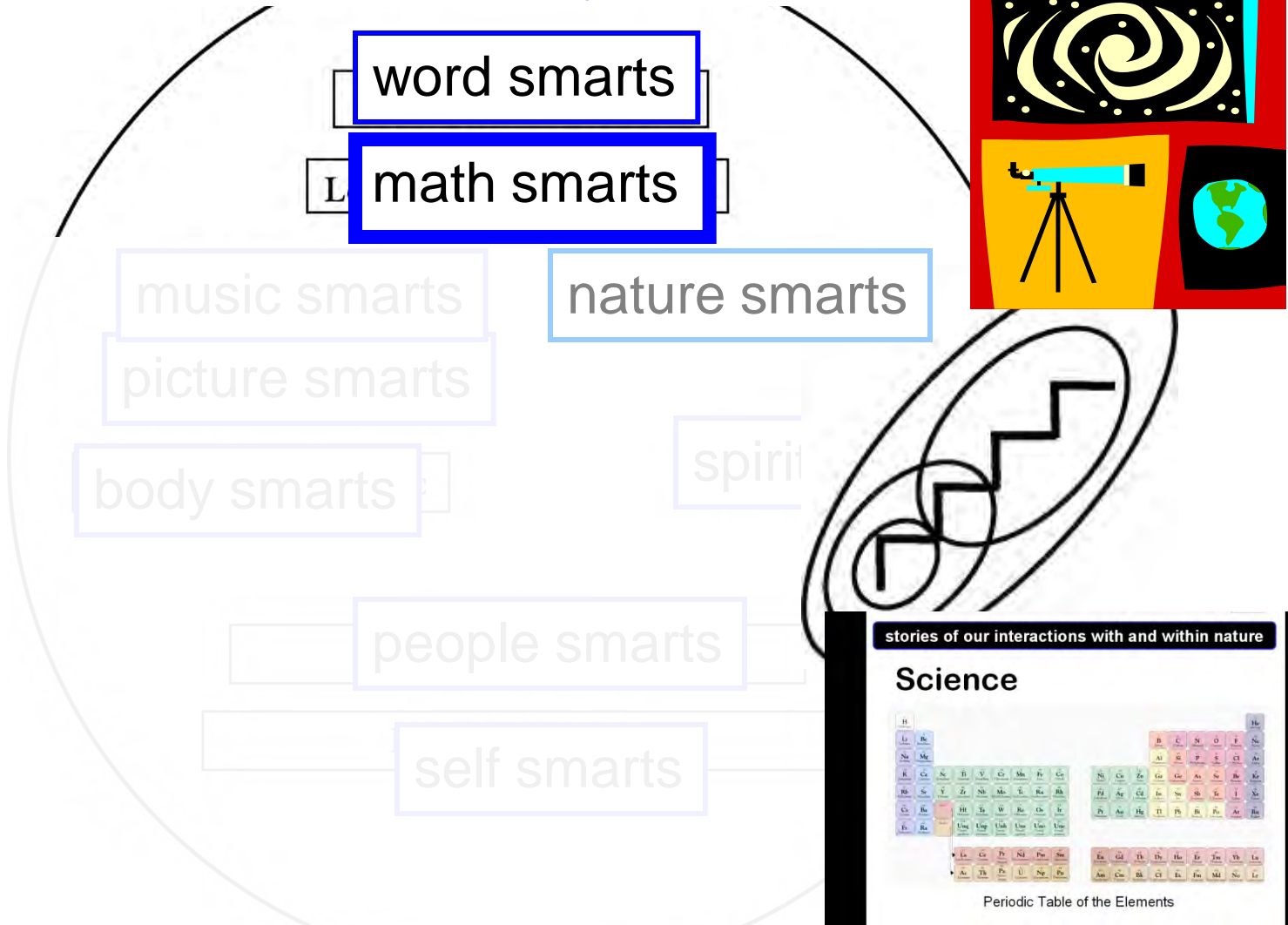
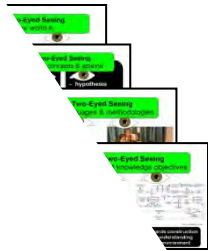
**DO**

**multiple intelligences**

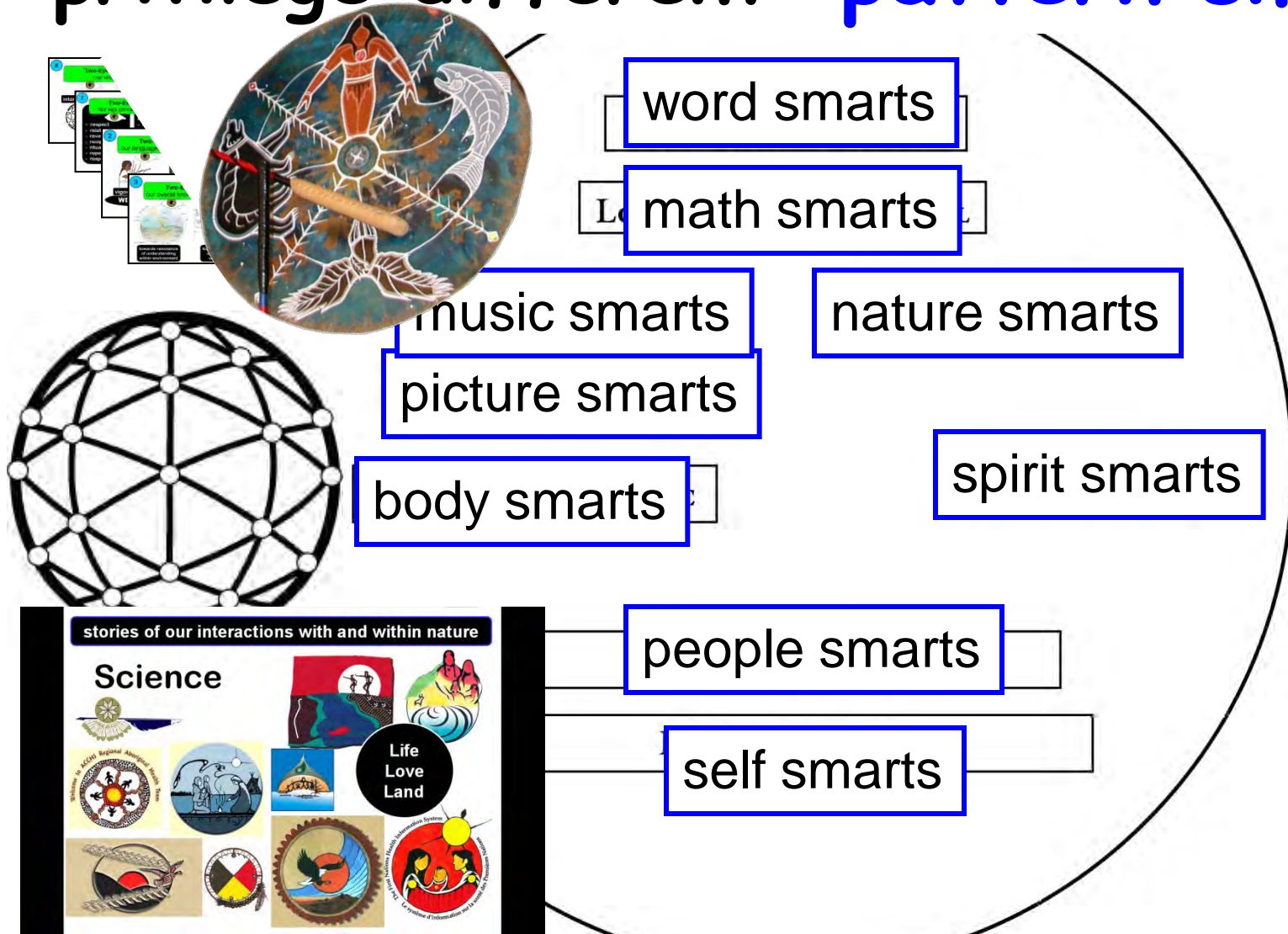


**SANCTIONED PERSPECTIVES & INTELLIGENCES:**  
who we are; where we are; where we were;  
what we know, do and value

# our different science stories ... privilege different "pattern smarts"



# our different science stories ... privilege different "pattern smarts"



word smarts

math smarts

music smarts

nature smarts

picture smarts

body smarts

spirit smarts

people smarts

self smarts

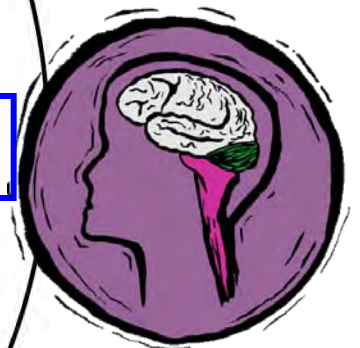
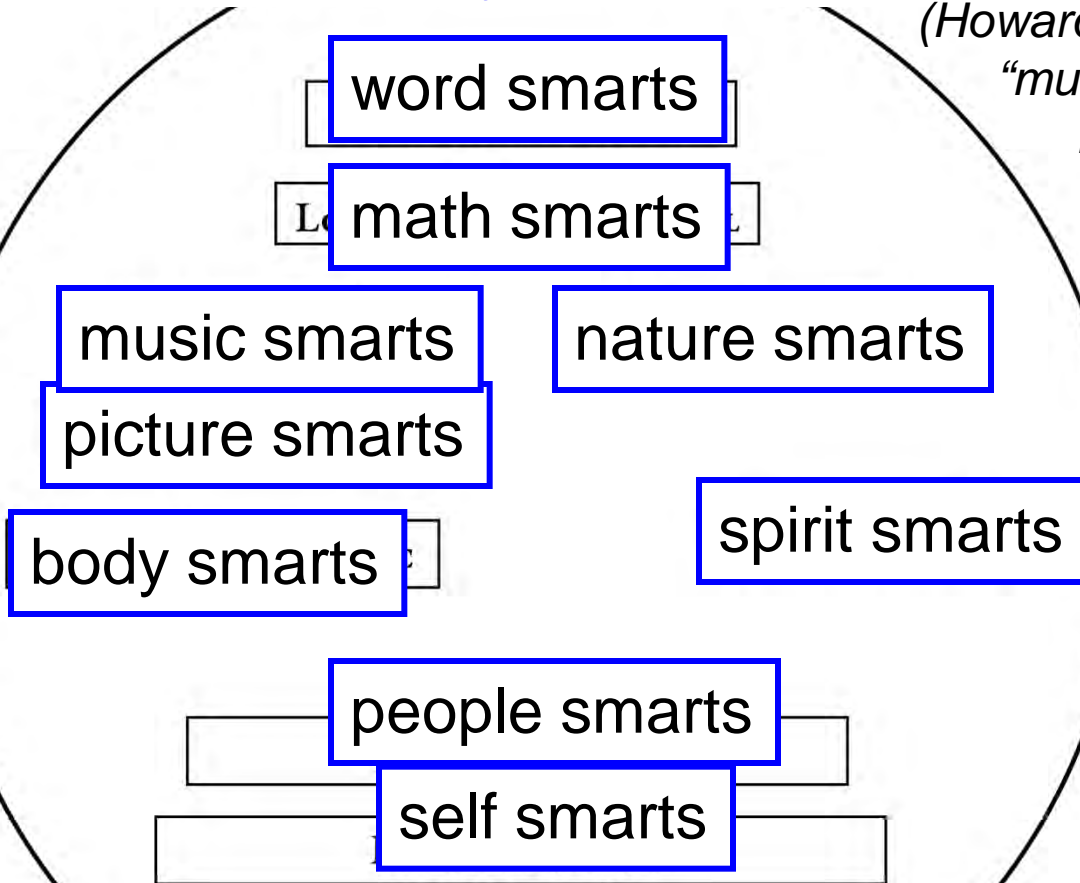
stories of our interactions with and within nature

Science

Life Love Land

# LEARNING & DOING SCIENCE ... using ALL our "pattern smarts"

(Howard Gardner's  
"multiple  
intelligences  
theory")





# PATTERN

## Sherman's Lagoon

OKAY, WE'RE HERE AT THE MALL. WHERE'S THIS WATCH YOU WANT TO BUY?

PATIENCE. PATIENCE.

<http://www.shermanslagoon.com>

ONE DOESN'T JUST RUSH INTO THE MALL FOR A QUICK ITEM AND LEAVE. IT'S NOT A CONVENIENCE STORE.

ONE MUST TAKE IT ALL IN. MEASURE THE VIBE. SOAK UP THE AMBIENCE. FIND PATTERNS AND IDENTIFY THE DISTURBANCES.

© 2008 Jim Toomey. Dist. by King Features Syndicate, Inc.

TRANSLATION?

YOU'RE HERE ALL DAY, PAL.



# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

natural

ideal

abstract



# PATTERN CONCEPTUAL FRAMEWORK

outer

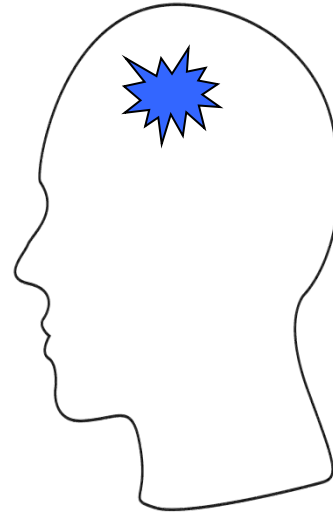
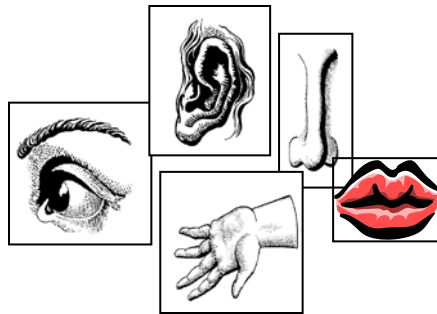
inner

outer

natural

ideal

abstract



recognize  
pattern

transform  
pattern

express  
pattern

# PATTERN CONCEPTUAL FRAMEWORK

outer

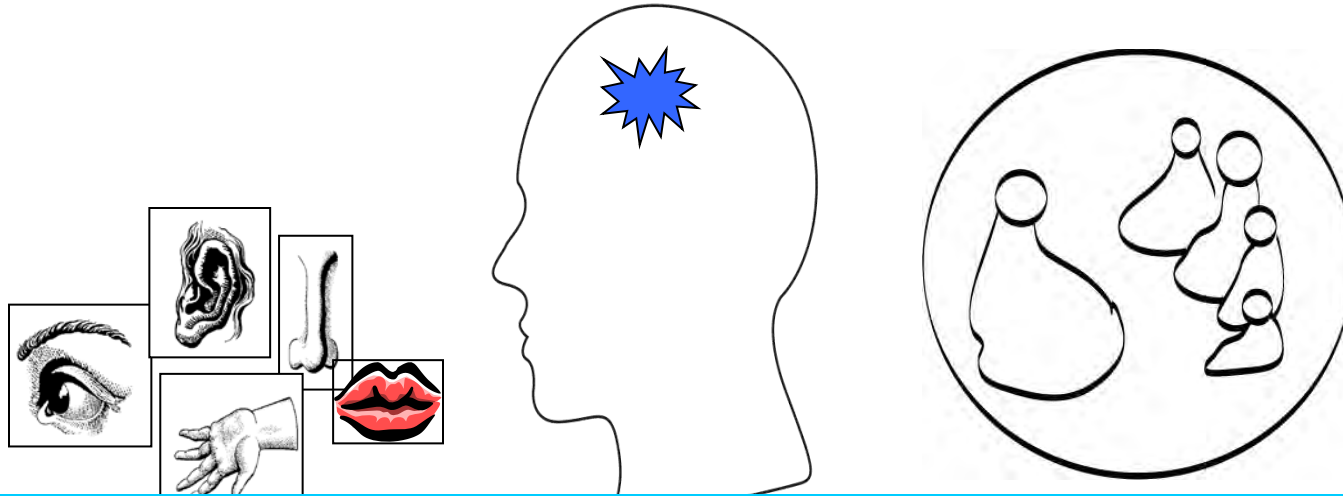
inner

outer

natural

ideal

abstract



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

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

natural

ideal

abstract



Ursa major  
muin

Artist: Basma Kavanagh

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

natural

ideal

abstract



Artist: Basma Kavanagh



Big Dipper



# PATTERN CONCEPTUAL FRAMEWORK



Murdena Marshall  
Mi'kmaq Elder

four  
plant examples



Sana Kavanagh, Research Assistant



natural



# PATTERN CONCEPTUAL FRAMEWORK

outer

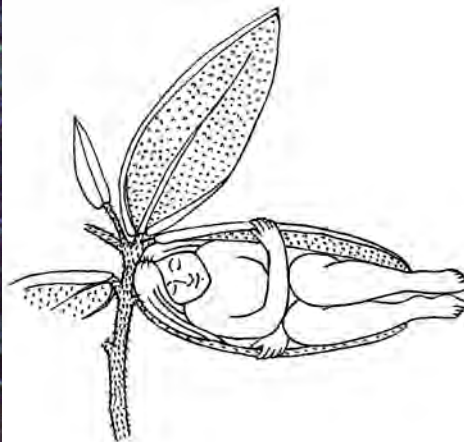
inner

outer

natural

ideal

abstract



**Etuiwulnuksit**

etui + wul  
*each side + good*

feel + plant  
*nuk+ sit*

# PATTERN CONCEPTUAL FRAMEWORK

outer

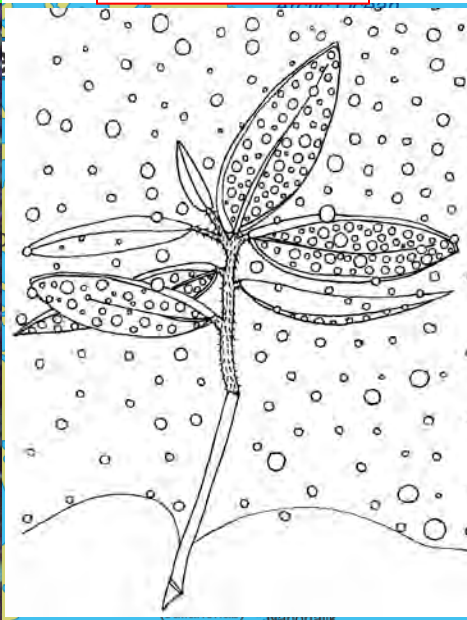
inner

outer

natural

ideal

abstract



*Ledum groenlandicum*

ledum

*oriental shrub*

groenlandicum

*of Greenland*

natural



# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

natural

ideal

abstract



**Altaqiaqwel**

**Altaqiaq + wel**

**creepy crawling +  
thing**

# PATTERN CONCEPTUAL FRAMEWORK

outer

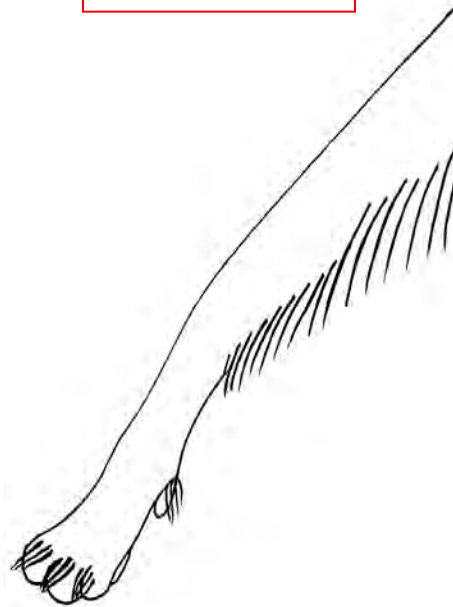
inner

outer

natural

ideal

abstract

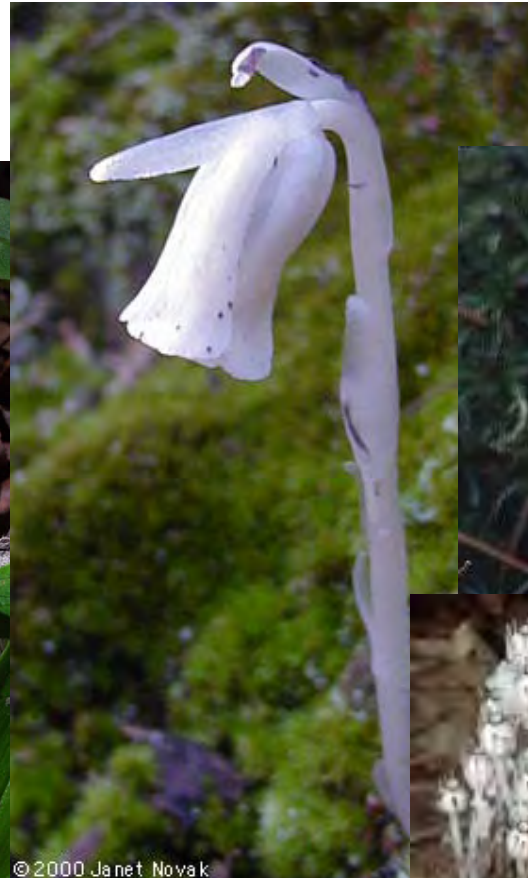


*Lycopodium*

*Lycō + podium*

*wolf foot*

natural



© 2000 Janet Novak



# PATTERN CONCEPTUAL FRAMEWORK

outer

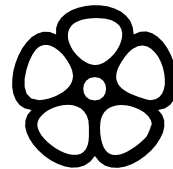
inner

outer

natural



ideal



abstract

*Monotropa uniflora*

Mono + tropa

*one + turn*

uni + flora

*one + flower*



# PATTERN CONCEPTUAL FRAMEWORK

outer

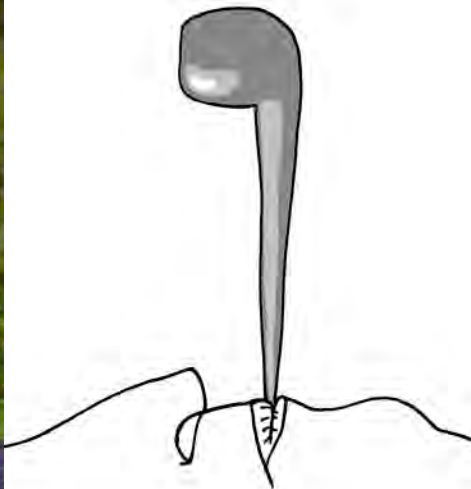
inner

outer

natural



ideal



abstract

**Lnuitmaqne'l**

Lnui + tmaqne'l

*People's + pipe*

# PATTERN CONCEPTUAL FRAMEWORK

outer

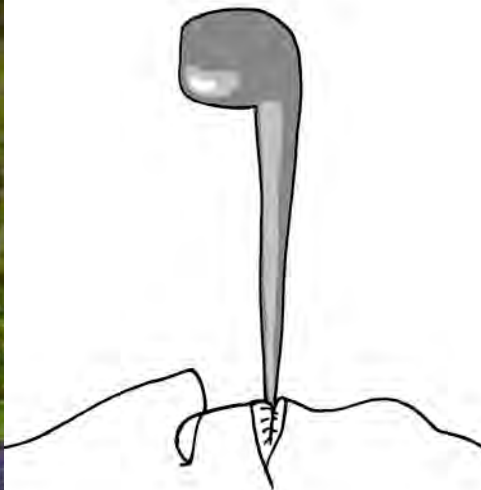
inner

outer

natural

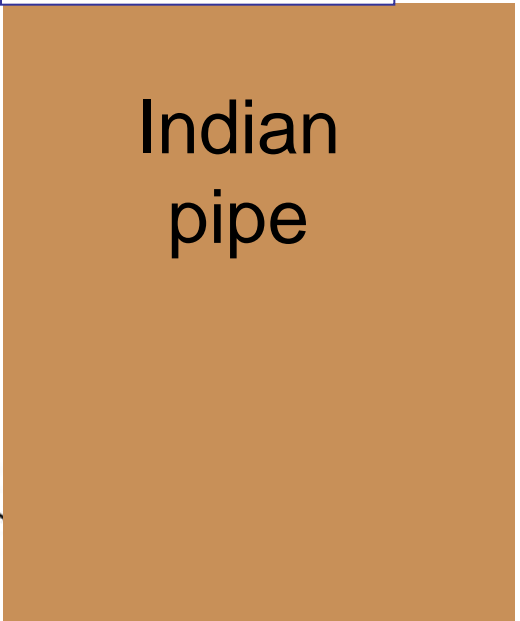


ideal



abstract

Indian  
pipe



# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

natural

ideal

abstract



ghost  
plant

natural



# PATTERN CONCEPTUAL FRAMEWORK

outer

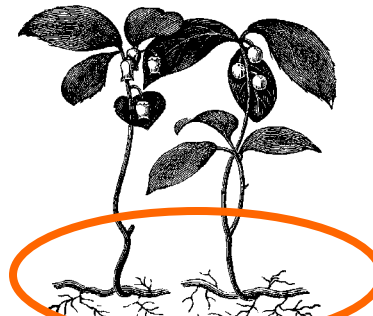
inner

outer

natural

ideal

abstract



*Gaultheria procumbens*

gaultheria

for J. F. Gaultier

Canadian physicist

procumbens

*prostrate*

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

natural

ideal

abstract



Kaqawejumanaqsi'1

Kaqawej

*crow*

uman + aqsi'l

*berries + plant*

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

natural

ideal

abstract



tea berry

ground tea

petit thé du bois

# PATTERN CONCEPTUAL FRAMEWORK

outer

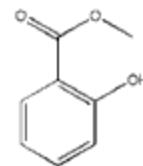
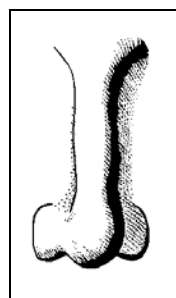
inner

outer

natural

ideal

abstract



wintergreen

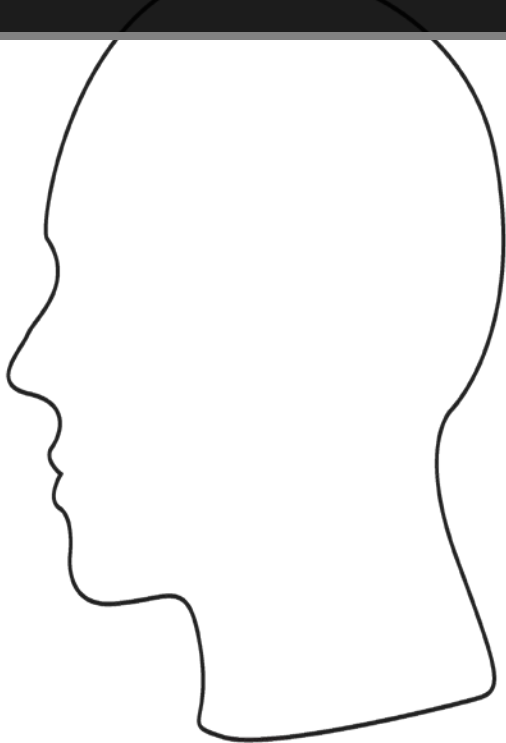


# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

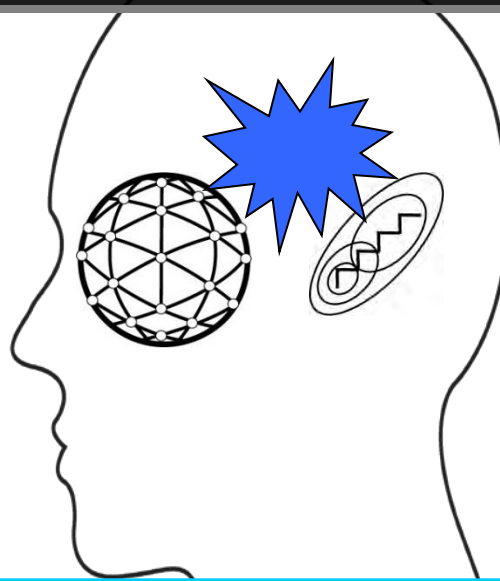


# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



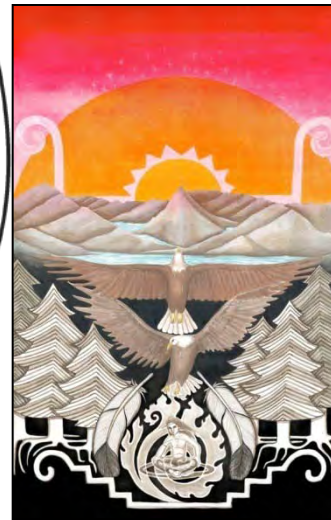
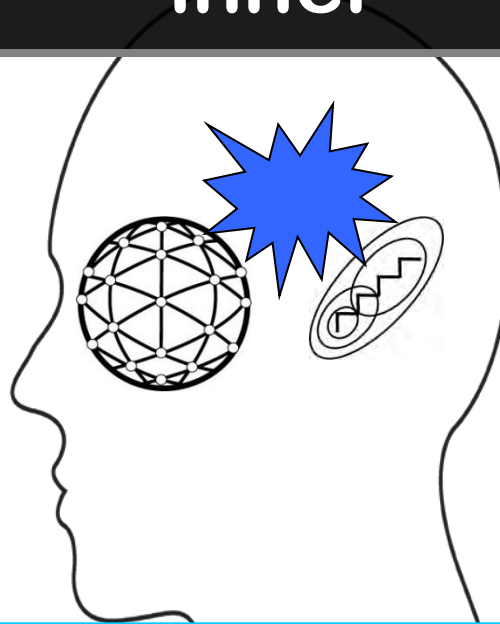
**SANCTIONED  
PERSPECTIVES & INTELLIGENCES:**  
who we are; where we are; where we were;  
what we know, do and value

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
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1971	100	100	100	100	100	100	100	100	100	100	100	100	1200
1972	100	100	100	100	100	100	100	100	100	100	100	100	1200
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1974	100	100	100	100	100	100	100	100	100	100	100	100	1200
1975	100	100	100	100	100	100	100	100	100	100	100	100	1200
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1983	100	100	100	100	100	100	100	100	100	100	100	100	1200
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1985	100	100	100	100	100	100	100	100	100	100	100	100	1200
1986	100	100	100	100	100	100	100	100	100	100	100	100	1200
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2019	100	100	100	100	100	100	100	100	100	100	100	100	1200
2020	100	100	100	100	100	100	100	100	100	100	100	100	1200
2021	100	100	100	100	100	100	100	100	100	100	100	100	1200
2022	100	100	100	100	100	100	100	100	100	100	100	100	1200

**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.

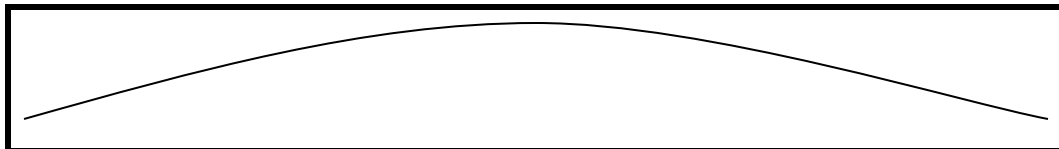
SYDNEY, NS  
Rise and Set for the Sun for 2004

Location: W060 11, N46 09      Zone: 4h West of Greenwich

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

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	Rise
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	
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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

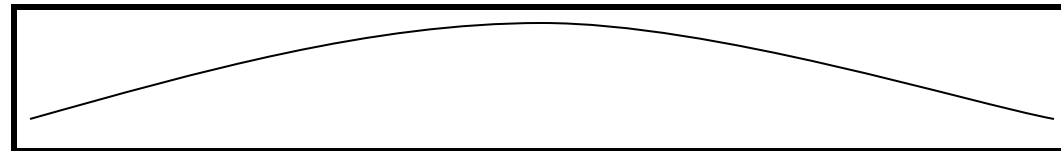
SYDNEY, NS  
Rise and Set for the Sun for 2004

Zone: 4h West of Greenwich

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

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
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
05	0743	1629	0719	1711	0632	1753	0532	1835	0441	1915	0411	1948	0416	1954	0448	1925	0527	1831	0605	1732	0648	1640	0728	1615
06	0743	1630	0718	1712	0630	1755	0530	1837	0439	1916	0410	1949	0417	1954	0449	1923	0528	1829	0606	1730	0649	1639	0729	1615
07	0743	1631	0716	1714	0628	1756	0528	1838	0438	1917	0410	1950	0418	1953	0450	1922	0529	1827	0607	1729	0651	1638	0730	1615
08	0743	1632	0715	1715	0626	1757	0527	1839	0437	1919	0410	1950	0418	1953	0452	1920	0530	1825	0609	1727	0652	1636	0731	1615
09	0742	1633	0714	1717	0624	1759	0525	1841	0435	1920	0409	1951	0419	1952	0453	1919	0532	1823	0610	1725	0654	1635	0732	1615
10	0742	1635	0712	1718	0622	1800	0523	1842	0434	1921	0409	1952	0420	1952	0454	1917	0533	1821	0611	1723	0655	1634	0733	1615
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12	0741	1637	0709	1721	0619	1803	0519	1845	0431	1924	0409	1953	0422	1951	0457	1914	0535	1817	0614	1719	0658	1631	0734	1615
13	0741	1638	0708	1723	0617	1804	0517	1846	0430	1925	0409	1953	0423	1950	0458	1912	0537	1815	0616	1717	0659	1630	0735	1615
14	0740	1640	0706	1724	0615	1806	0515	1847	0429	1926	0409	1954	0424	1949	0459	1911	0538	1813	0617	1716	0701	1629	0736	1615
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26	0731	1656	0646	1742	0551	1822	0455	1903	0417	1939	0411	1956	0436	1938	0514	1850	0553	1750	0634	1655	0717	1619	0742	1621
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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](http://www.nrc-cnrc.gc.ca/multimedia/picture/life/nrc-imb_natural_toxins_e.html)

**Categorization**



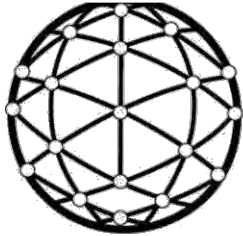
**detached & instrumental**

# Western Science

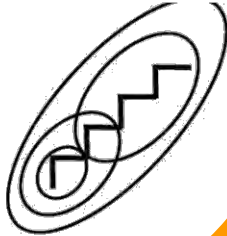
**Two-Eyed Seeing**  
our world is



**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)

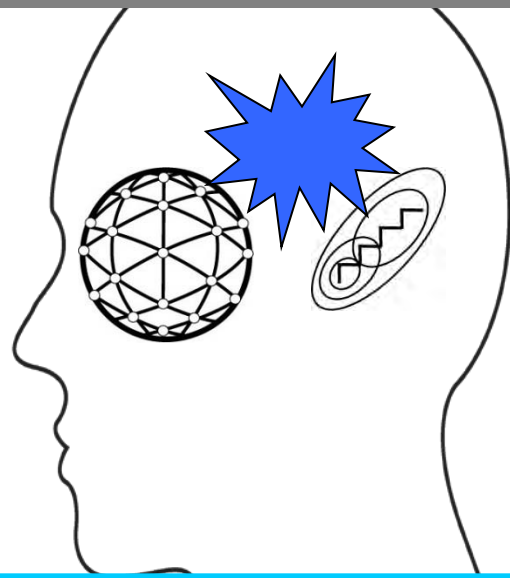
Setford, Steve. 1996. Science Facts. Firefly Books Ltd., Willowdale, ON. (pp. 36-37)

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



SYDNEY, NS  
 Location: W060 11, N46 09  
 Rise and Set for the Sun for 2004  
 Zone: 4h West of Greenwich  
 Astronomical Applications Dept.  
 U. S. Naval Observatory  
 Washington, DC 20391-3420

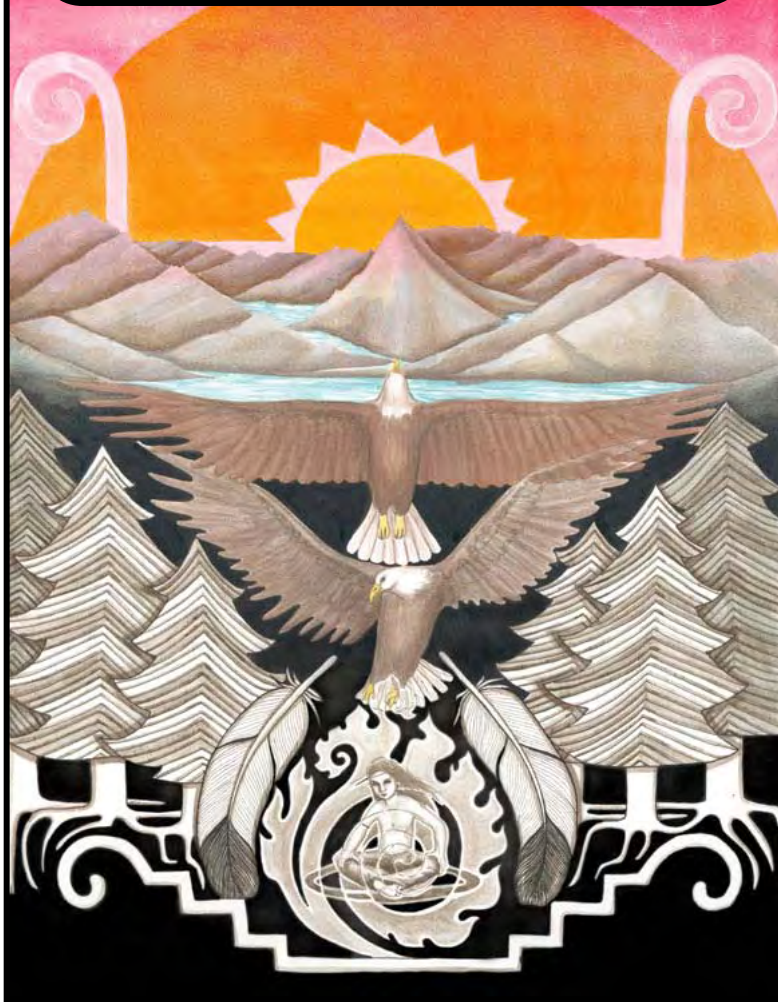
Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Rise	07:43	06:25	05:07	03:50	02:33	01:16	00:00	00:45	01:30	02:15	03:00	03:45
Set	18:25	19:43	21:01	22:19	23:37	00:55	02:13	03:30	04:48	05:65	06:83	07:01
Rise	07:43	06:25	05:07	03:50	02:33	01:16	00:00	00:45	01:30	02:15	03:00	03:45
Set	18:25	19:43	21:01	22:19	23:37	00:55	02:13	03:30	04:48	05:65	06:83	07:01



**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

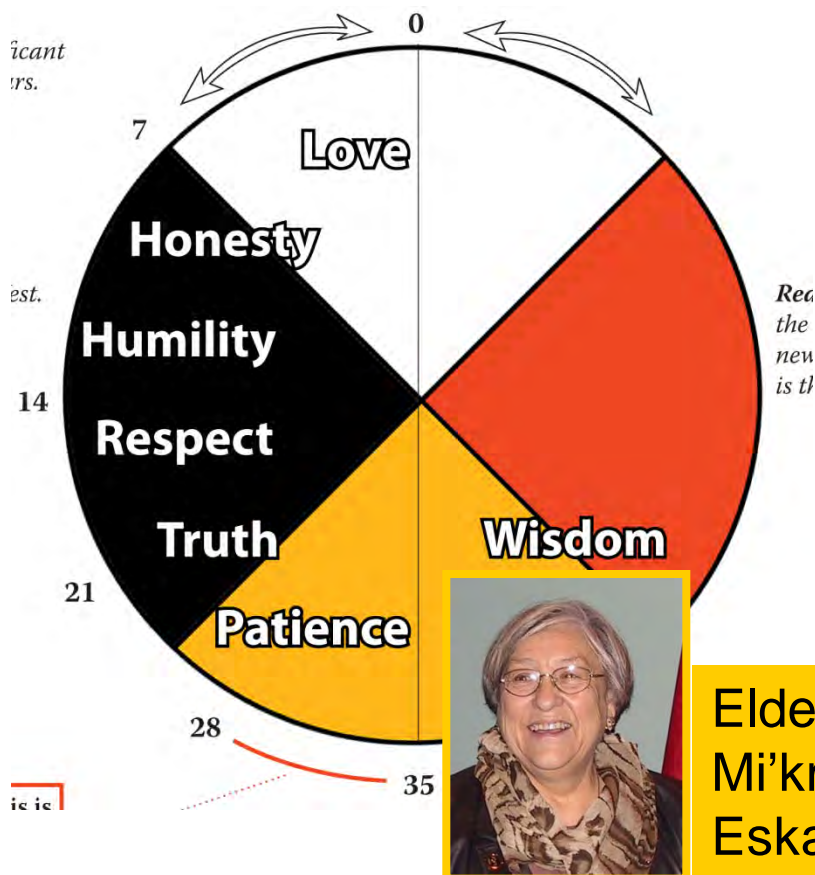
- 
- respect
  - relationship
  - reverence
  - reciprocity
  - ritual (ceremony)
  - repetition
  - responsibility

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

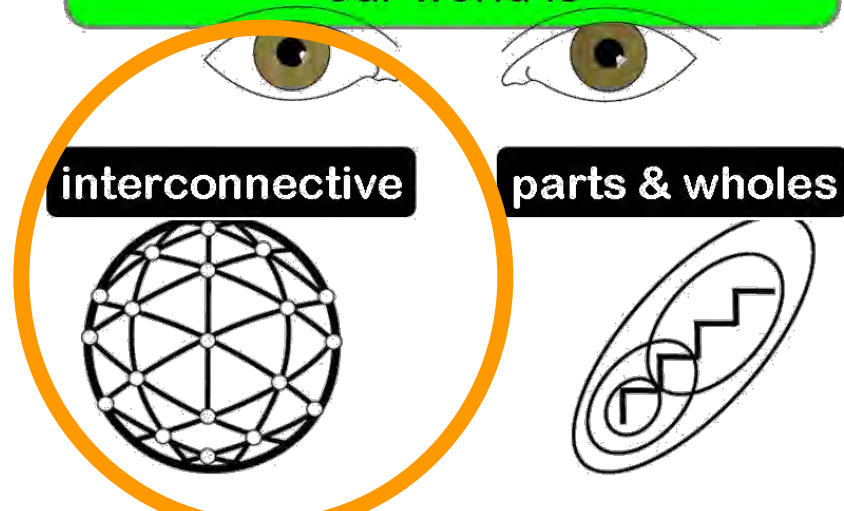


**participatory & creative choice**

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



**Two-Eyed Seeing**  
our world is



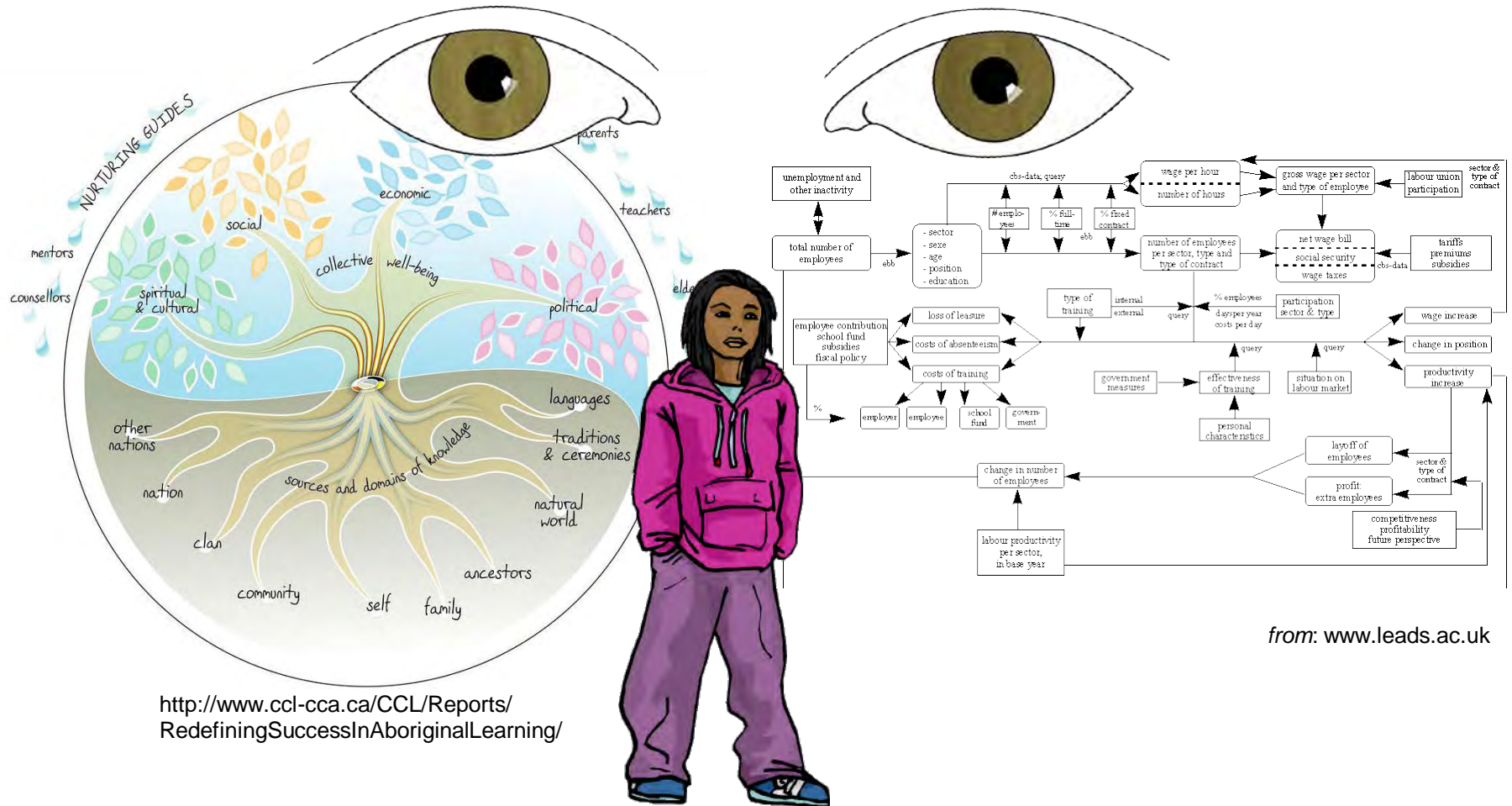
Elder Murdena Marshall, MEd  
Mi'kmaq Elder & Spiritual Leader  
Eskasoni First Nation

# Journey of Life



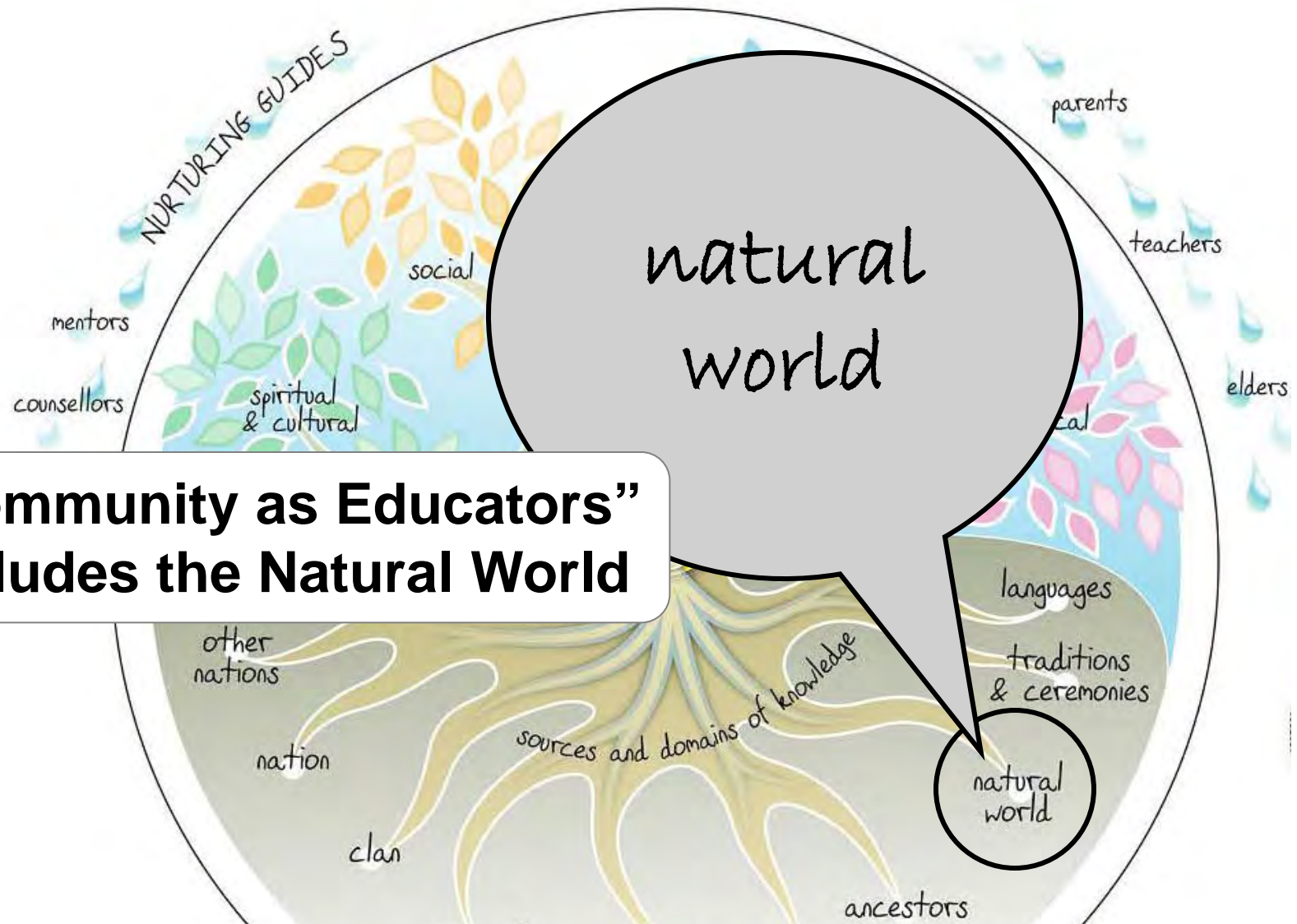
# Two-Eyed Seeing: overall knowledge objectives

## Lifelong Learning (models)



<http://www.ccl-cca.ca/CCL/Reports/RedefiningSuccessInAboriginalLearning/>

from: [www.leads.ac.uk](http://www.leads.ac.uk)



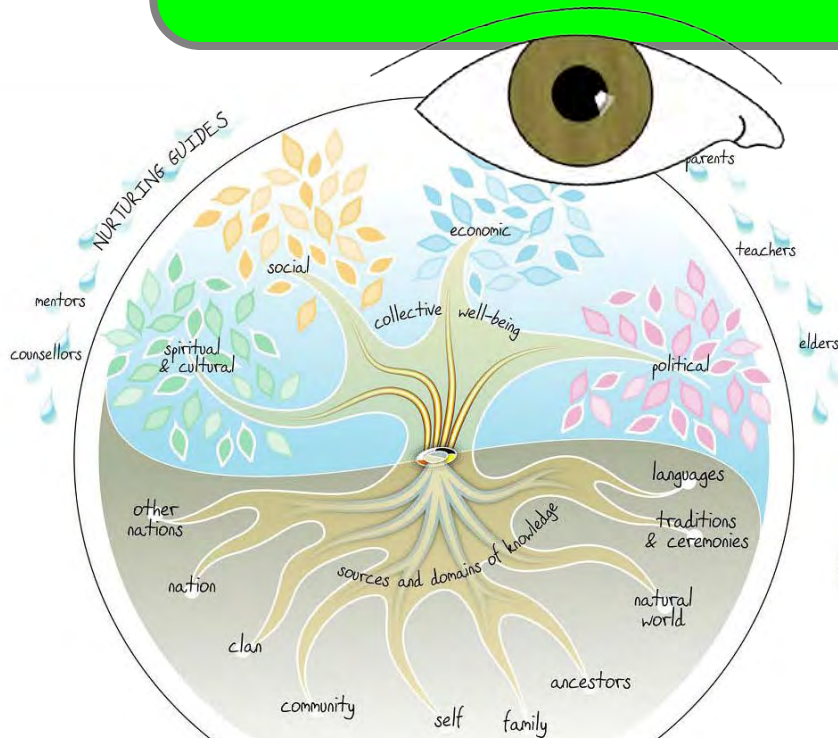
**“Community as Educators”  
includes the Natural World**

## First Nations Holistic Lifelong Learning Model

from: Canadian Council on Learning: Aboriginal Learning Knowledge Centre

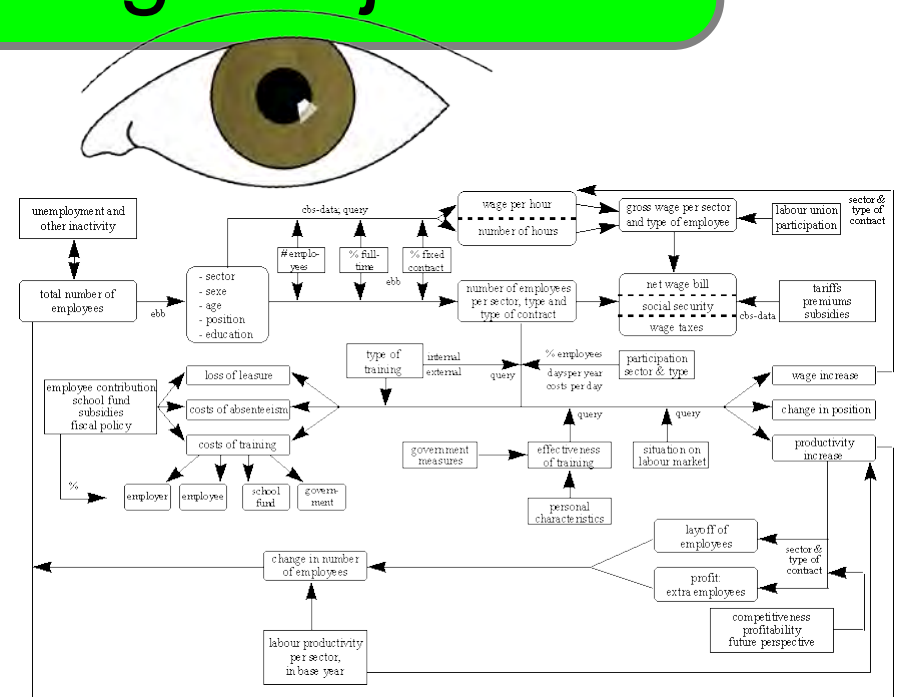
<http://www.ccl-cca.ca/CCL/Reports/RedefiningSuccessInAboriginalLearning/>

# Two-Eyed Seeing our overall knowledge objectives



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

**towards resonance  
of understanding  
within environment**



from: [www.leads.ac.uk](http://www.leads.ac.uk)

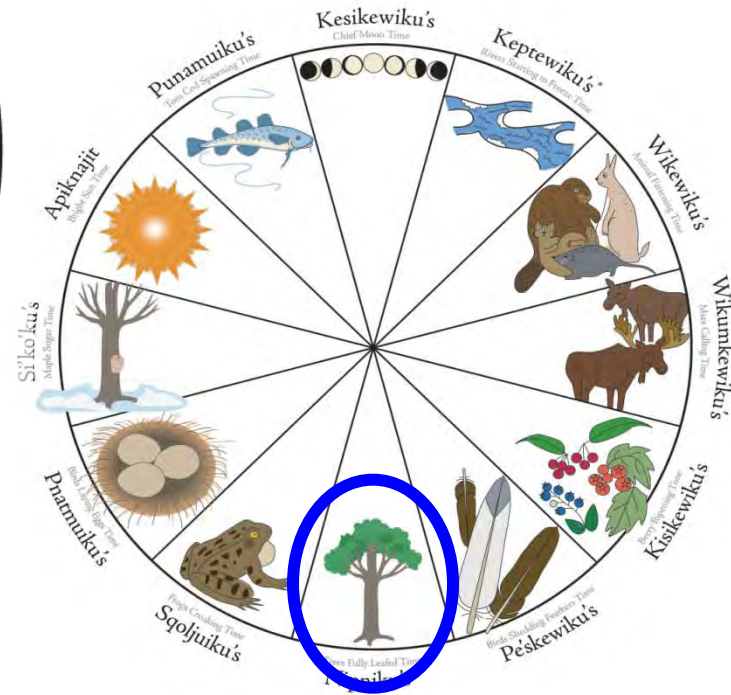
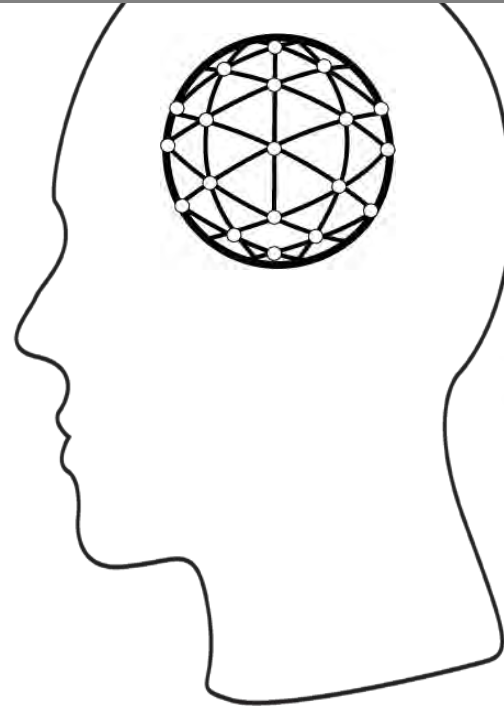
**towards construction  
of understanding  
of environment**

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer







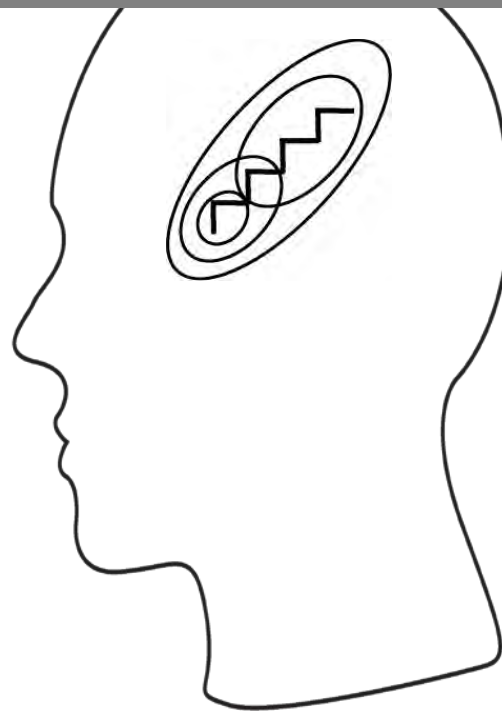
# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

**X**



**June**

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



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



## Murdena's Story

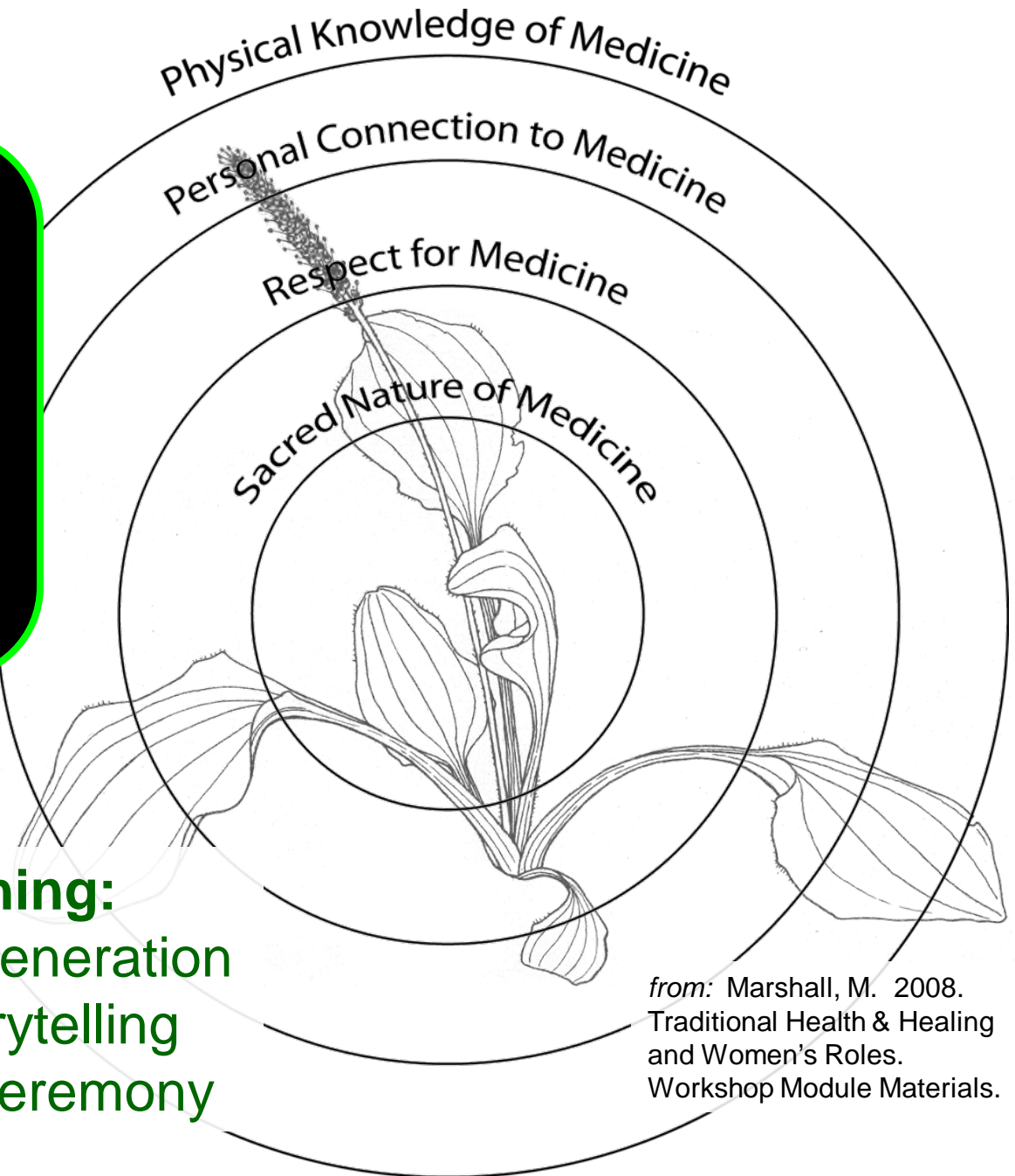
(with permission)

*from:* Marshall, M. 2008.  
Traditional Health & Healing  
and Women's Roles.  
Workshop Module Materials.

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

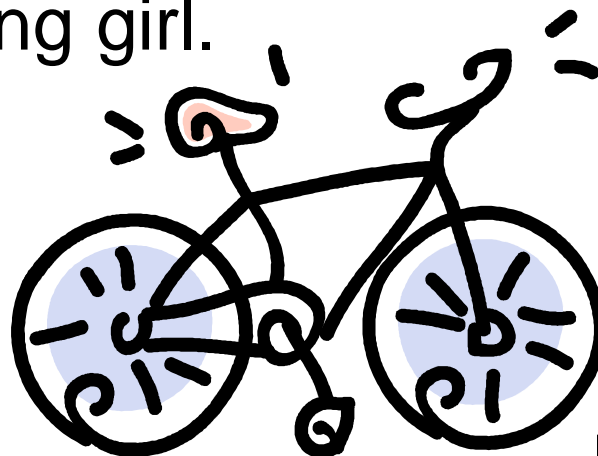
from: J. Archibald, 2001.  
Can. J. Native Ed. 25(1):1-5

**Sacred Circle Teaching:**  
reality passes from generation  
to generation via storytelling  
and participation in ceremony

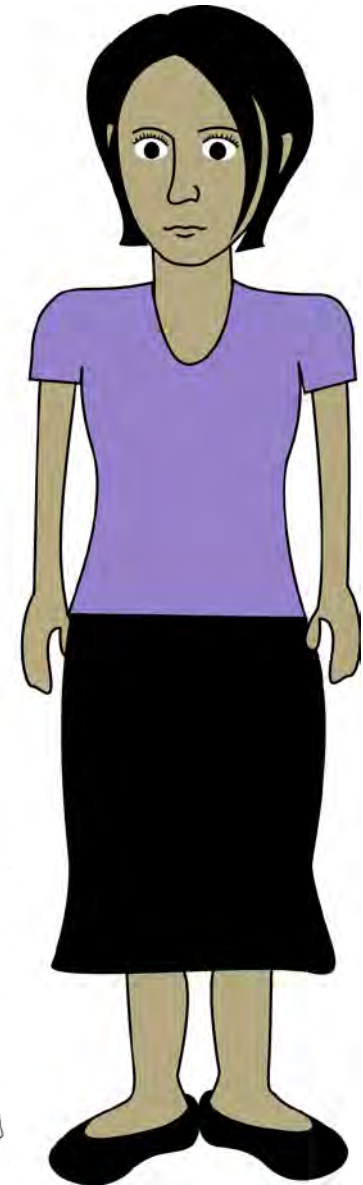


from: Marshall, M. 2008.  
Traditional Health & Healing  
and Women's Roles.  
Workshop Module Materials.

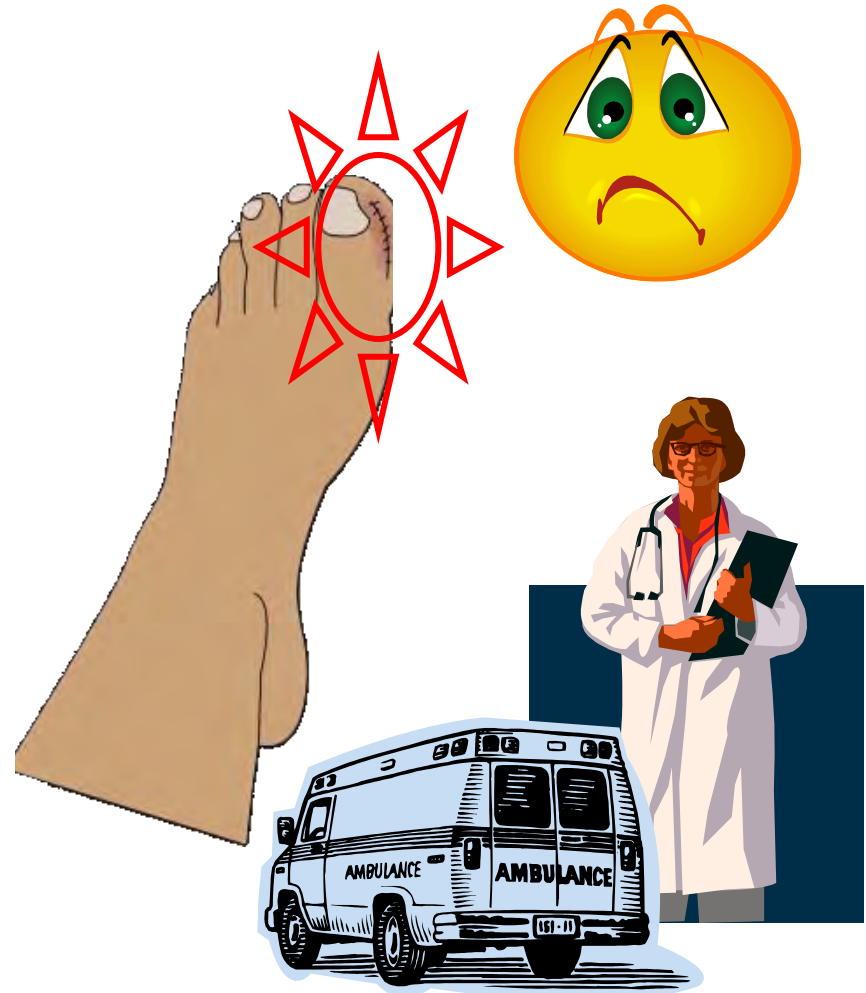
Murdena is a young girl.



Murdena has an Auntie.

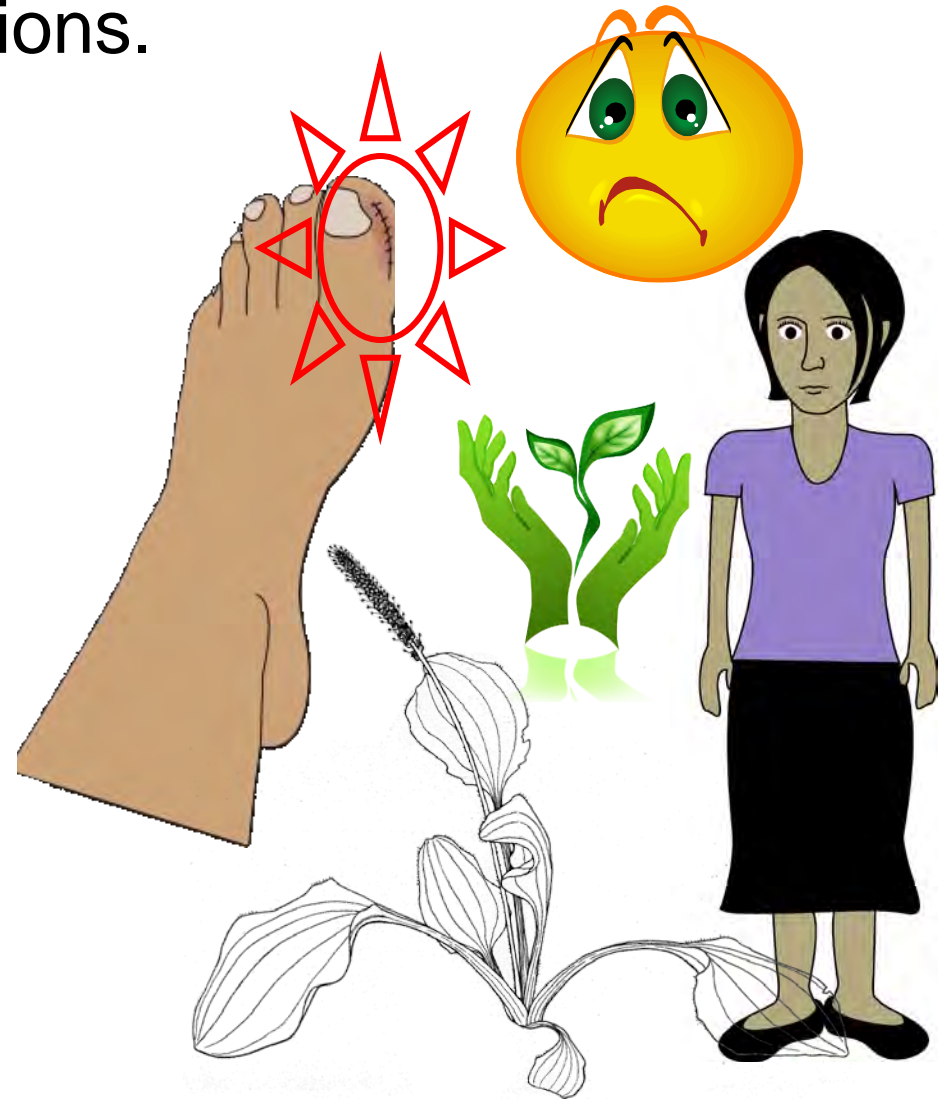


Murdena is a Grandmother.

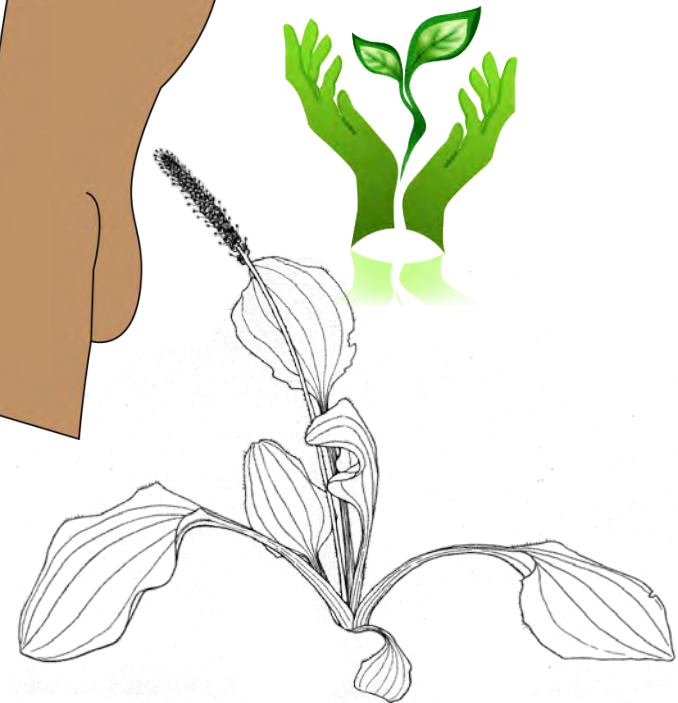




Murdena is a Grandmother whose Journey of Life has experienced many relations.

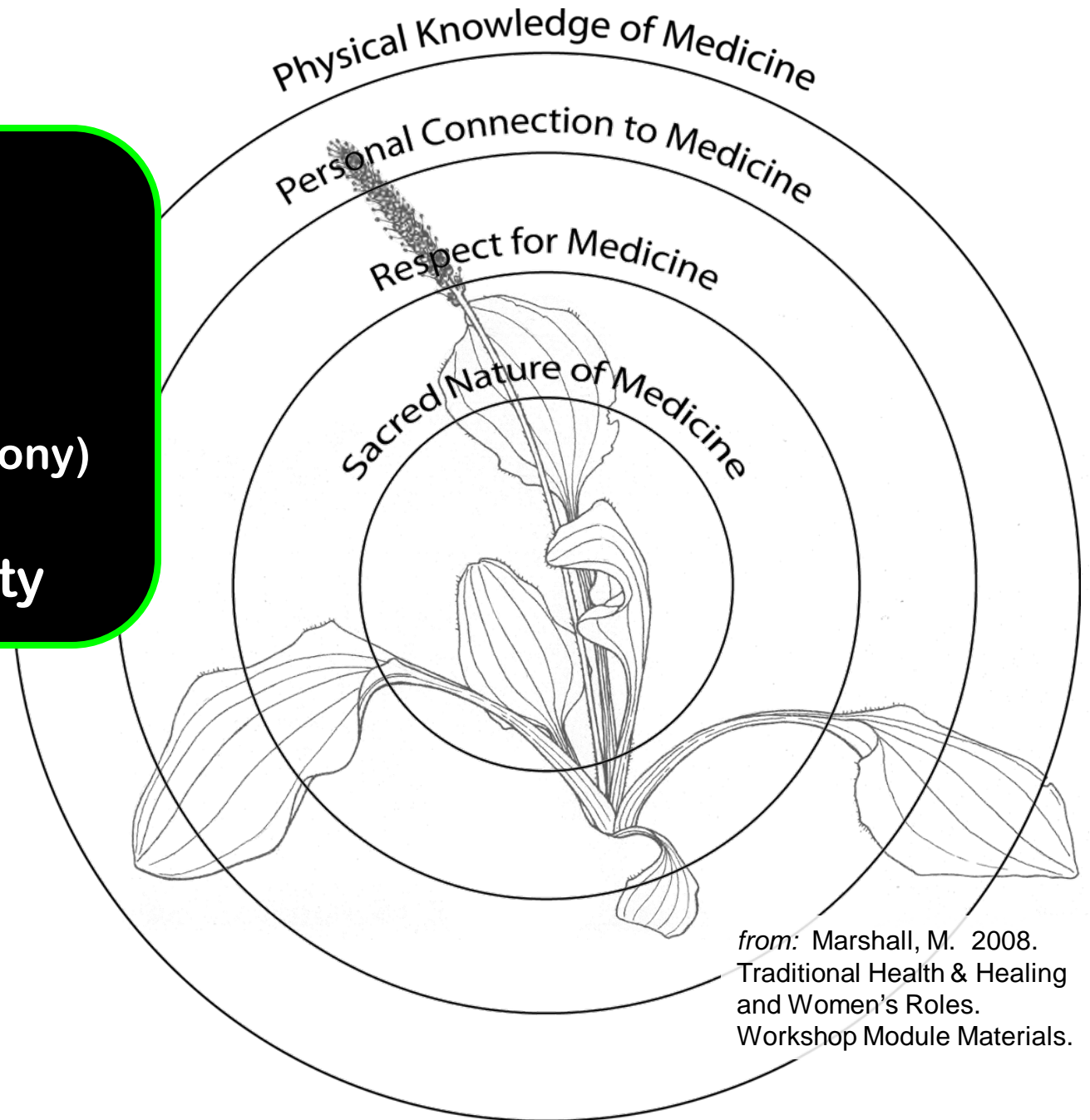


Murdena is a Grandmother whose Journey of Life has experienced many relations.



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

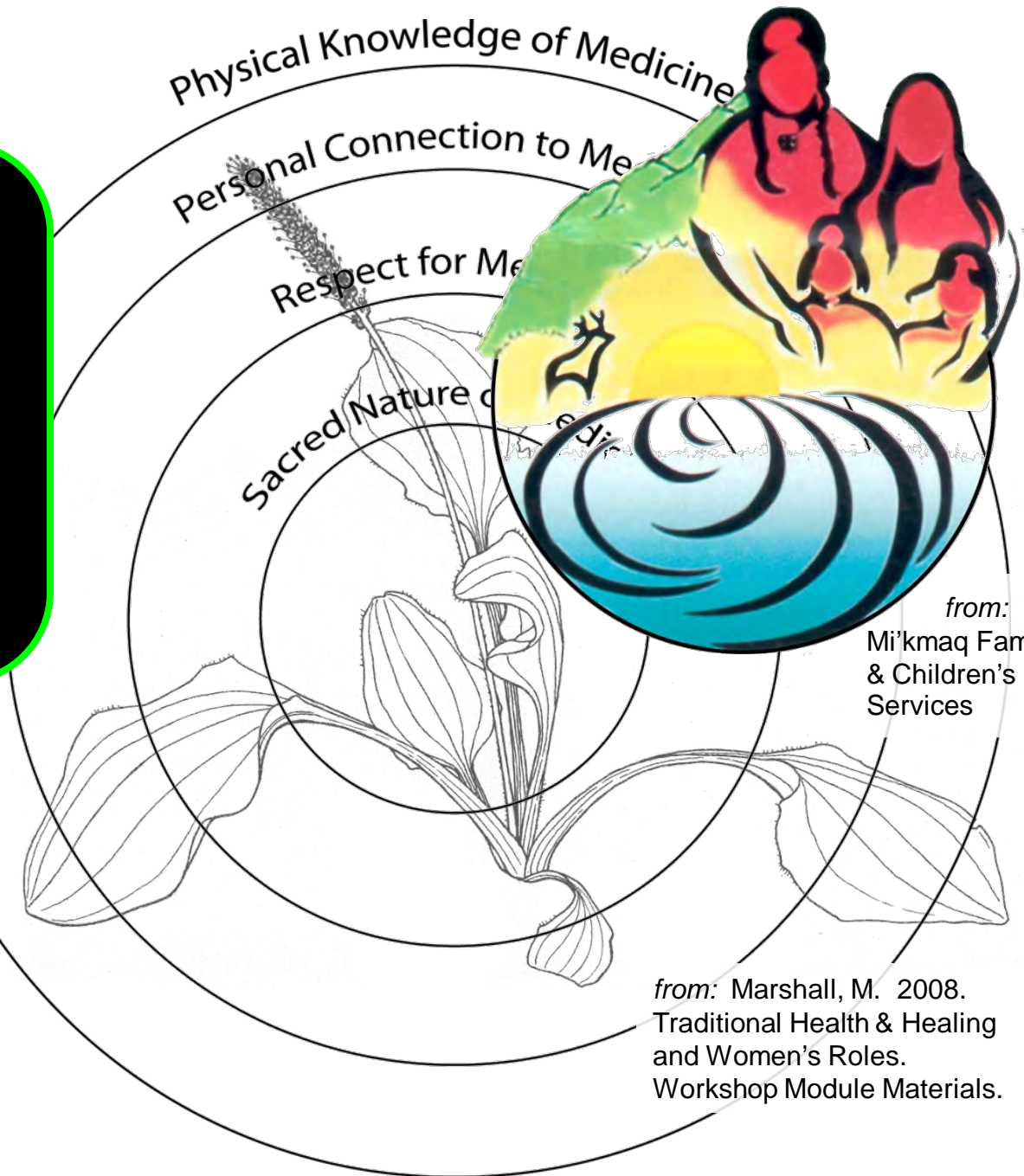
from: J. Archibald, 2001.  
Can. J. Native Ed. 25(1):1-5



from: Marshall, M. 2008.  
Traditional Health & Healing  
and Women's Roles.  
Workshop Module Materials.

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

from: J. Archibald, 2001.  
Can. J. Native Ed. 25(1):1-5



from:  
Mi'kmaq Family  
& Children's  
Services

from: Marshall, M. 2008.  
Traditional Health & Healing  
and Women's Roles.  
Workshop Module Materials.

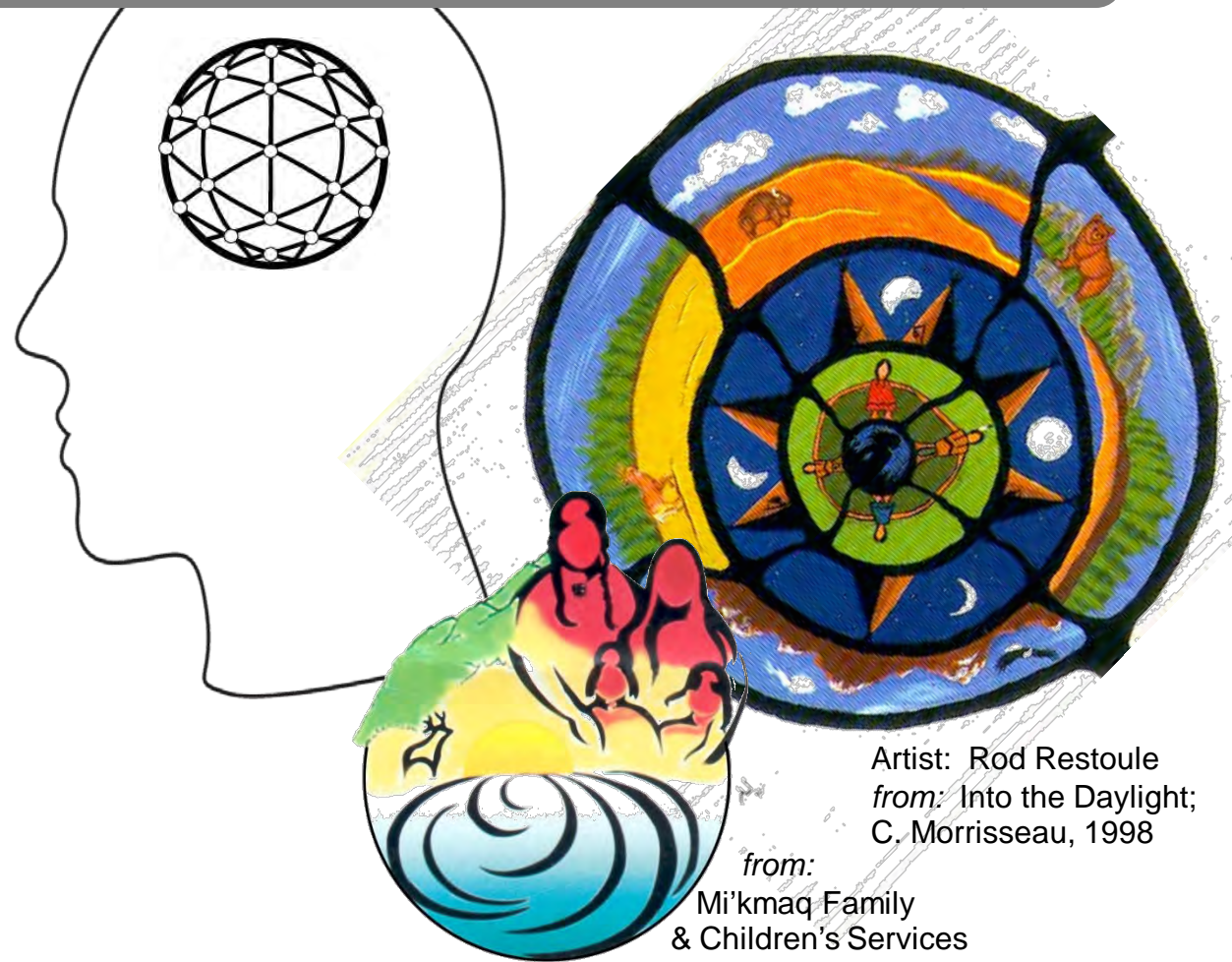
# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

*“human health”*



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

from:  
Mi'kmaq Family  
& Children's Services

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

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



Life  
Love  
Land

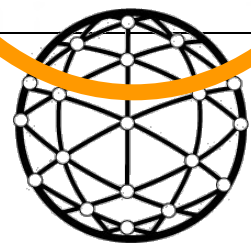
Math  
&  
Instruments

vigour

rigour

**WEAVING**

**UN-WEAVING**



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

from:  
Mi'kmaq Family  
& Children's Services

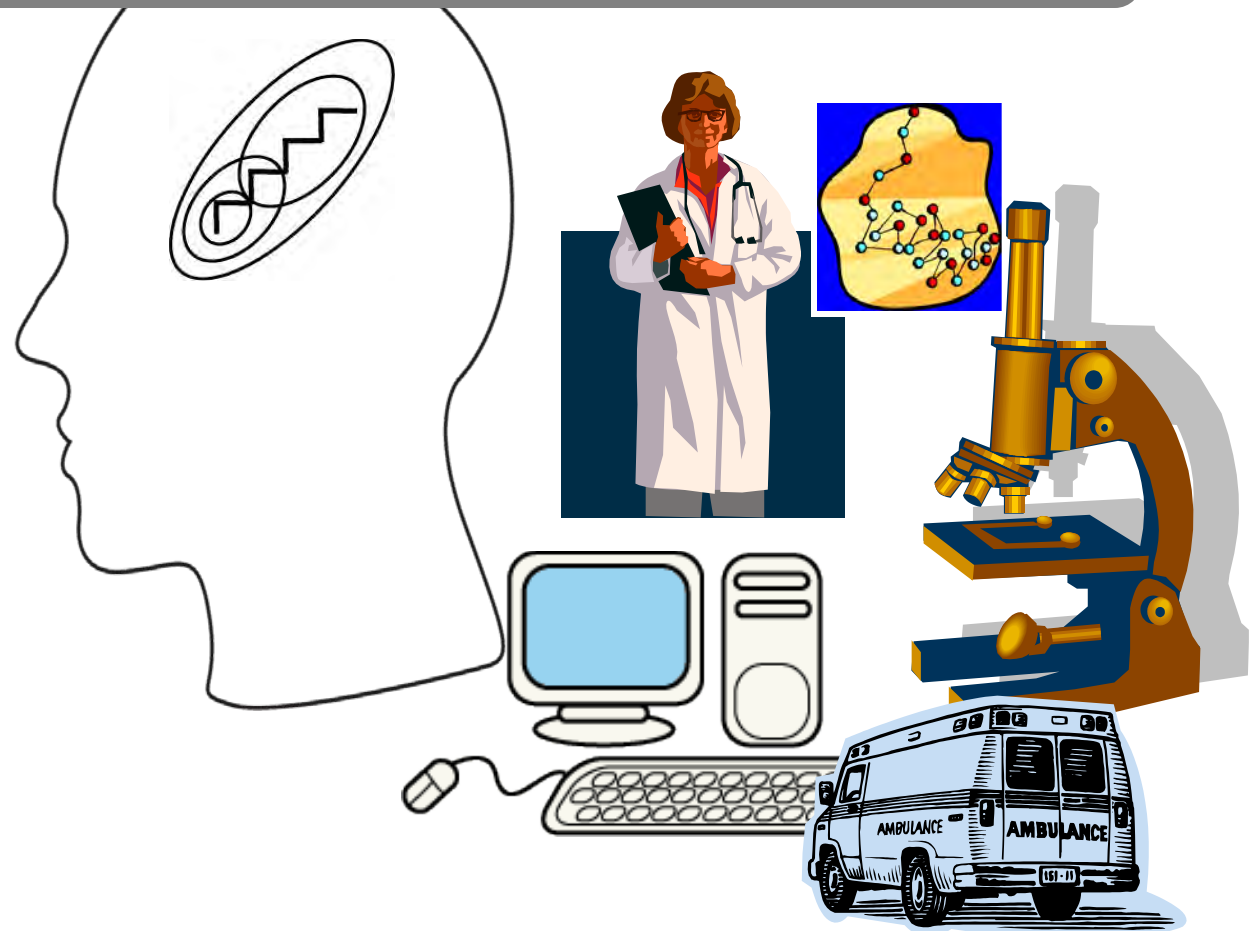
# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

*“human health”*



# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

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



Life  
Love  
Land

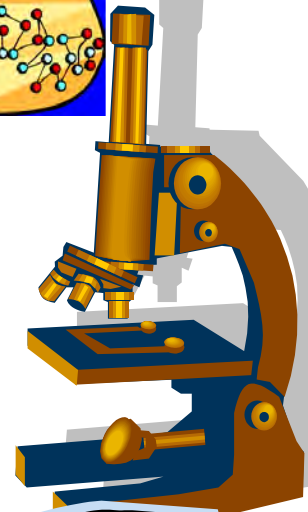
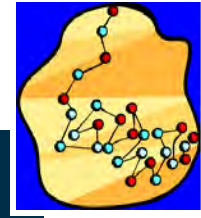
Math  
&  
Instruments

vigour

rigour

**WEAVING**

**UN-WEAVING**





# Indigenous Science

Mother  
Earth

# HEALTH



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



Gabled



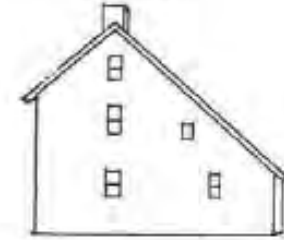
Mansard



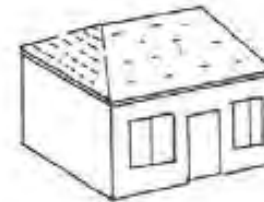
Gambrel



Saltbox



Hip



Flat

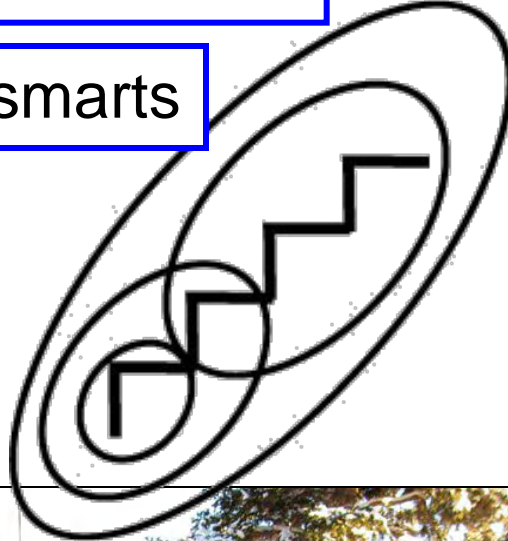
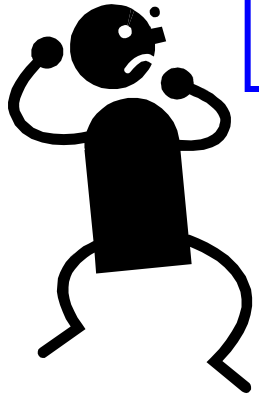


importance of  
**embodied experience**  
as part of the learning process:  
e.g. snow loading on a roof  
- roofs of different slopes  
- snow of different weights



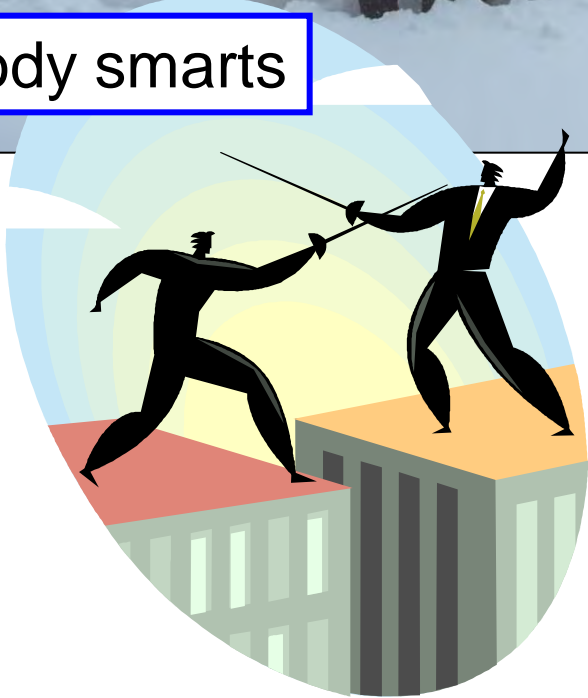
math smarts

word smarts





body smarts





body smarts



importance of  
**embodied experience**  
as part of the learning and knowing processes

Physical Knowledge of Medicine

Personal Connection to Medicine

Respect for Medicine

Sacred Nature of Medicine

# International Year of Astronomy



Indigenous



Western

“bringing our astronomies together”



# “Reflections”

artist Gerald Gloade  
Millbrook First Nation



# Patterns in Stars

## “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>  
Accessed: 17/04/2008 11:50

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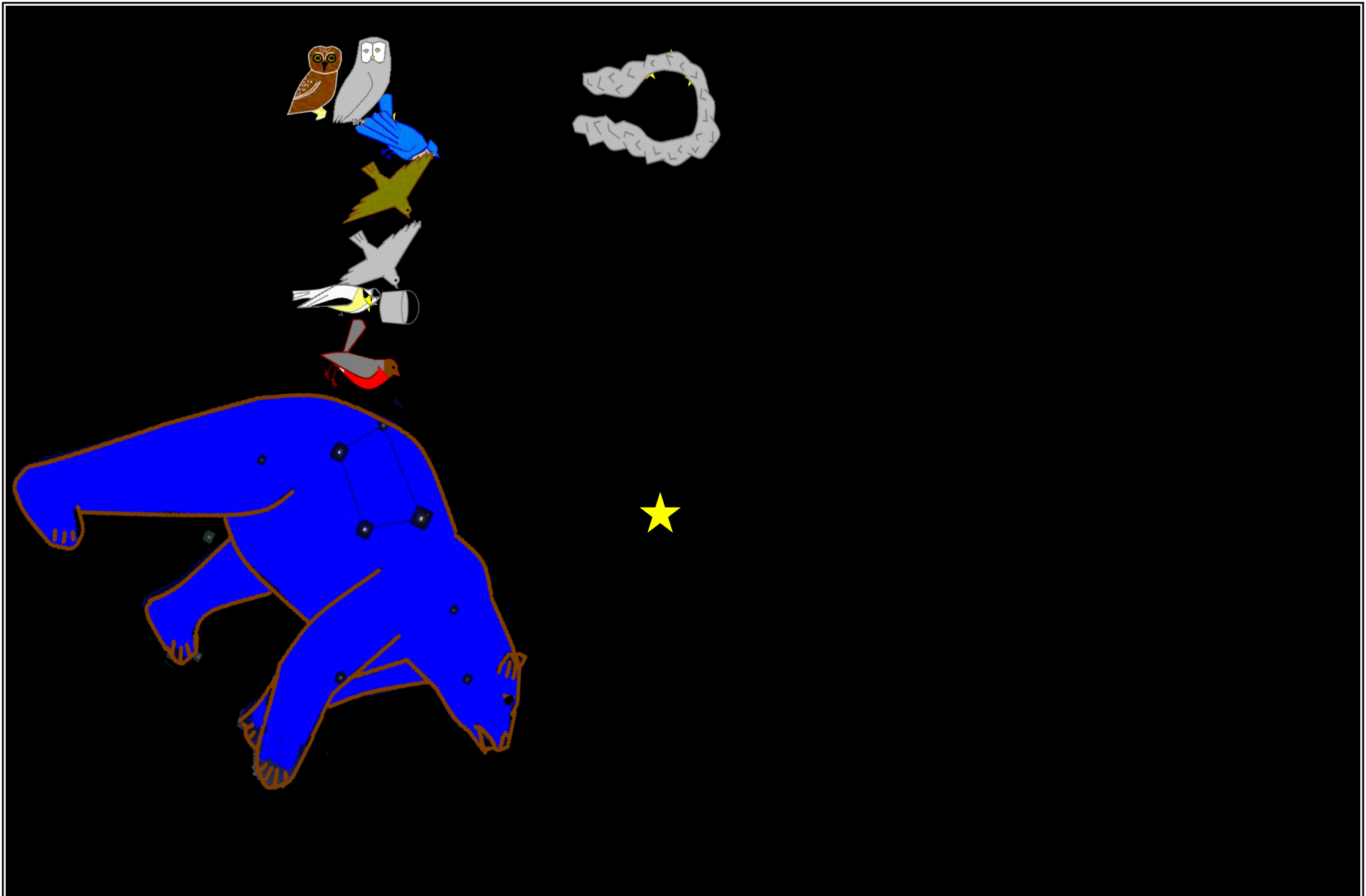
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# The Great Bear Muin

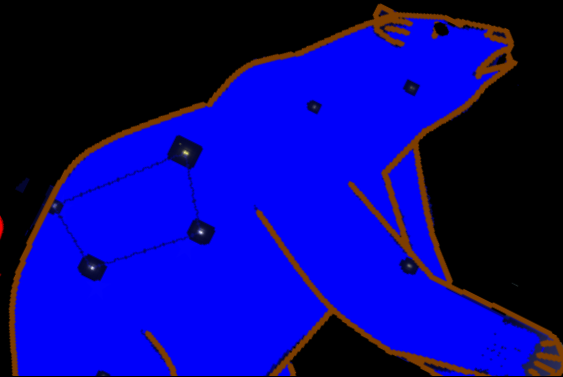
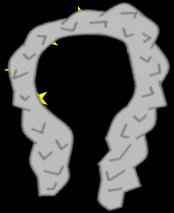
patterns  
and  
meta-patterns  
in our natural  
world



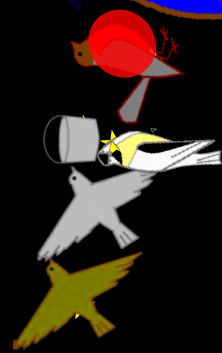
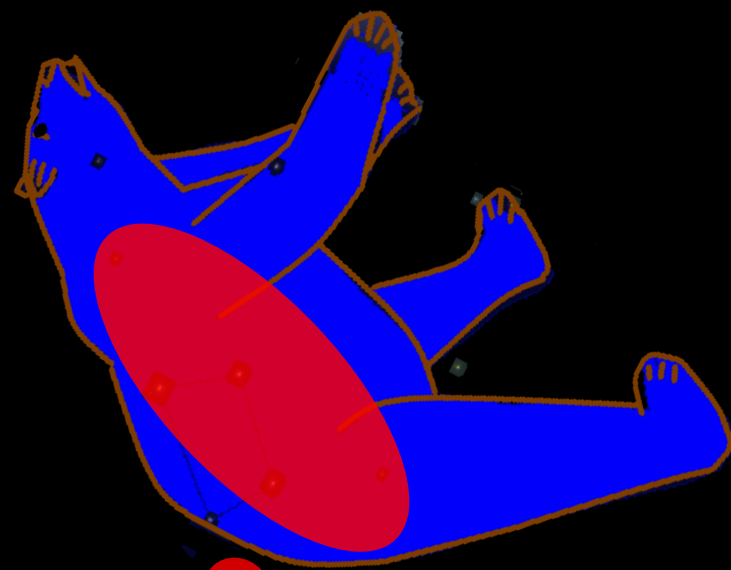
★ Polaris



Mid Spring



Mid Summer



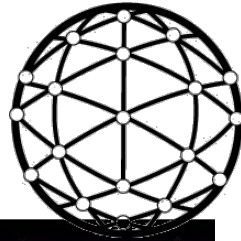
Mid Autumn





Mid Winter

# Indigenous Science



## Great Bear Night Sky Story



Two-Eyed Seeing  
our languages & methodologies



Life  
Love  
Land

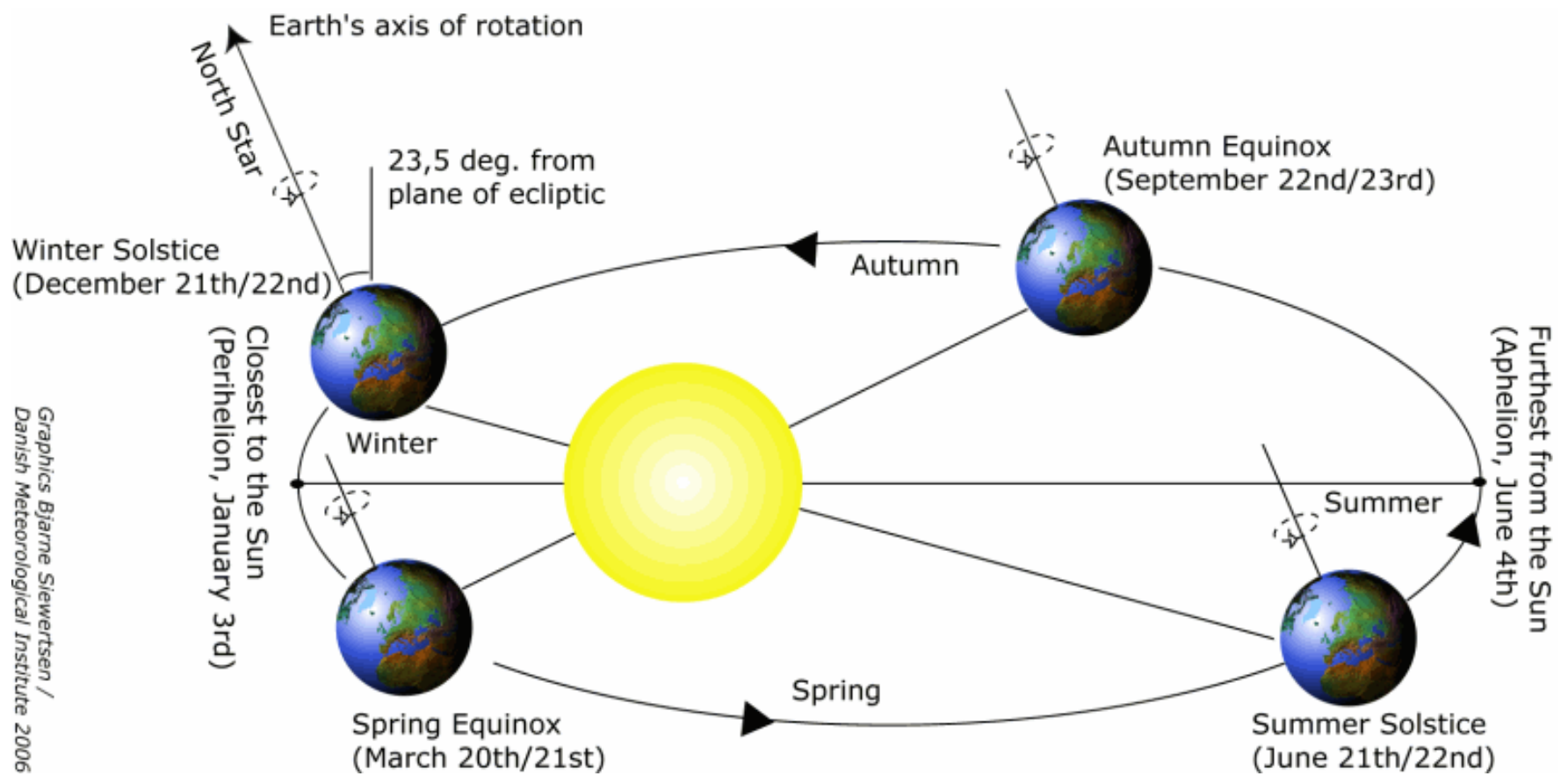
vigour

WEAVING



rigour

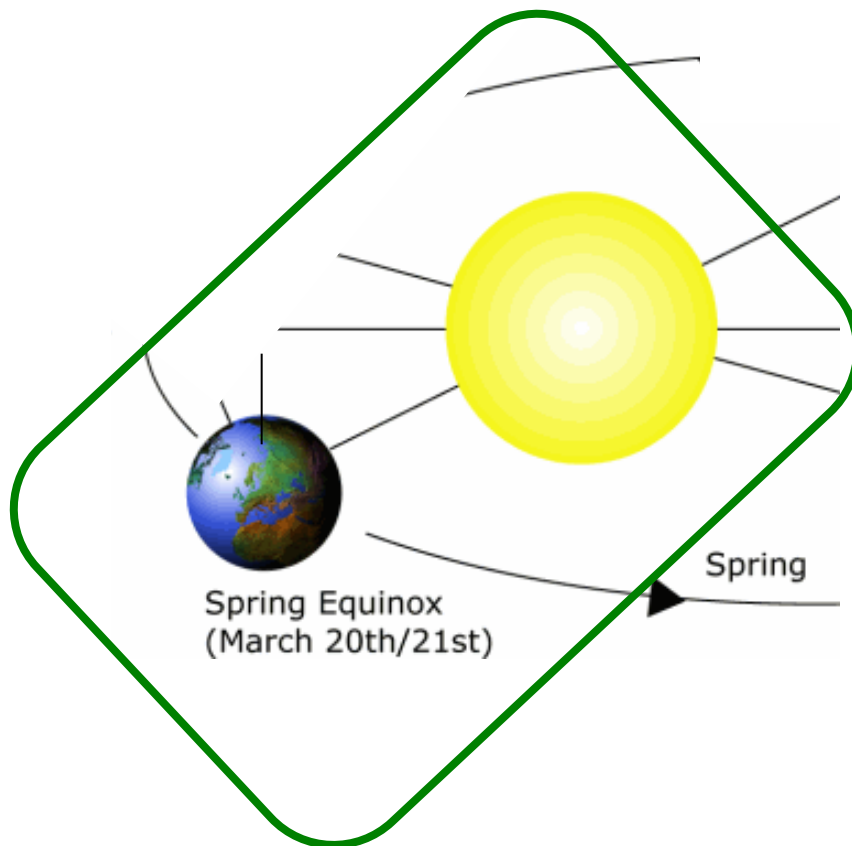
UN-WEAVING



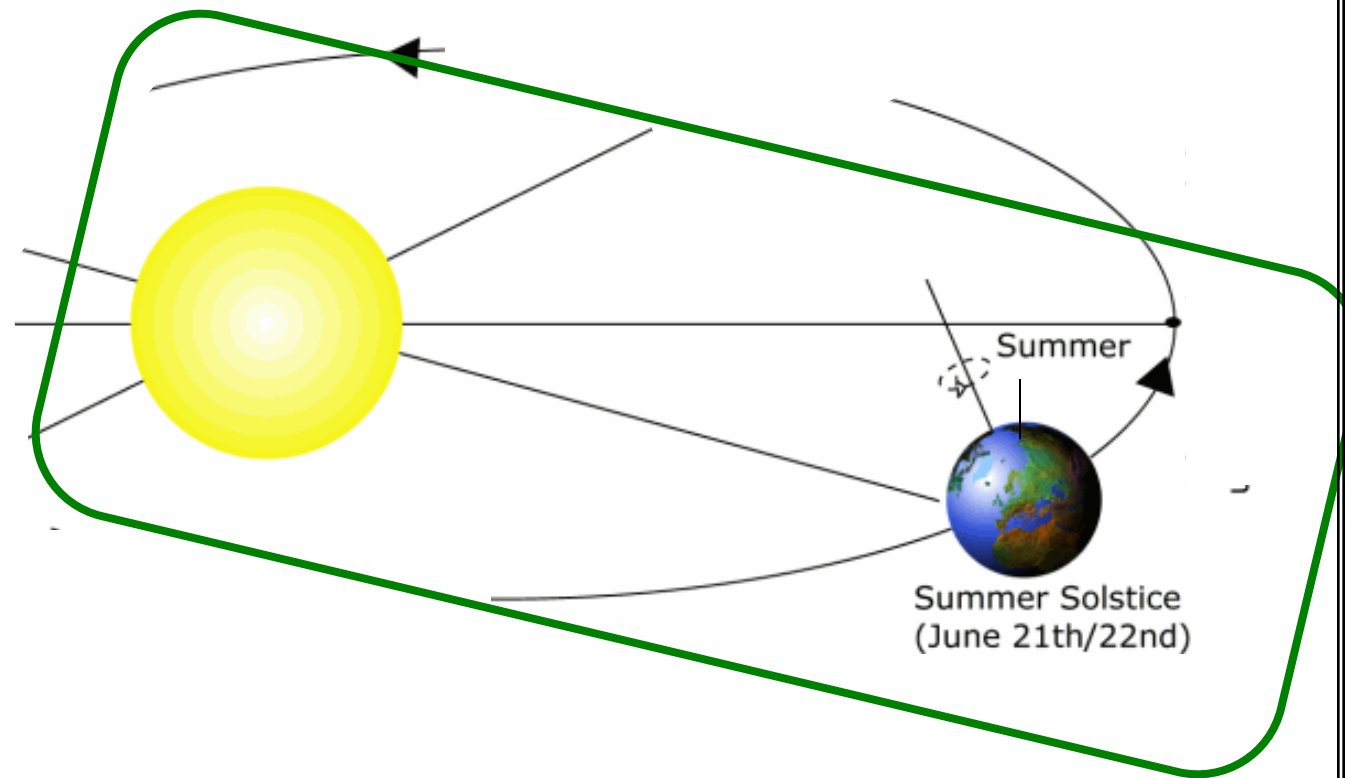
Graphics Bjarne Siewertsen /  
Danish Meteorological Institute 2006



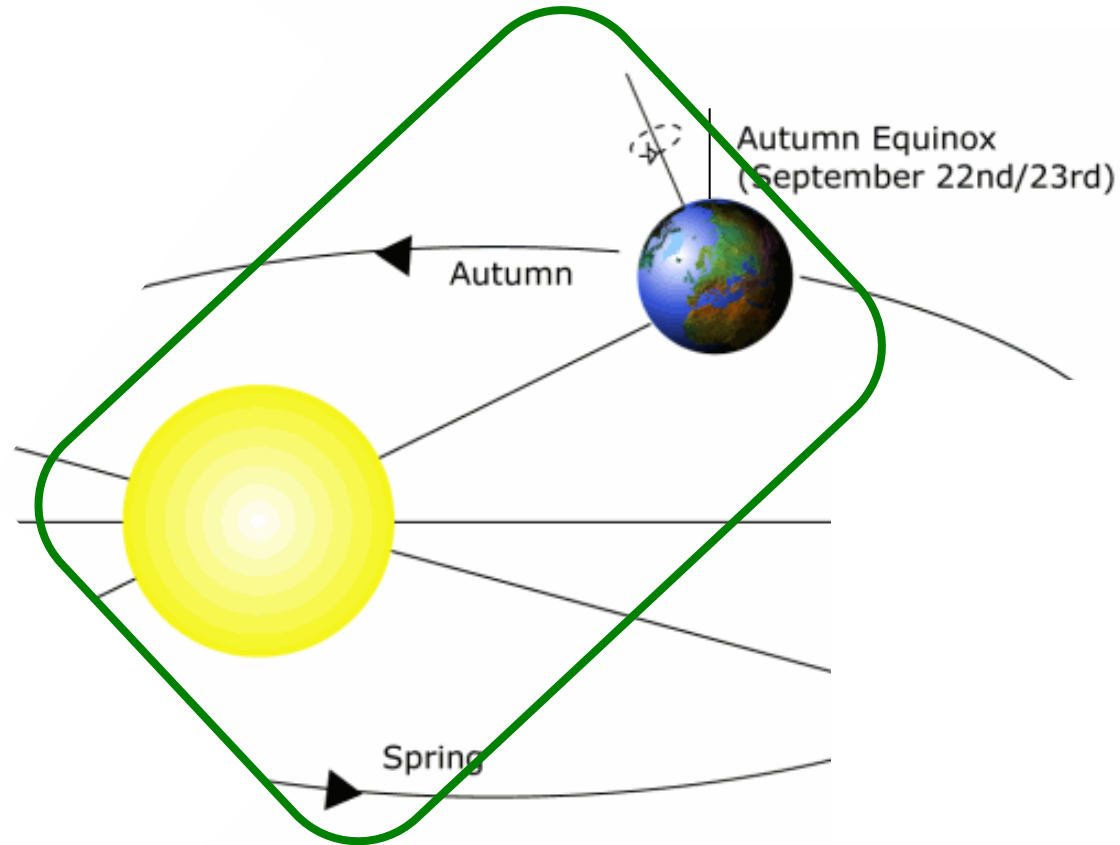
# Spring Equinox



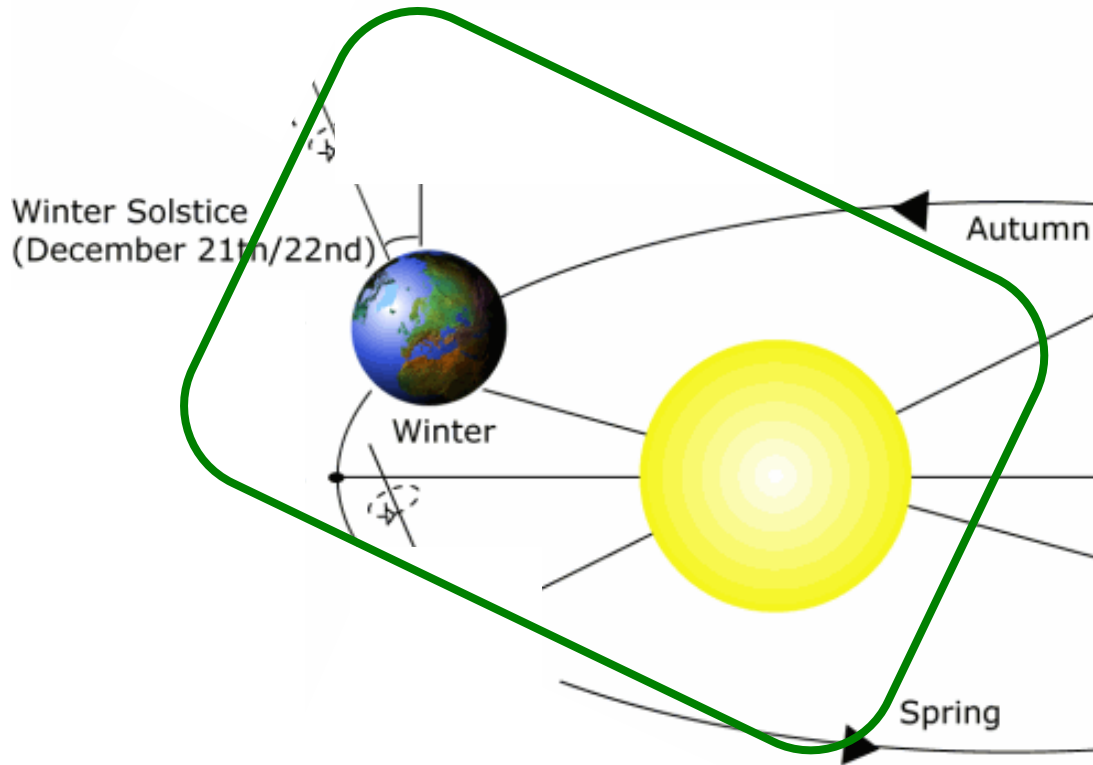
# Summer Solstice

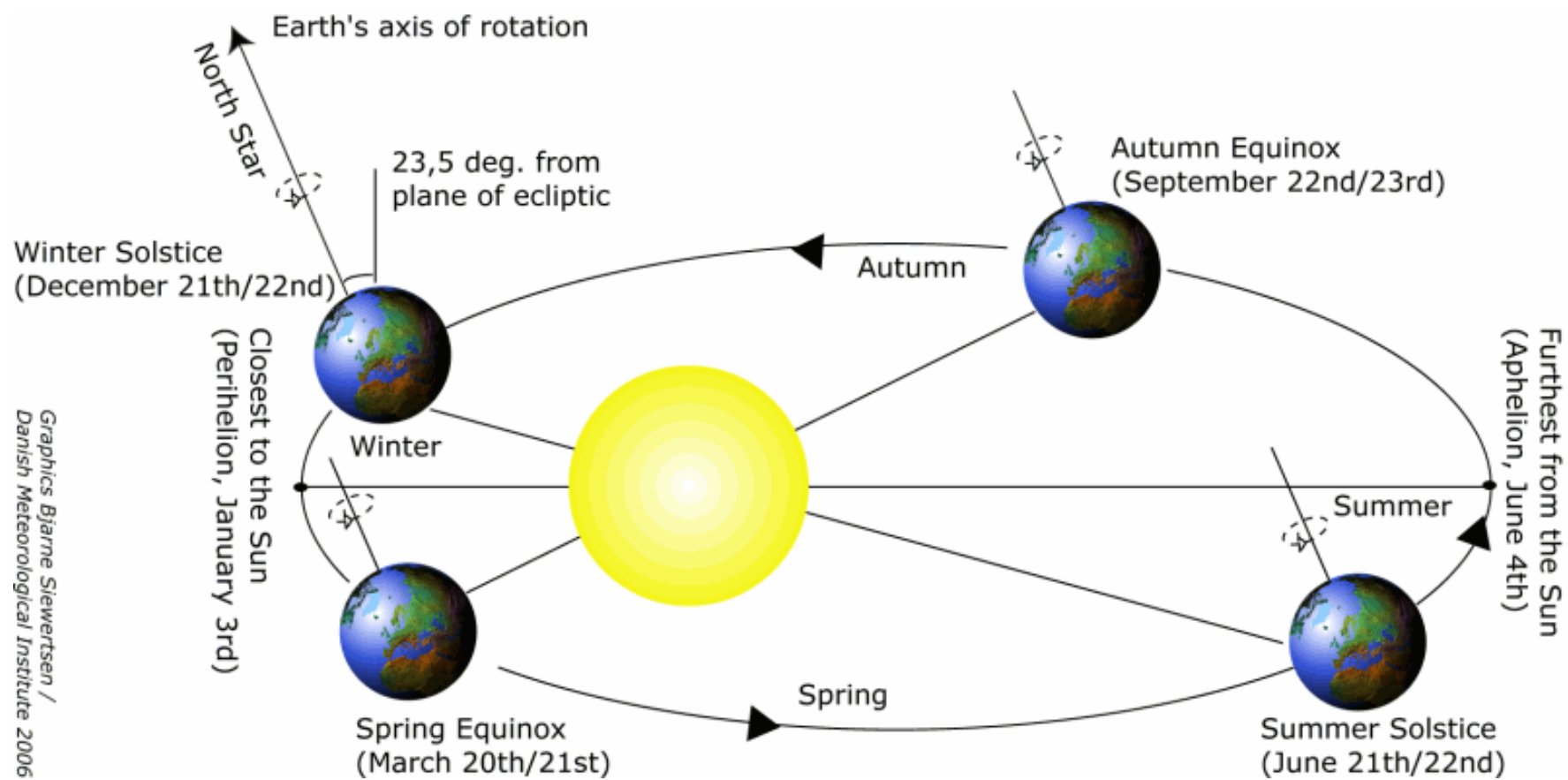


# Fall Equinox



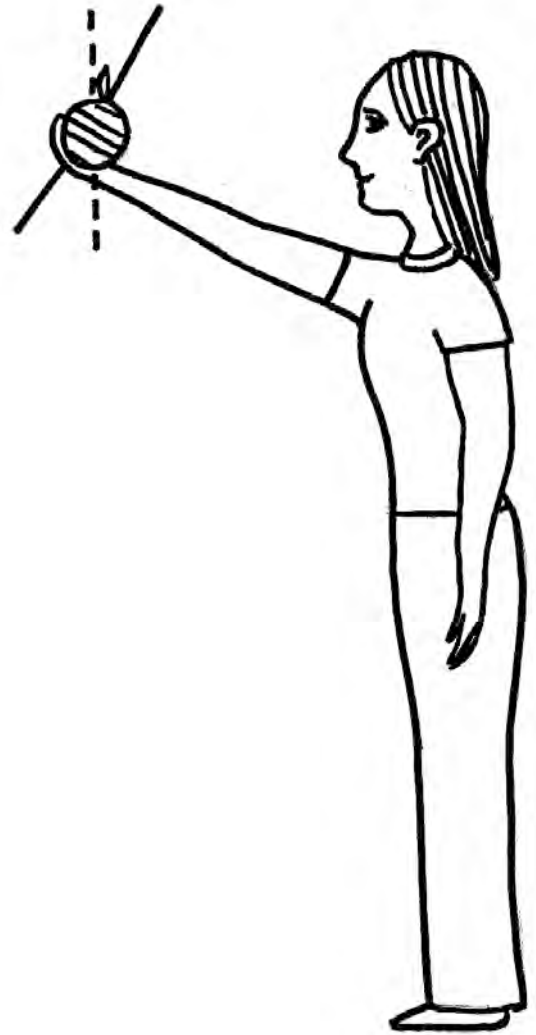
# Winter Solstice



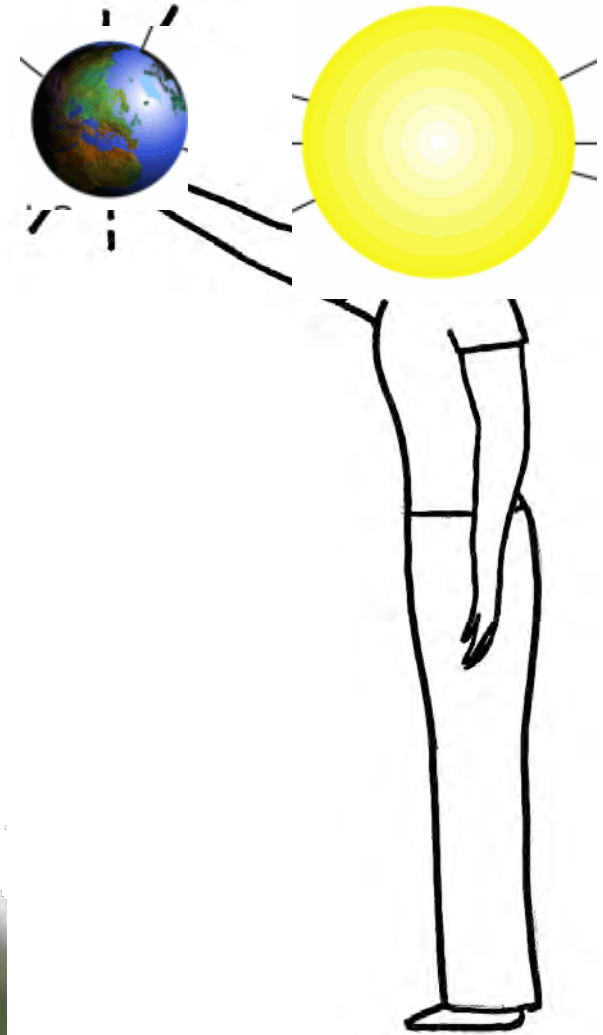


Graphics Bjarne Siewertsen /  
Danish Meteorological Institute 2006

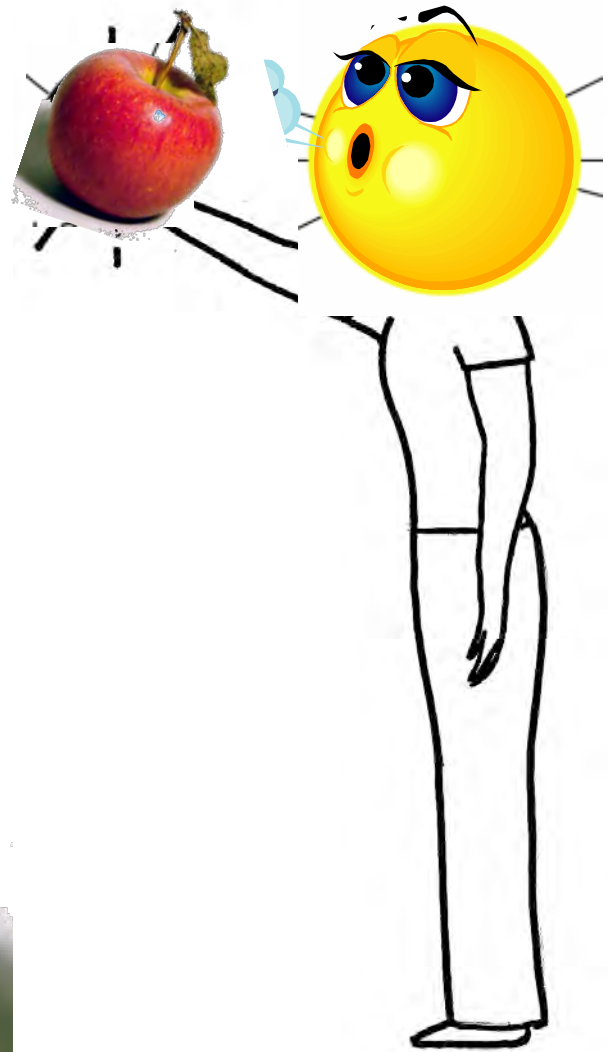
- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility



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

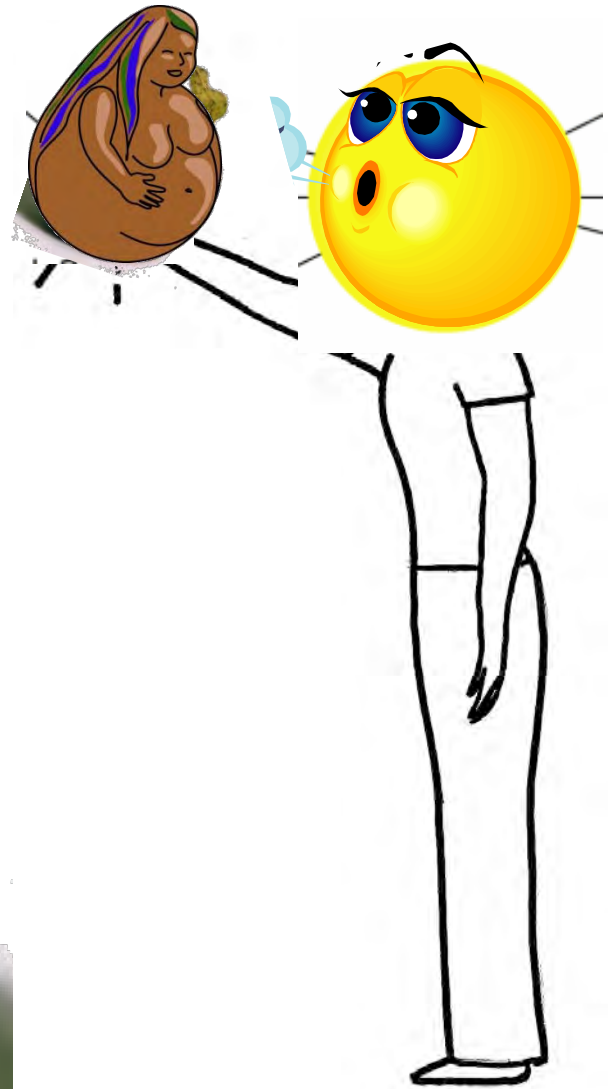


- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility

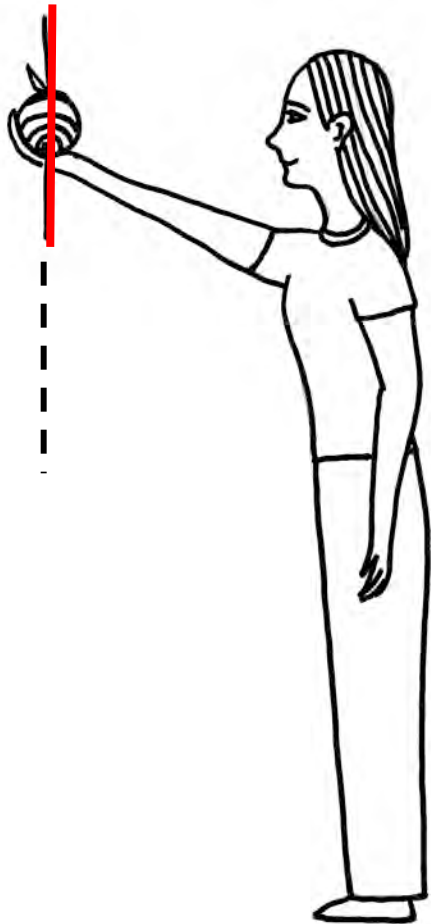




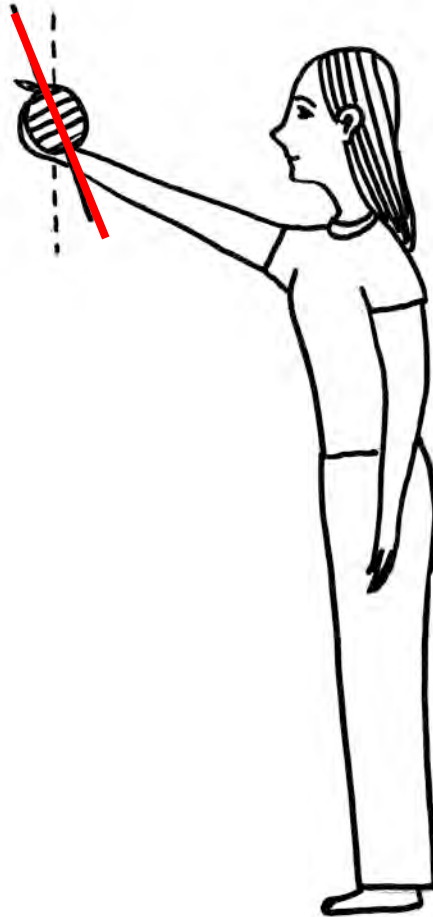
- respect
- relationship
- reverence
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- ritual (ceremony)
- repetition
- responsibility



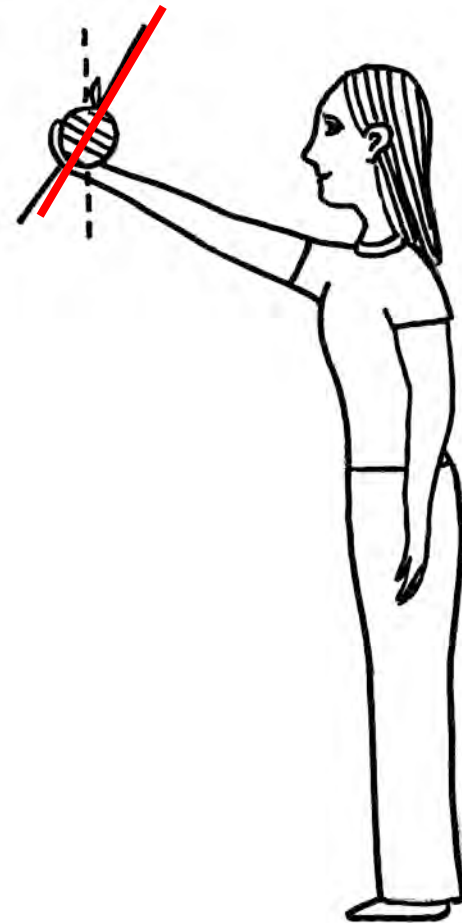
# Equinox Spring / Fall



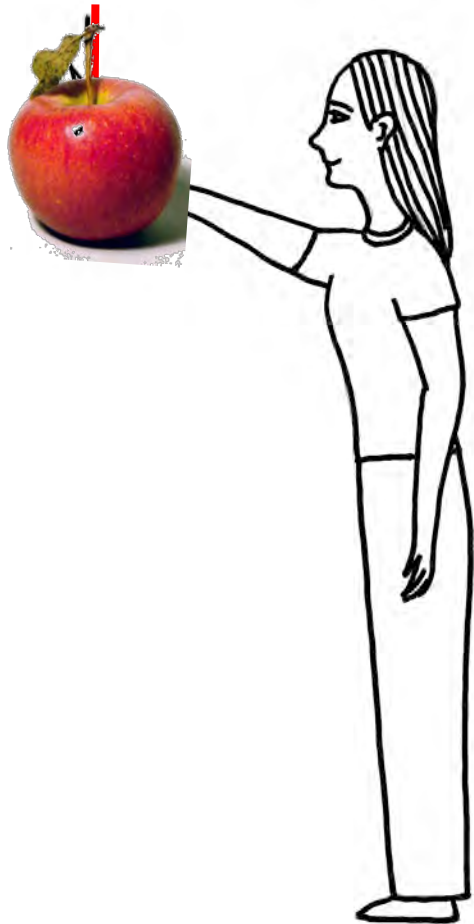
# Winter Solstice



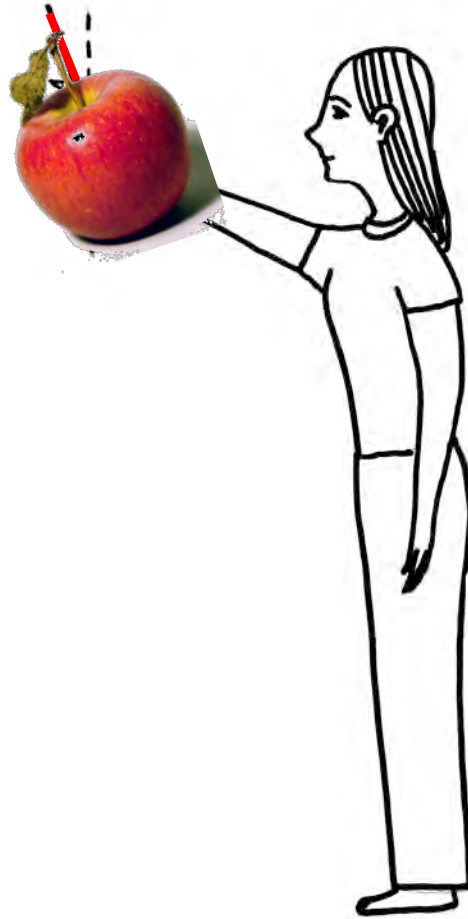
# Summer Solstice



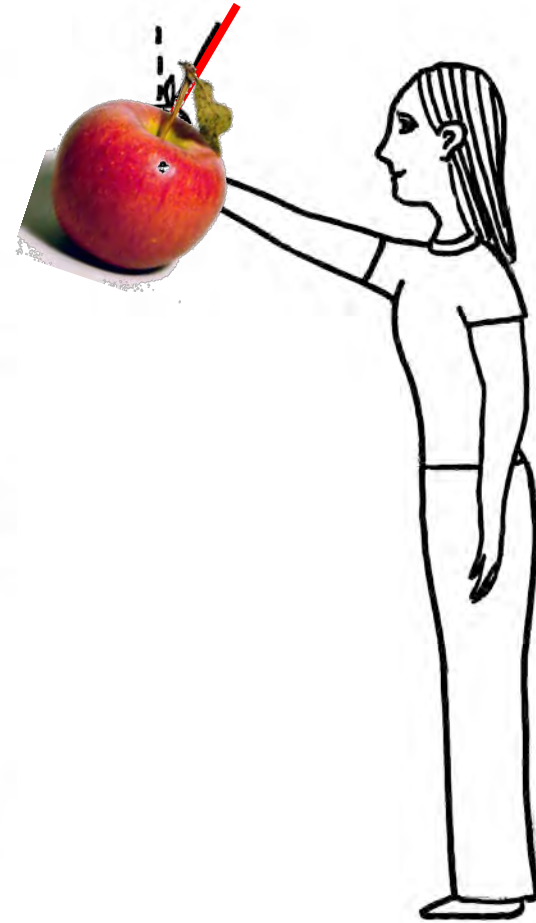
# Equinox Spring / Fall



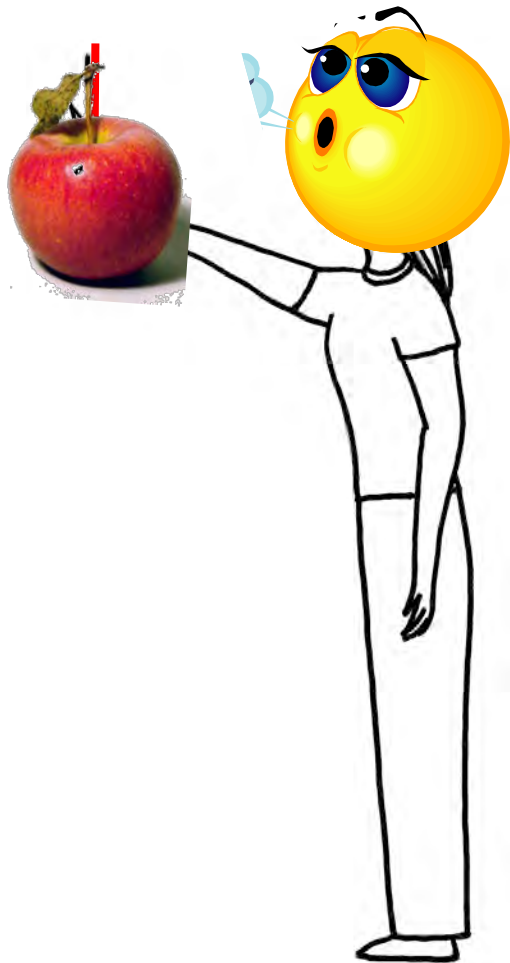
# Winter Solstice



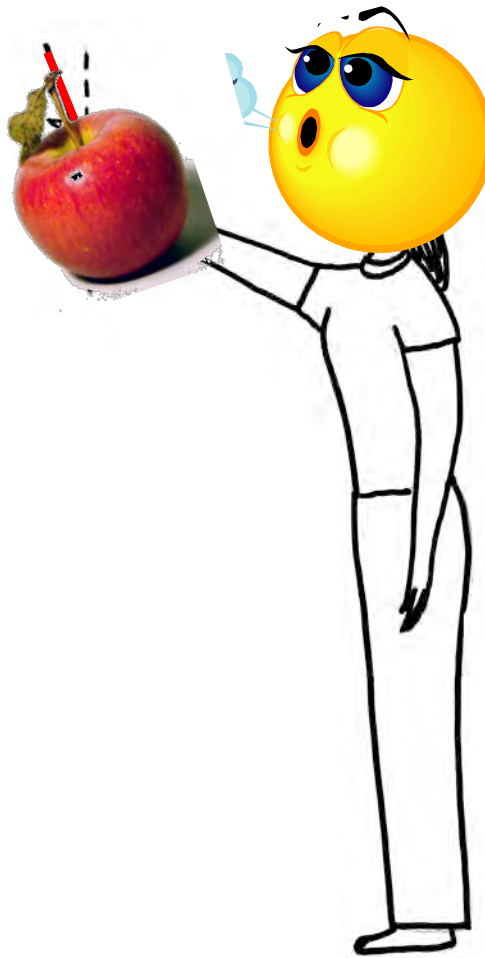
# Summer Solstice



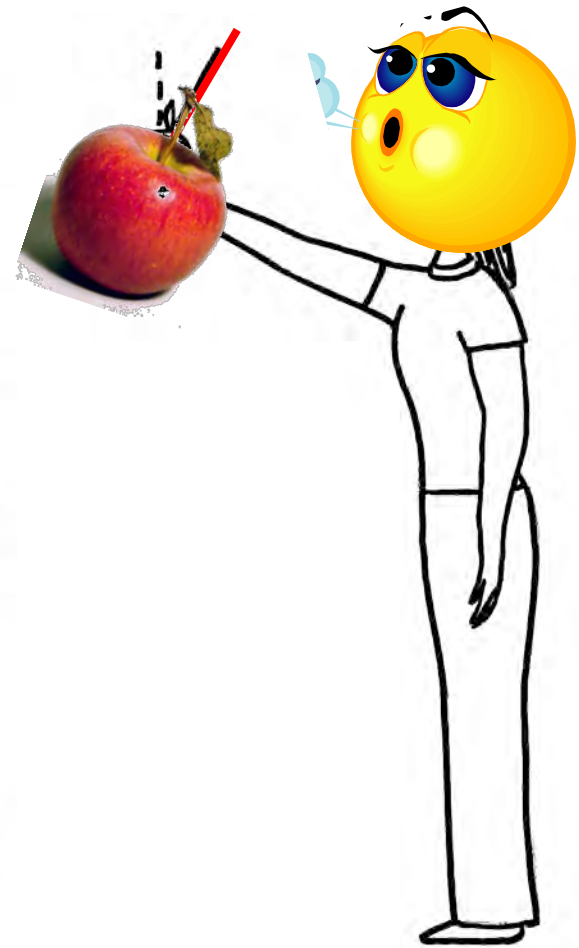
**Equinox**  
**Spring / Fall**



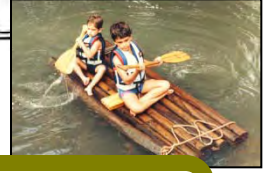
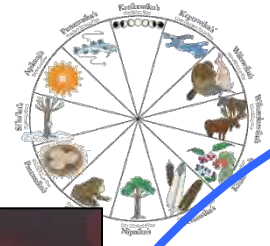
**Winter**  
**Solstice**



**Summer**  
**Solstice**



# OUTLINE OF TALK



Part 1: A conceptual framework  
exploring our sciences

Pattern smarts

Four Big Pictures  
for  
Two-Eyed Seeing

Conclusion

Introduction

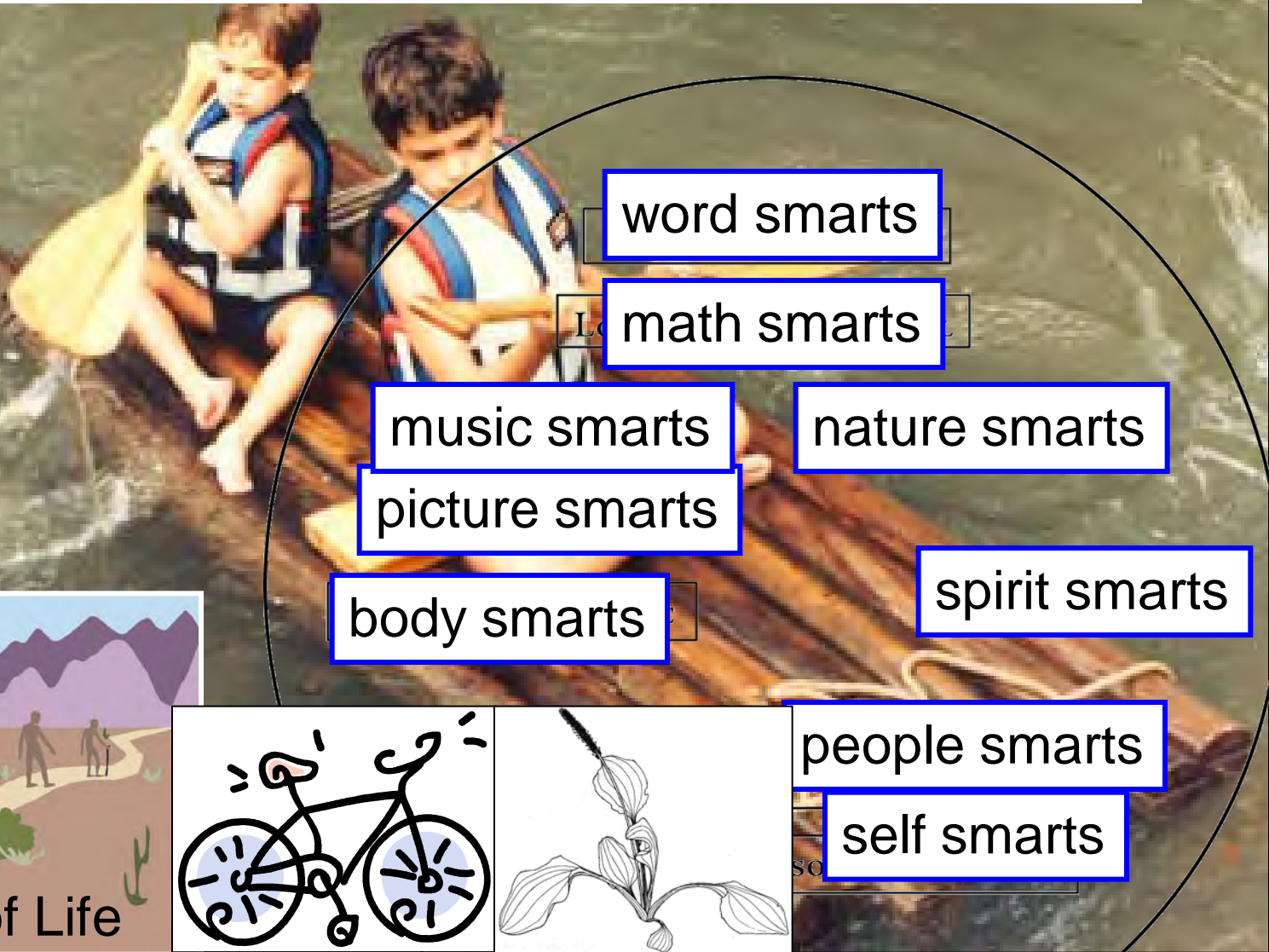
**Integrative Science**  
within an ongoing  
Co-Learning Journey

Science as  
“pattern stories”



Journey of Life

# LEARNING & DOING SCIENCE ... using ALL our "pattern smarts"



word smarts

math smarts

music smarts

nature smarts

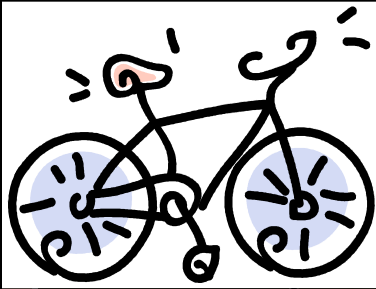
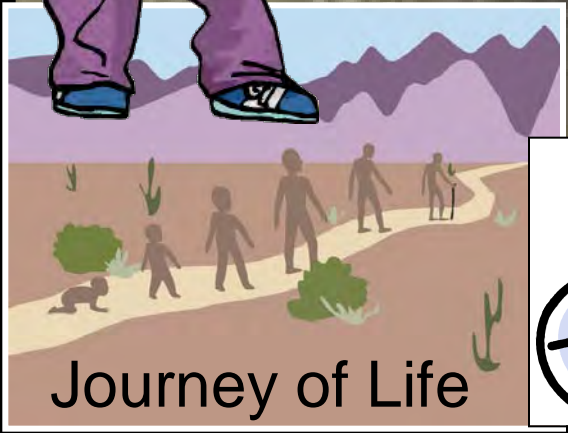
picture smarts

body smarts

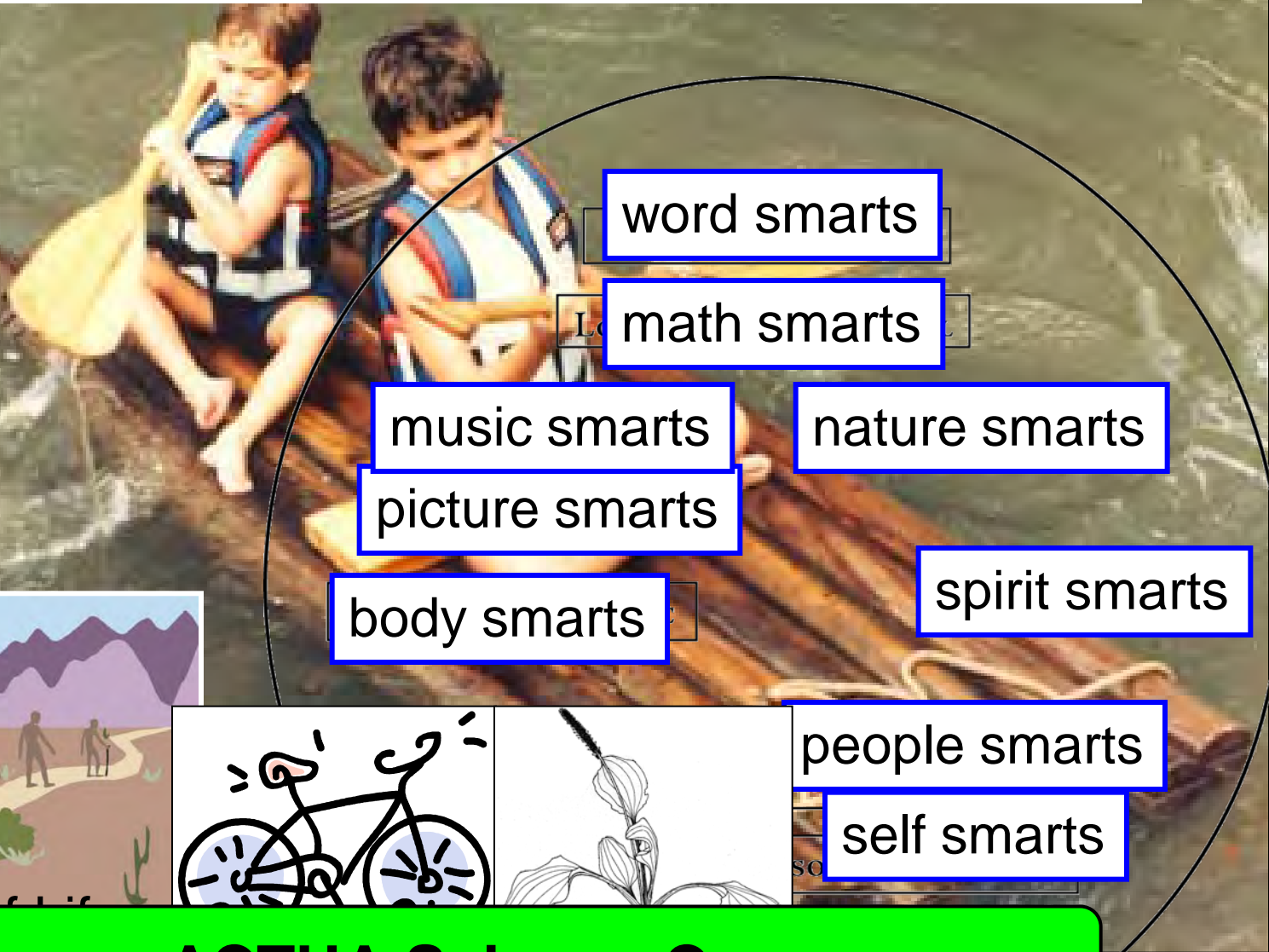
spirit smarts

people smarts

self smarts



# LEARNING & DOING SCIENCE ... using ALL our "pattern smarts"



word smarts

math smarts

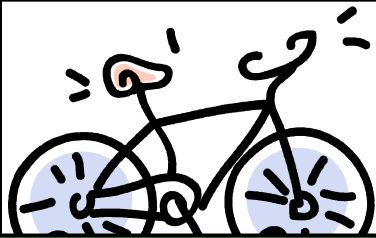
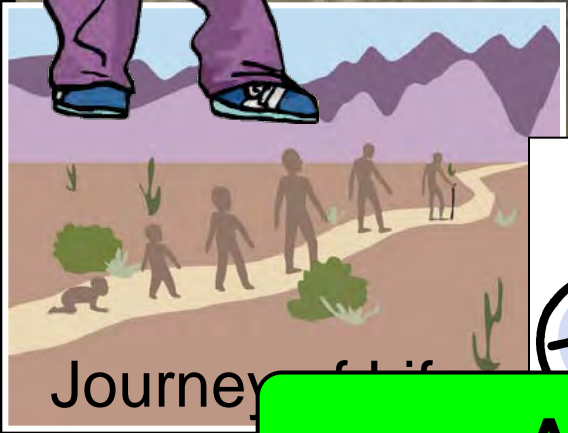
music smarts

nature smarts

picture smarts

body smarts

spirit smarts



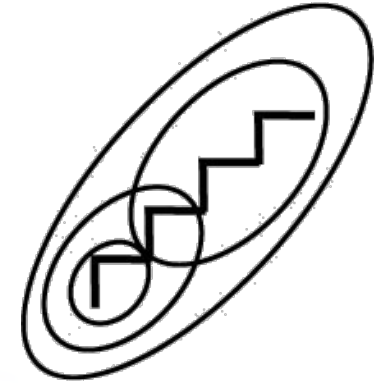
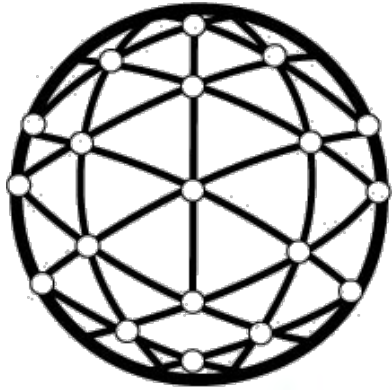
people smarts

self smarts

**ACTUA Science Camps**



# stories of our interactions with and within nature



## Indigenous Science



images from: Aboriginal or

photo credit: NRC



## Western Science



# ACTUA Science Camps

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



Wela'ioq / Thank you



Mi'kmaq Elders

