



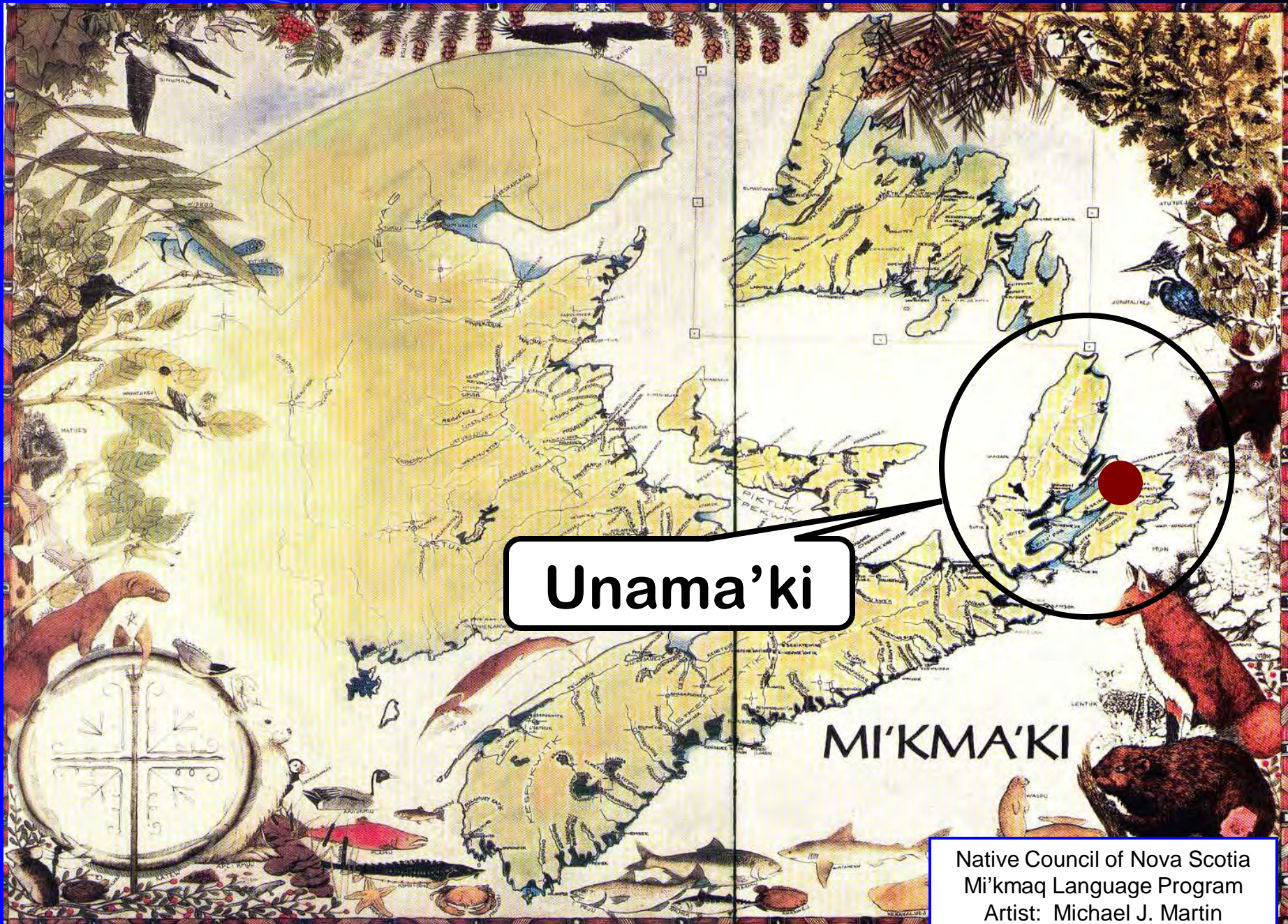
Cheryl Bartlett, CRC in Integrative Science, UCCB  
**Integrative Science: “newness” for the 21st Century**

*presentation for:* Advisory Board, Atlantic Aboriginal Health Research Program;  
Acadia University, Wolfville, NS, 25 September 2004



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin



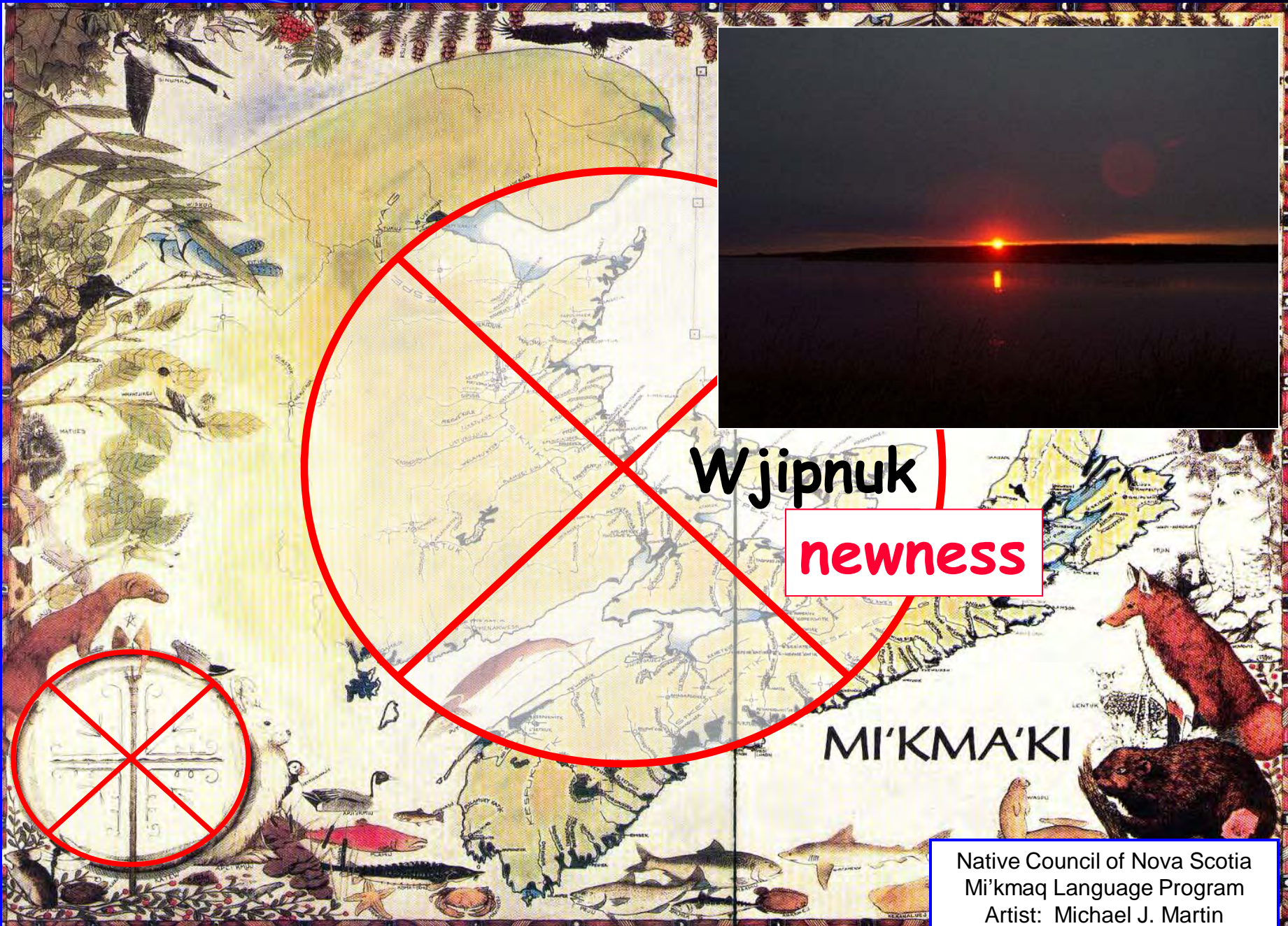


**Unama'ki**

**MI'KMA'KI**

Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin





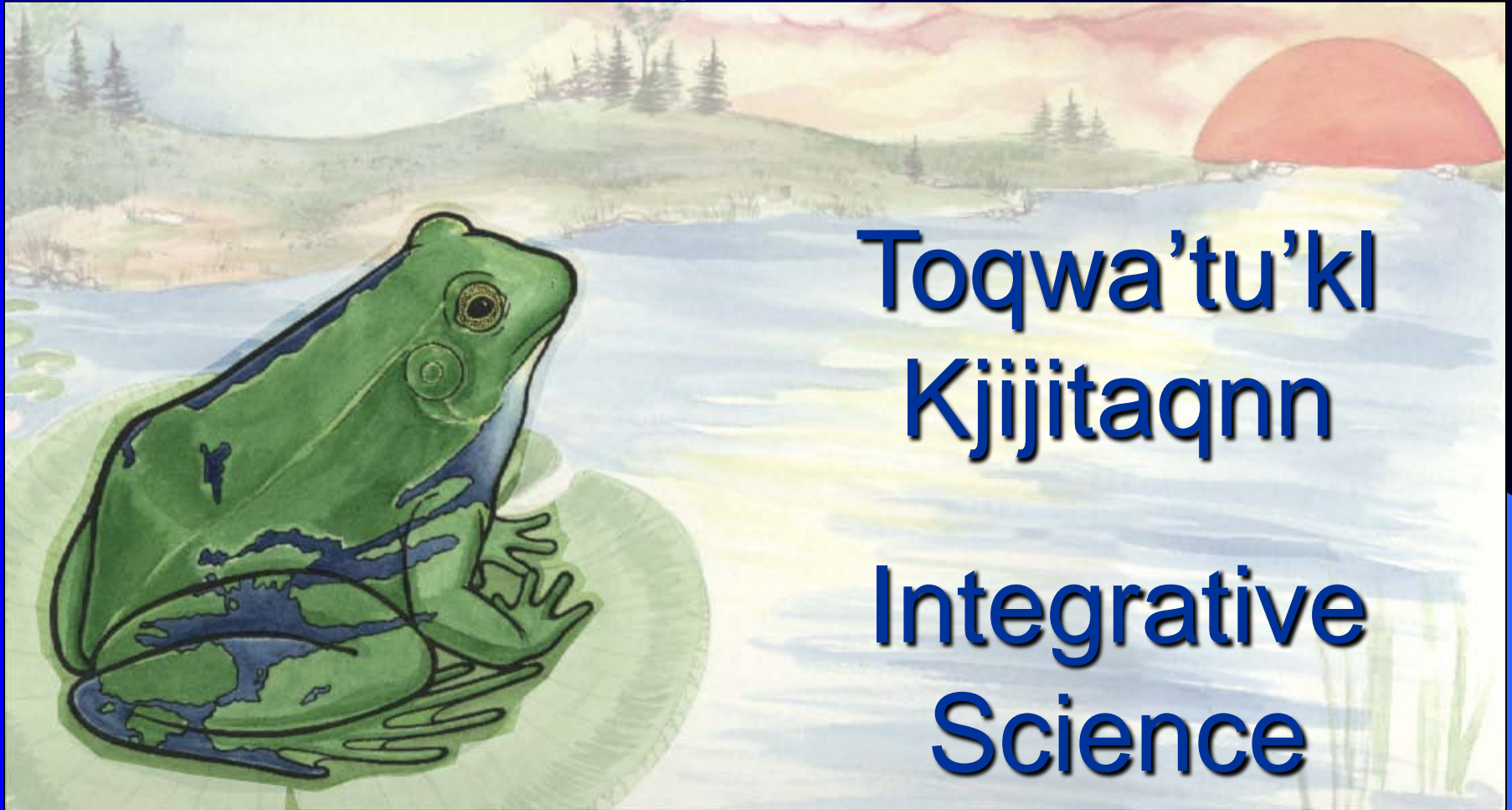
Wjipnuk

newness

MI'KMA'KI

Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin

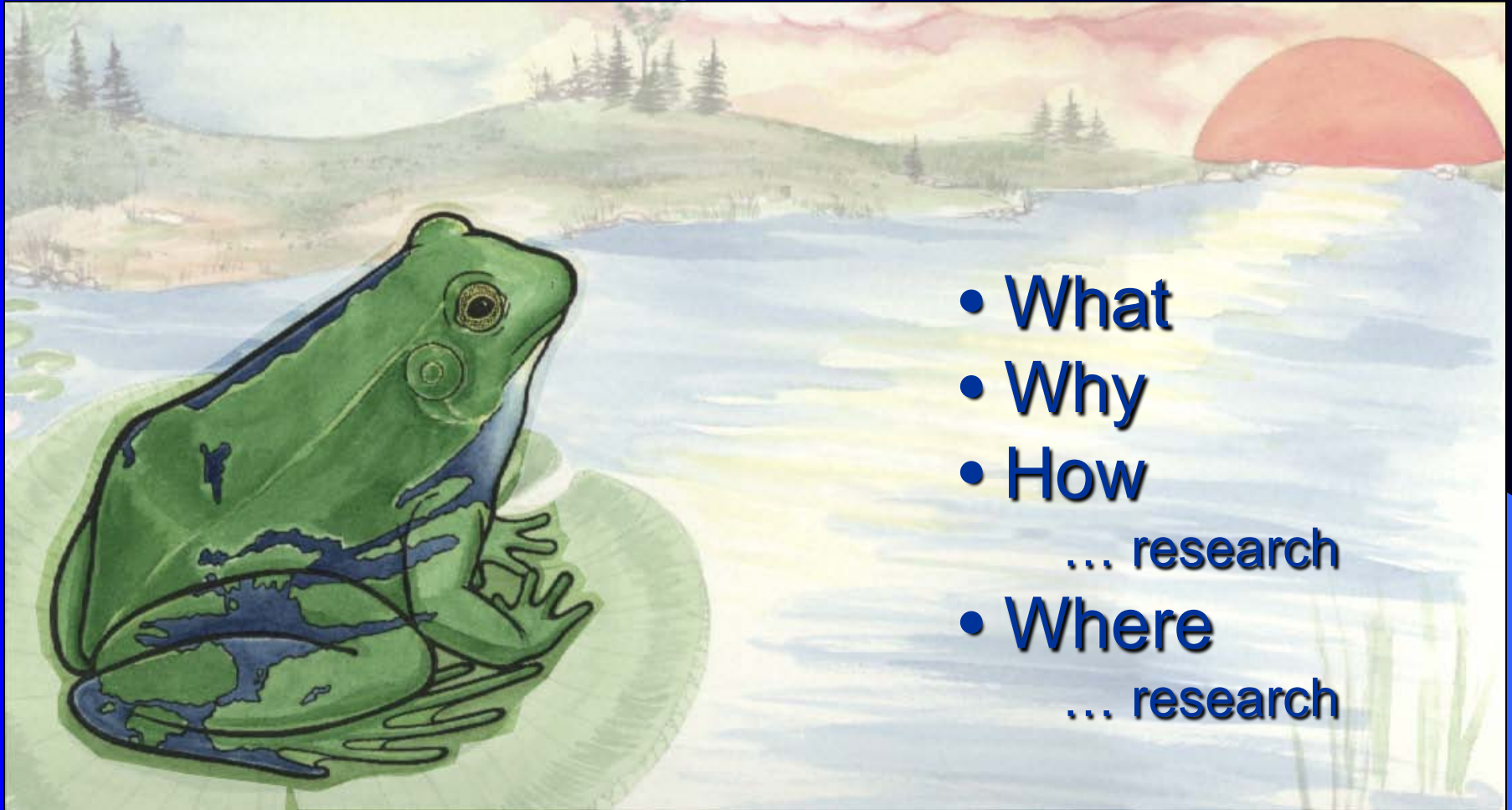




**Toqwa'tu'kl  
Kjijitaqnn**

**Integrative  
Science**

Artist Basma Kavanagh



- **What**
- **Why**
- **How**  
... research
- **Where**  
... research

Artist Basma Kavanagh

# What? Integrative Science ... is:

\* plus

university  
science



Breton University

4 year  
degree program



# Integrative Science ... is:



Artist Basma Kavanagh

# Integrative Science ... is:

**TK**

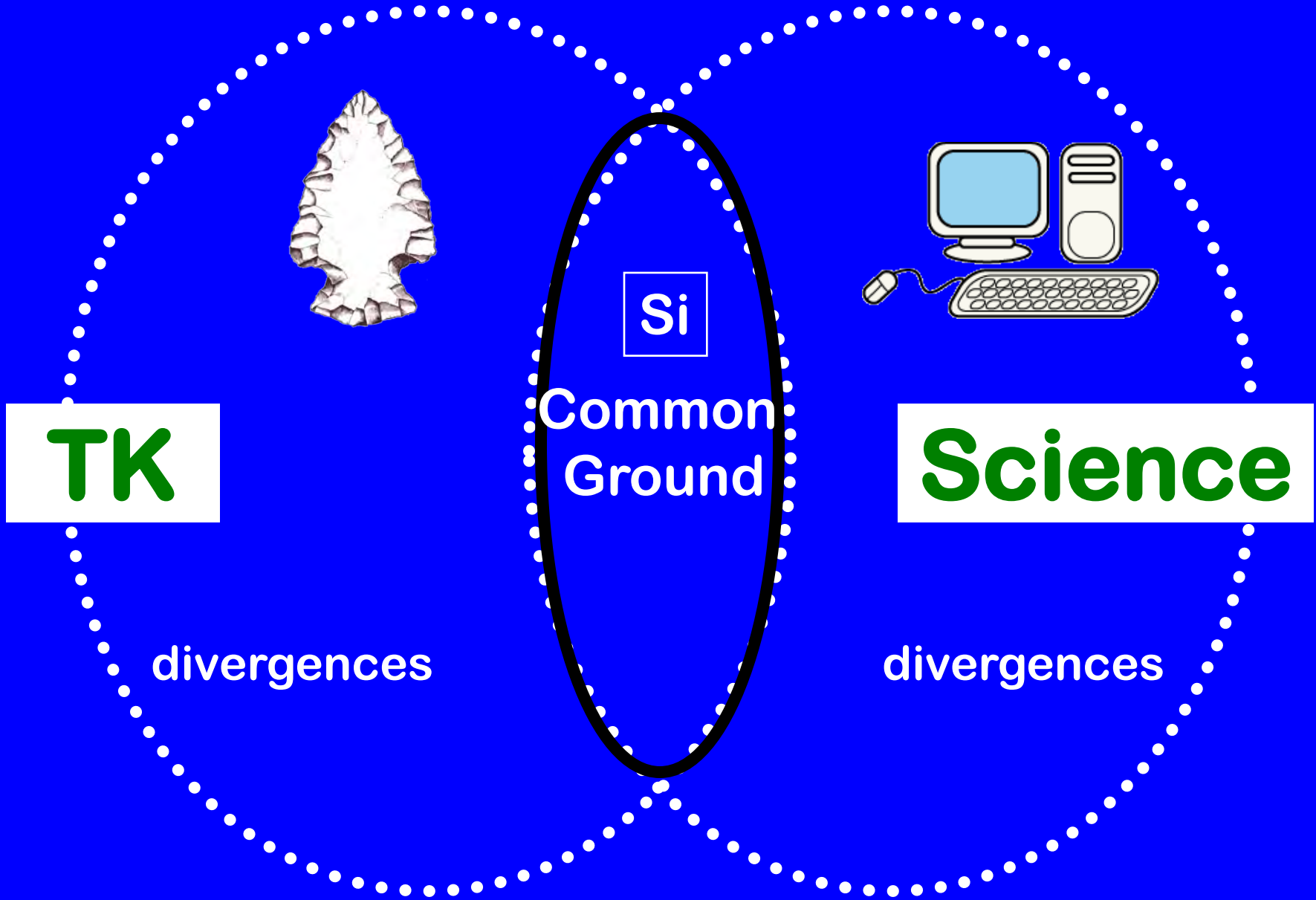
**Science**

“bringing knowledges together”  
Aboriginal – Western scientific





# Integrative Science: knowledges together







**PATTERN**



**TK**

towards resonance  
of understanding

**WEAVING**



**Science**

towards construction  
of understanding

**UN-WEAVING**



# TK & Science ...

## "integrative framework"

"integrative" ... both, plus

- our role (you & me) in "the knowing"
  - our common ground
  - our differences
- our journey forward, together

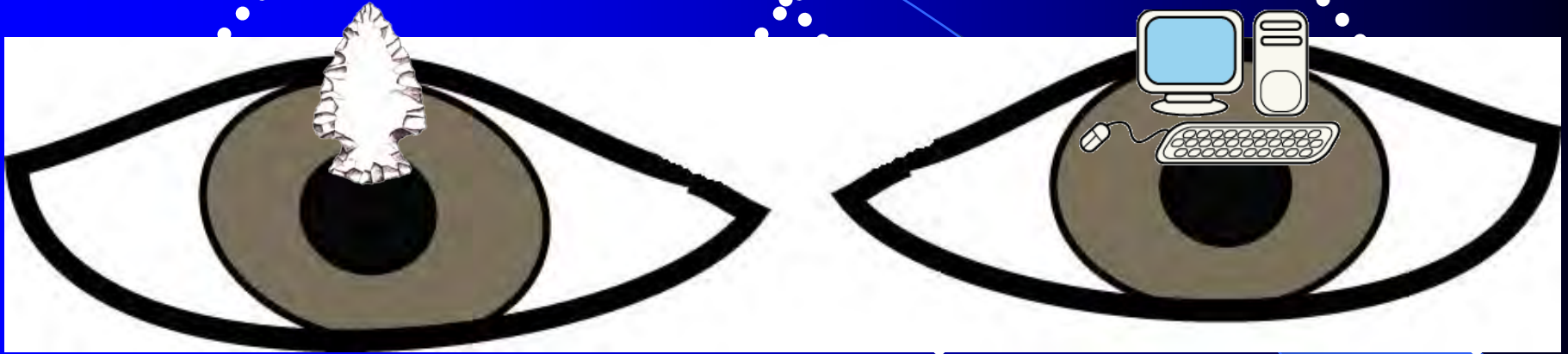
vs.

"integrated" ... science, plus  
bits and pieces of TK



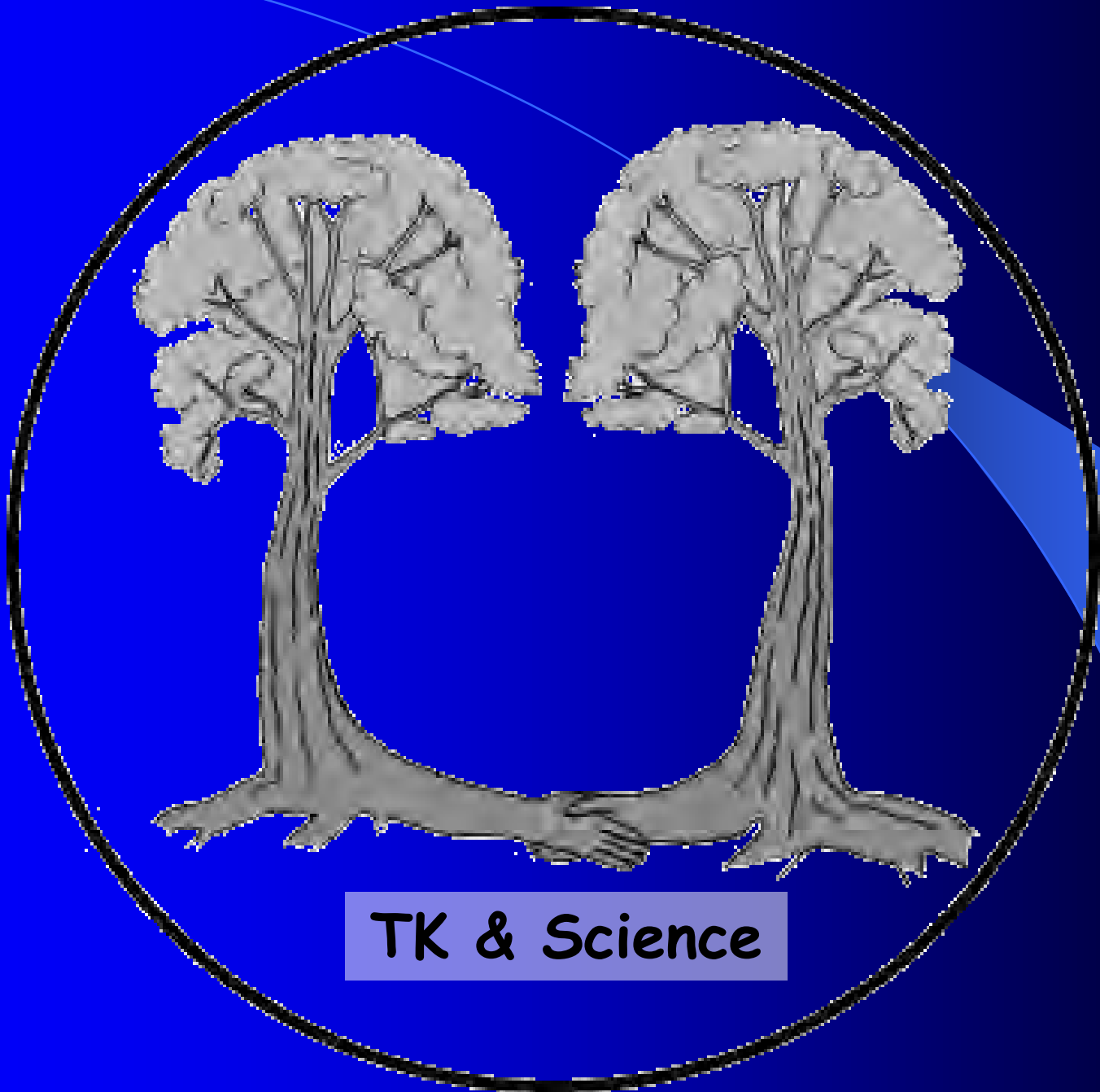
# “co-seeing”

Albert Marshall, Elder, Eskasoni First Nation, Unama'ki



**TK**

**Science**

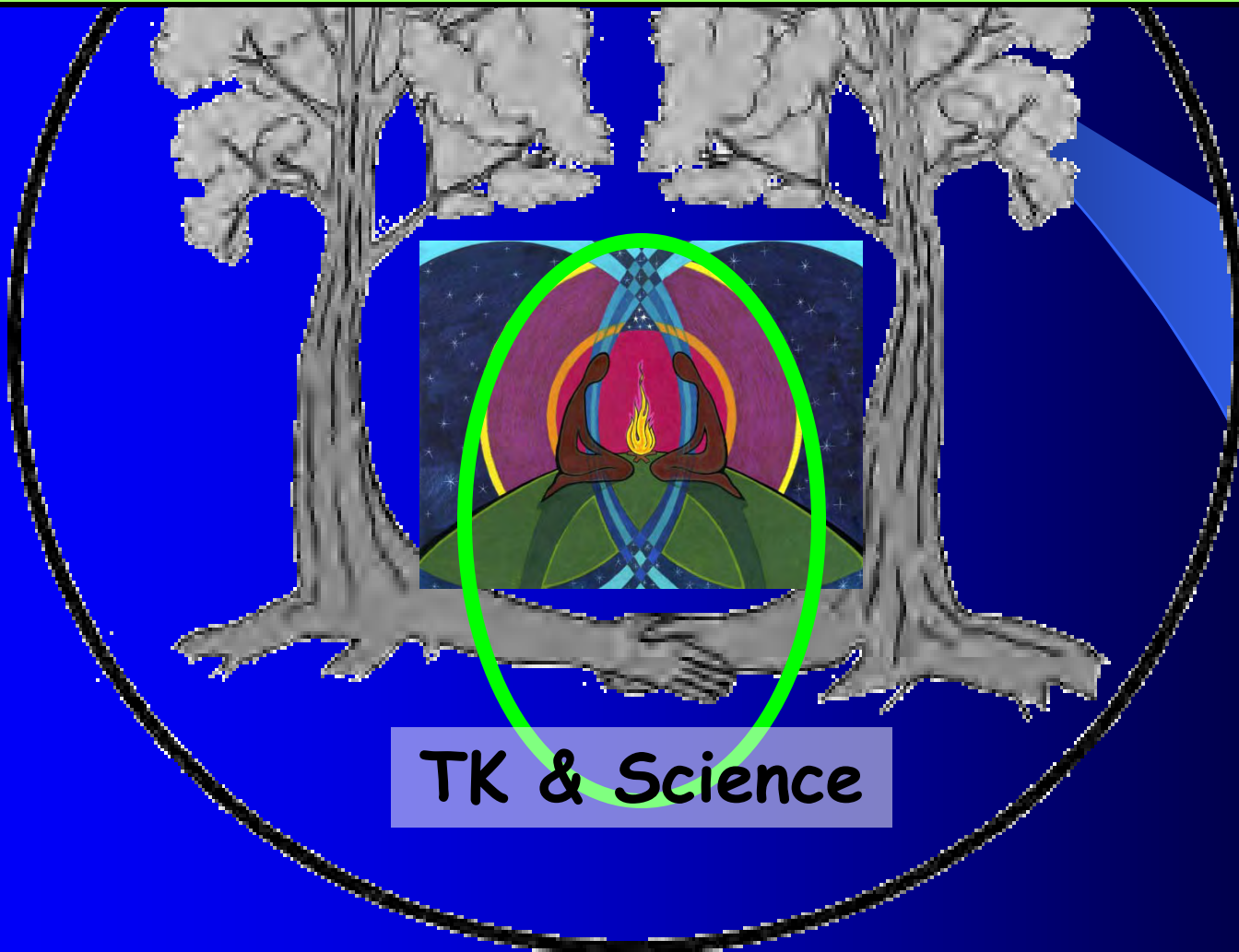


TK & Science

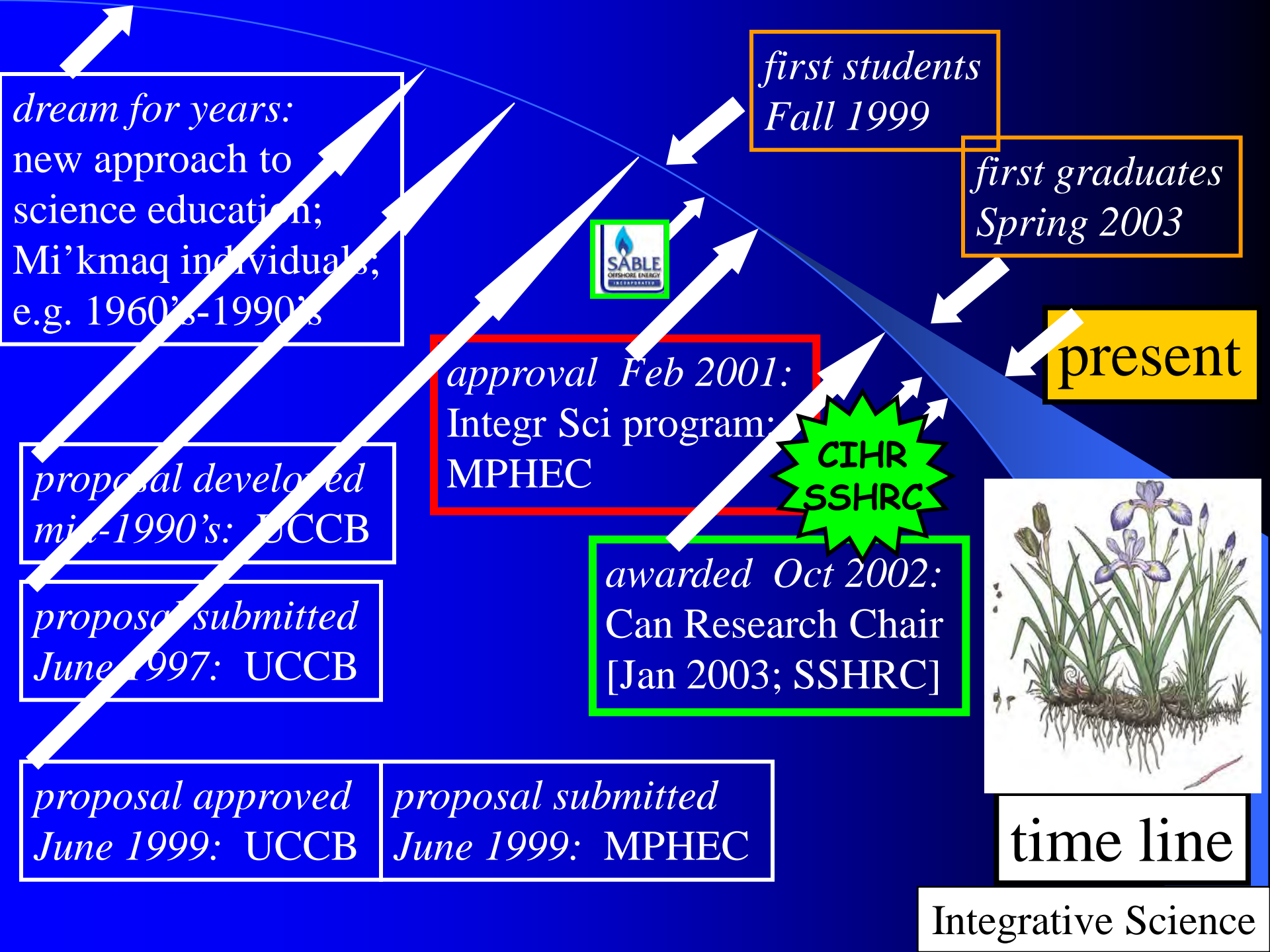


Go into a forest, you see the birch, maple, pine.  
Look underground and all those trees are holding  
hands. We as people must do the same.

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



TK & Science



*dream for years:  
new approach to  
science education;  
Mi'kmaq individuals;  
e.g. 1960's-1990's*

*proposal developed  
mid-1990's: UCCB*

*proposal submitted  
June 1997: UCCB*

*proposal approved  
June 1999: UCCB*

*proposal submitted  
June 1999: MPHEC*

*approval Feb 2001:  
Integr Sci program:  
MPHEC*

*awarded Oct 2002:  
Can Research Chair  
[Jan 2003; SSHRC]*

*first students  
Fall 1999*

*first graduates  
Spring 2003*

*present*



**time line**

**Integrative Science**



# Why?



today's young adults ...

# University Science Students

**UCCB 1999-2004:  
80-90 Mi'kmaq  
students ...  
1<sup>st</sup> year science**





# University Science Students



**UCCB 2004-2005:  
Mi'kmaq science\*  
students (approx.)**

- 1<sup>st</sup> yr: 10
- 2<sup>nd</sup> yr: 12
- 3<sup>rd</sup> yr: 6
- 4<sup>th</sup> yr: 10

-----  
• grads: 4

# University Science Students



all years: research projects





# Why?



... and the next generation





image by Arlene (Dozay) Christmas for  
Mi'kmawey Debert Cultural Centre



Challenges?





image by Arlene (Dozay) Christmas for  
Mi'kmawey Debert Cultural Centre

living knowledge  
... TK: yes  
... WSK education:  
more "book-based"

spirituality  
... TK: yes  
... WSK: "no"



TK

1<sup>st</sup>

Challenges?

disciplinary  
... TK: no  
... WSK: yes

students ...  
more familiar  
with computers  
than nature

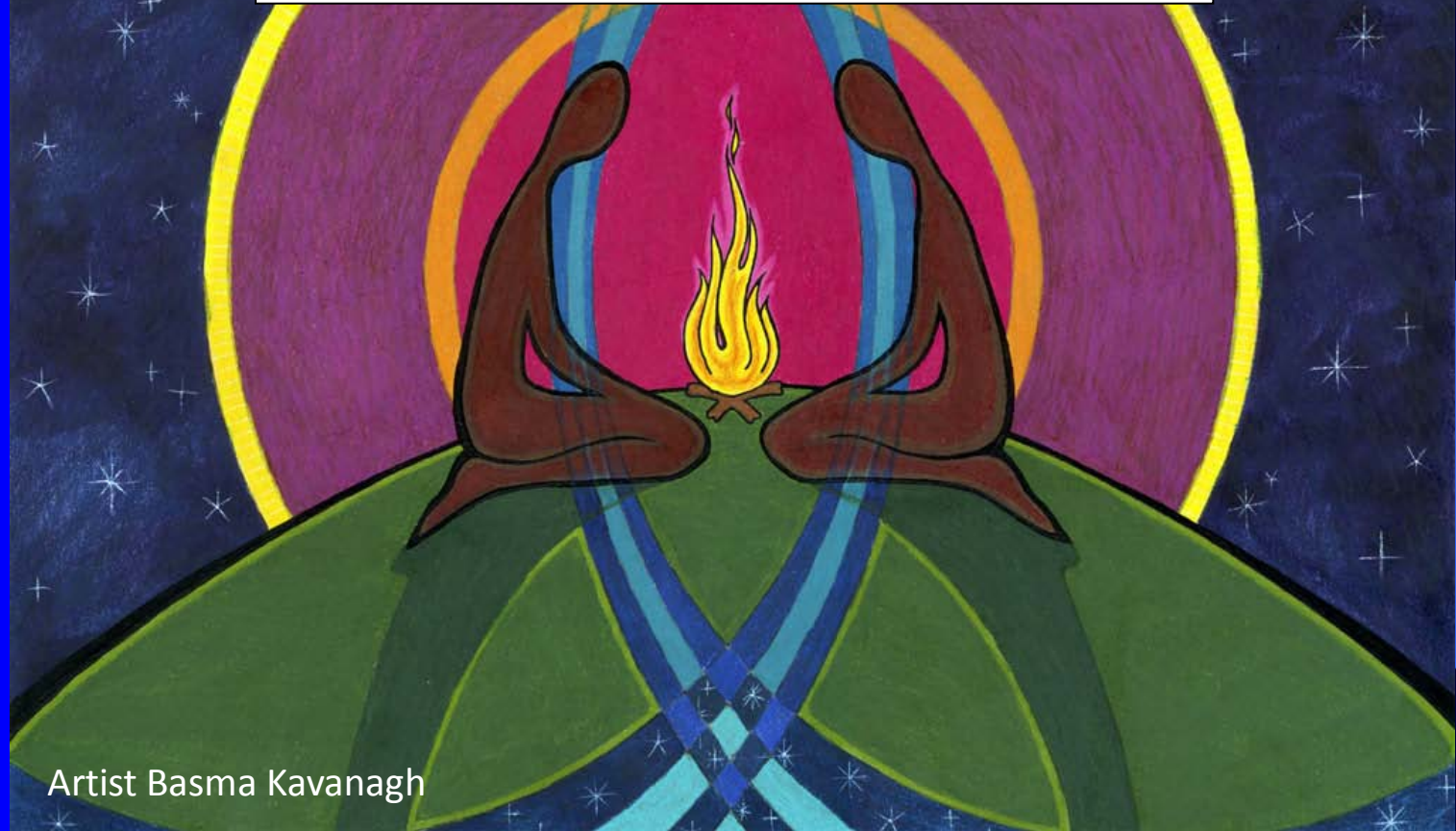


WSK



**Ta'n tujiw kijjitaqn tela'tasik  
kepme'ktn ketloqo kisiktpi'taskitew.**

Only when knowledge is conditioned  
by respect can it be truly shared.



Artist Basma Kavanagh

**TK & Science**



# How?



Artist Basma Kavanagh

Mi'kmaq Community Elders  
and Resource People



1



2

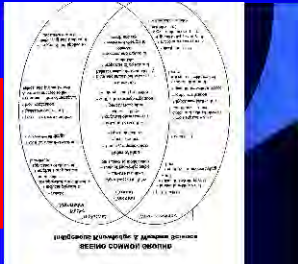
TK literature

3

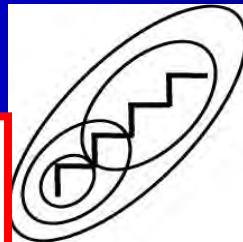
students  
out-of-doors



6



5



4

Aboriginal concepts  
& pedagogy

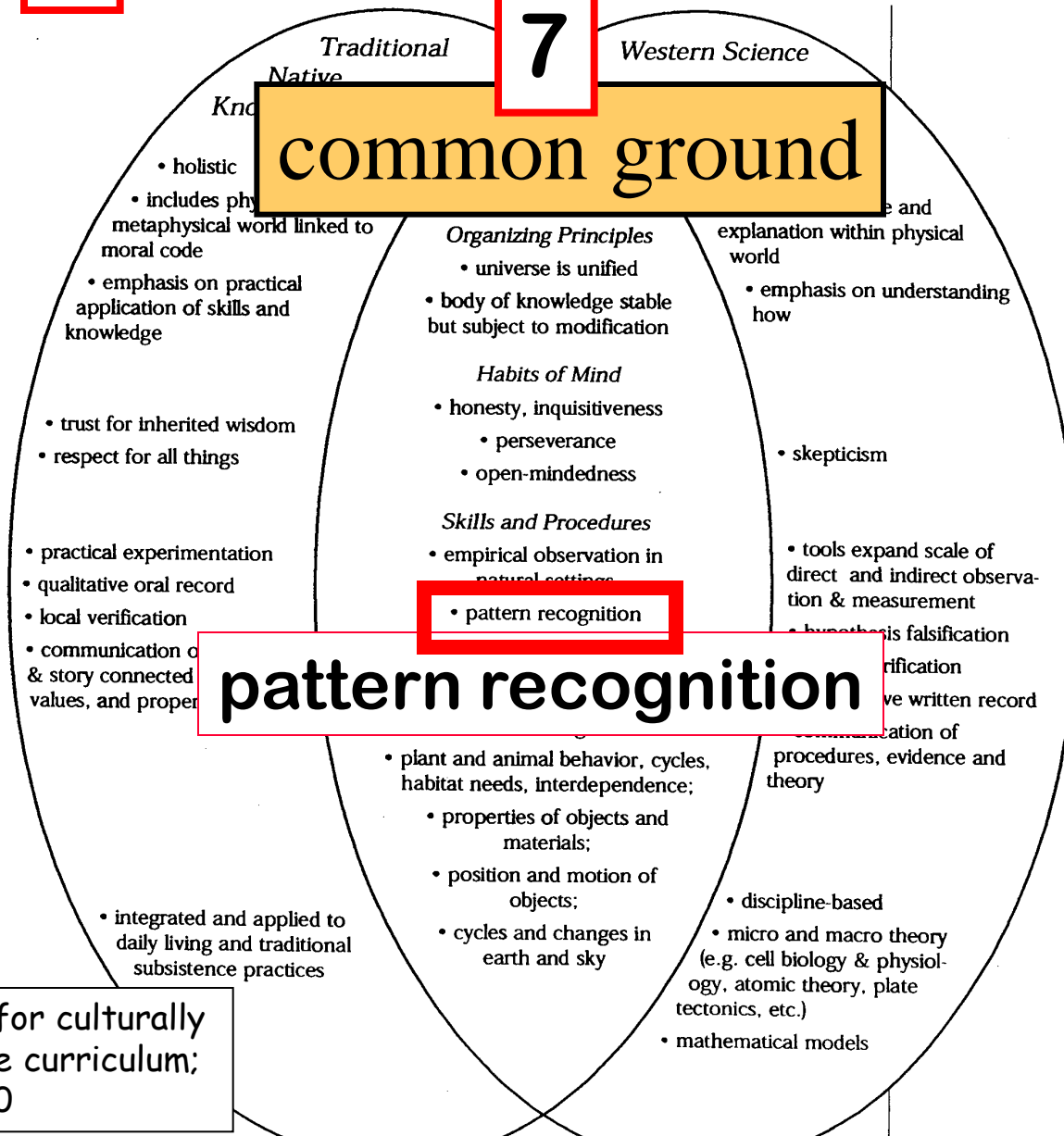


Western science: cosmology-physics-  
chemistry-geology-biology-consciousness

6

# Univ. of Alaska (Fairbanks) Indigenous Knowledge & Western Science

7



from: Handbook for culturally responsive science curriculum; S. Stephens, 2000



# How?

common ground

**PATTERN RECOGNITION**



Artist Basma Kavanagh

Mother  
Earth



PATTERN

PATTERN RECOGNITION

TK & Science

Both are based on observations of the  
environment

Both result from the same intellectual  
process of creating order / harmony er.





recognize patterns





recognize  
patterns





recognize  
patterns

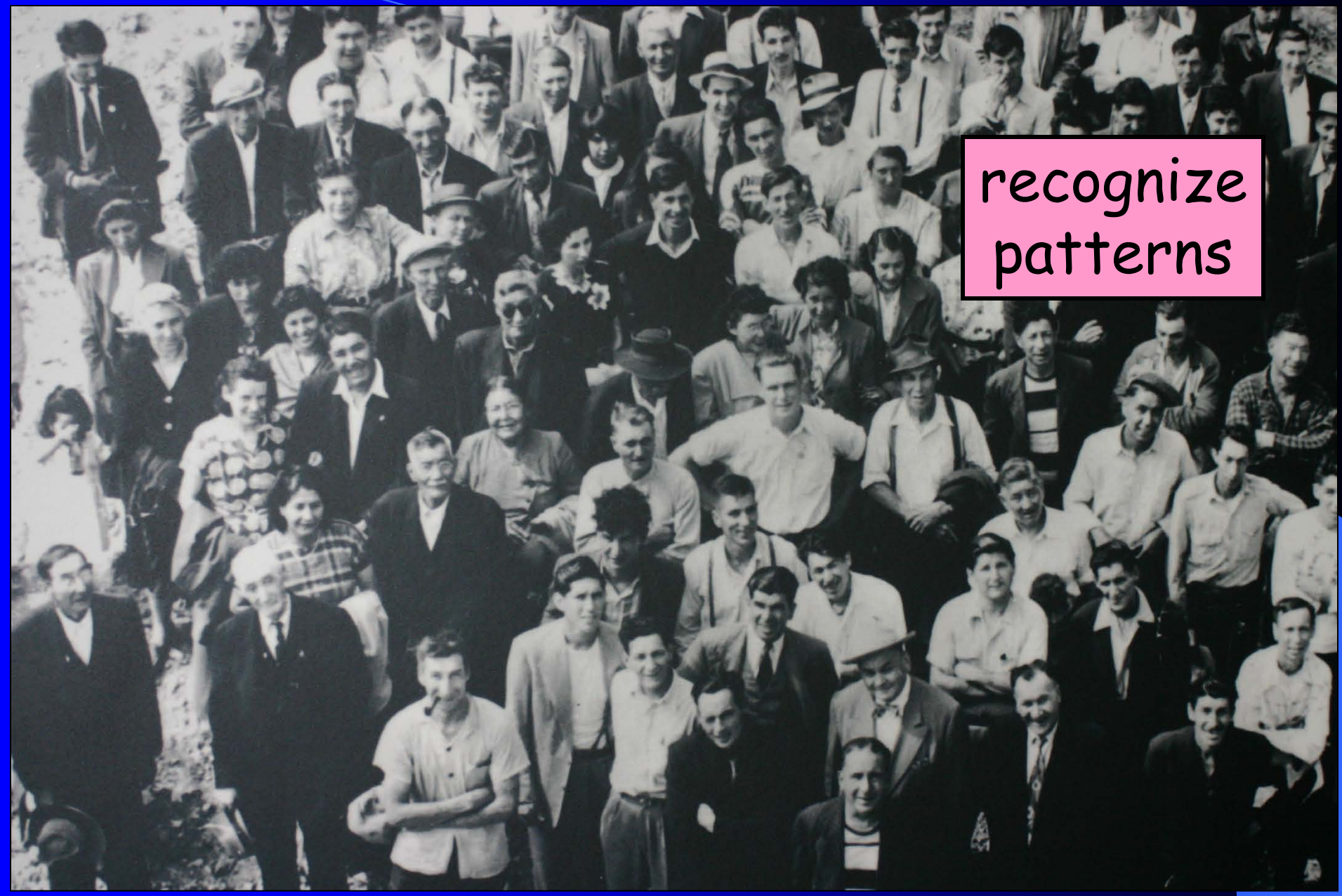


recognize  
patterns

Artist Basma Kavanagh



recognize  
patterns





recognize  
patterns





A wide-angle photograph of a winter landscape. In the foreground, there is a snow-covered bank with some dry, brown grasses. A large body of water, possibly a lake or a wide river, occupies the middle ground, reflecting the overcast sky. The water's surface is textured with small ripples. On the right side, a dense forest of evergreen and bare deciduous trees lines the shore. In the far distance, rolling hills or mountains are visible under a heavy, grey sky with some light breaking through the clouds. The overall mood is quiet and somewhat somber due to the winter setting.

recognize  
patterns

recognize  
patterns







recognize  
patterns



Artist Basma Kavanagh



recognize  
patterns







recognize  
patterns



recognize

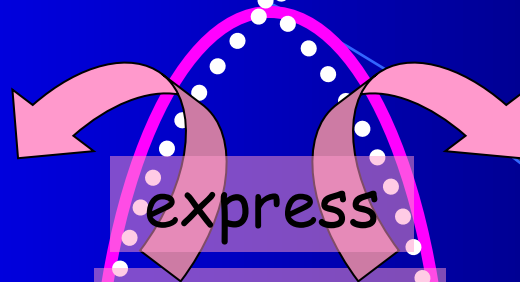
environmental patterns

express





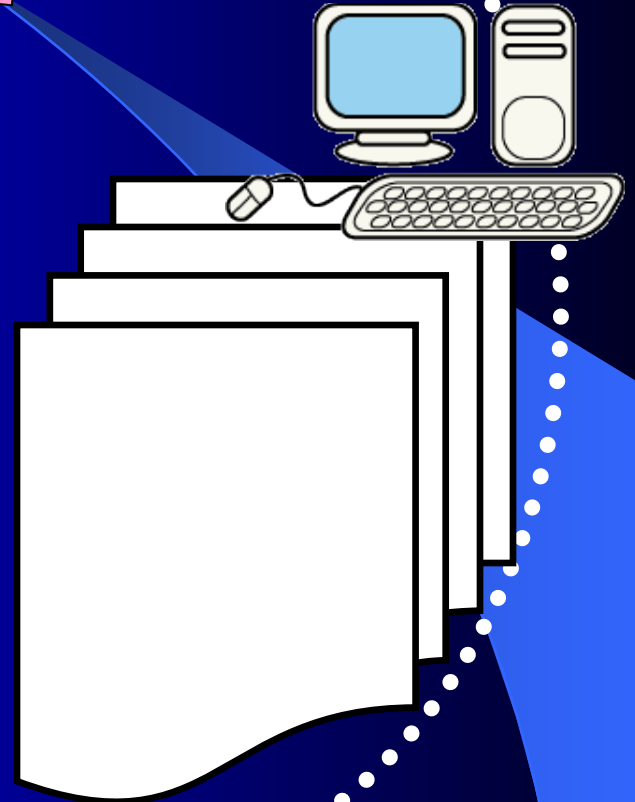
# “pattern smarts”



express

recognize

environmental  
patterns



common ground

# “pattern smarts”

multiple intelligences theory

(H. Gardner, Harvard Univ.)

use ... tied to  
cultural value

- numbers
- language
- music
- body (e.g. dance)
- spatial
- other people ... all creatures
- self
- naturalist
- spiritual



# “pattern smarts”

participatory  
interconnectedness

masterful  
prediction & control

all my relations

- numbers
- language
- music
- body (e.g. dance)
- spatial
- all creatures
- self
- naturalist
- spiritual

environmental  
patterns

mathematical models

- numbers
- language
- naturalist



differences



living, oral

theory, written

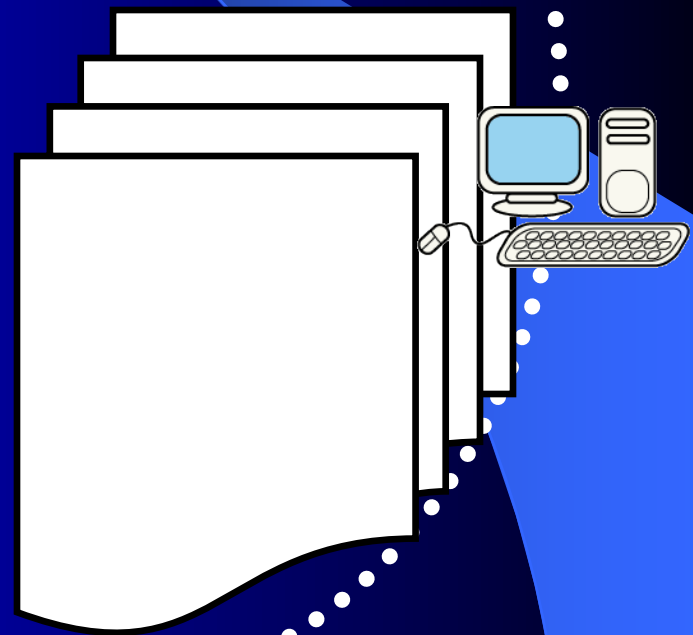
participatory  
interconnectedness

masterful  
prediction & control

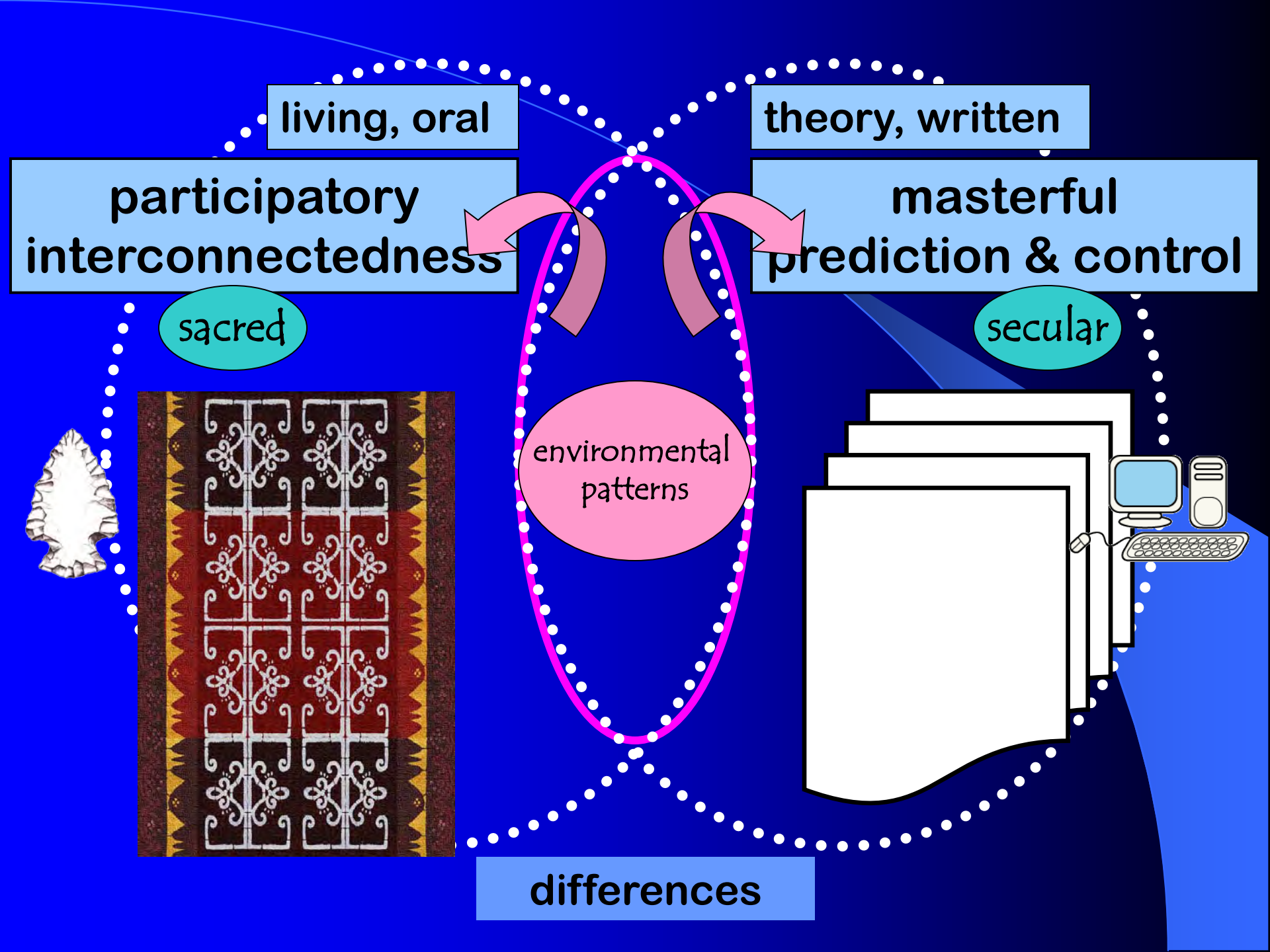
sacred

secular

environmental  
patterns



differences





# PATTERN



## WEAVING

- relationship
- respect
- reverence
- reciprocity
- ritual
- repetition
- responsibility

## UN-WEAVING

- data collection
- data analysis
- hypothesis  
(induction, deduction)
- testing
- theory



# How?



Social Sciences and Humanities  
Research Council of Canada

Conseil de recherches en  
sciences humaines du Canada

**SSHRC**

**Our Journey, forward ...  
together**

enriching the common ground ...

pattern recognition  
... into science curricula



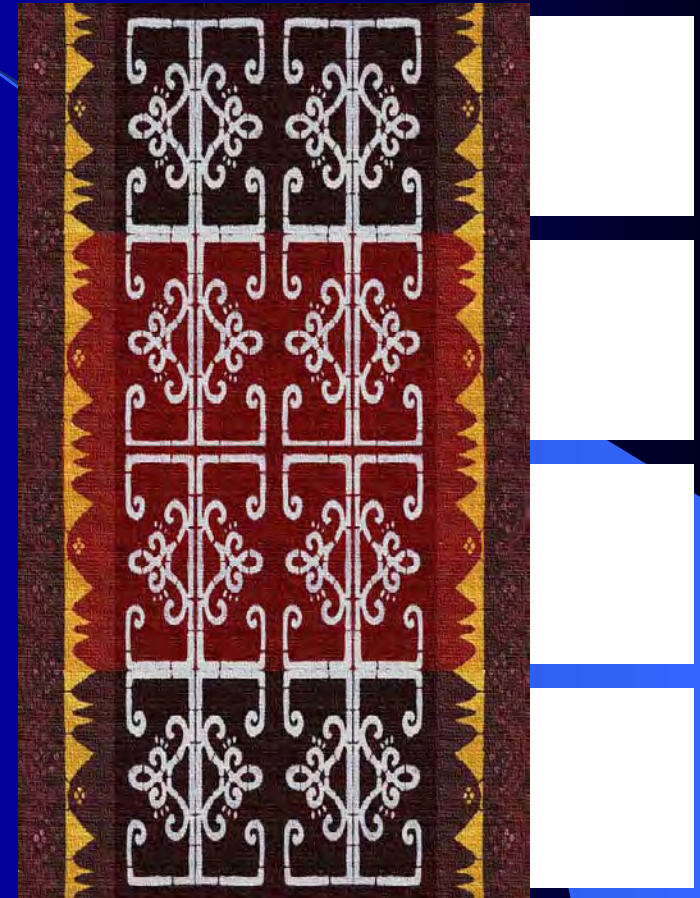
# PATTERN

## conceptual framework

natural

ideal

abstract



Mother  
Earth

recognize pattern

express pattern

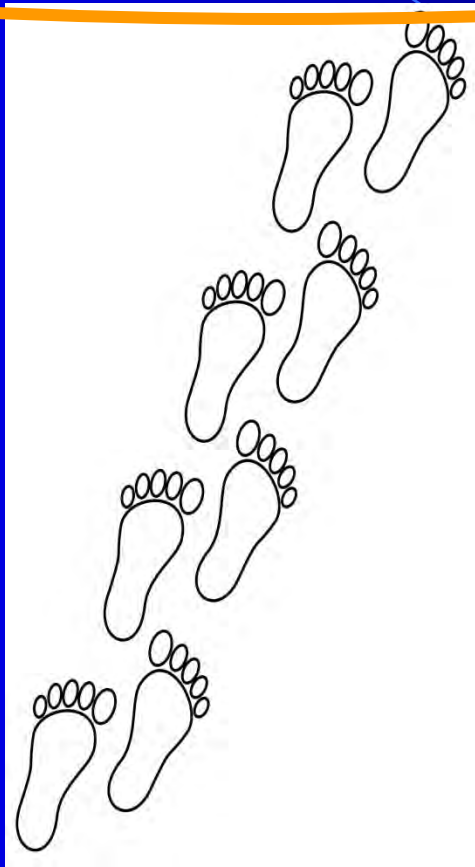
# PATTERN

natural



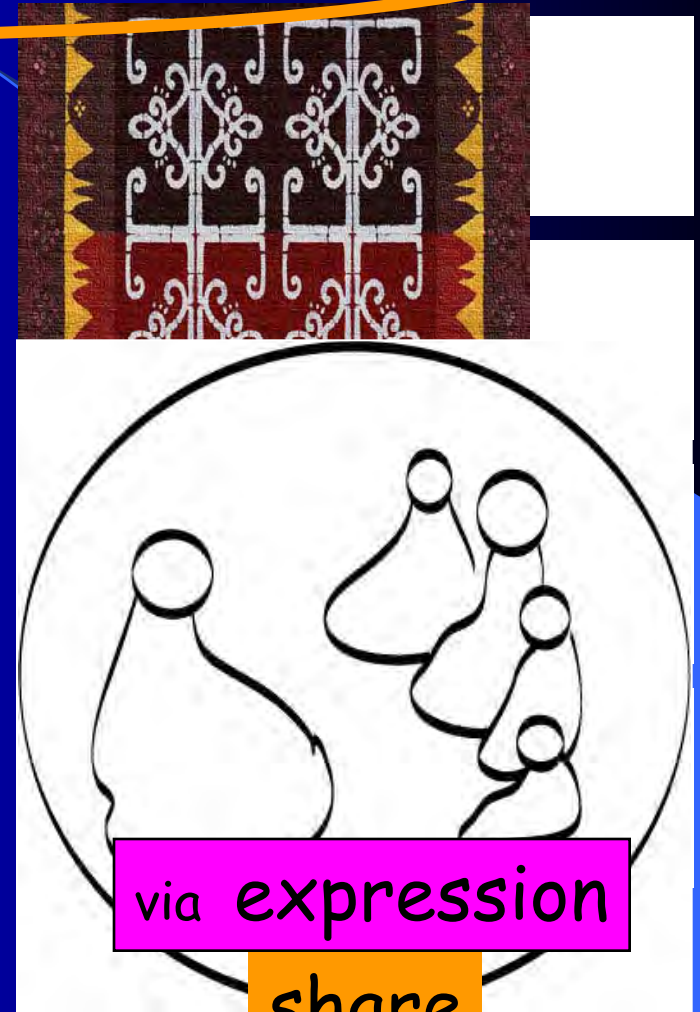
observe

ideal



interpret

abstract



via expression

share



# TK & Science

## pattern smarts

WEAVING

UN-WEAVING

- numbers
- language
- music
- body (e.g. dance)
- spatial
- other people ,  
all creatures
- self
- naturalist
- spiritual



# Traditional Knowledge

participatory  
interconnectedness

... specific ecological context



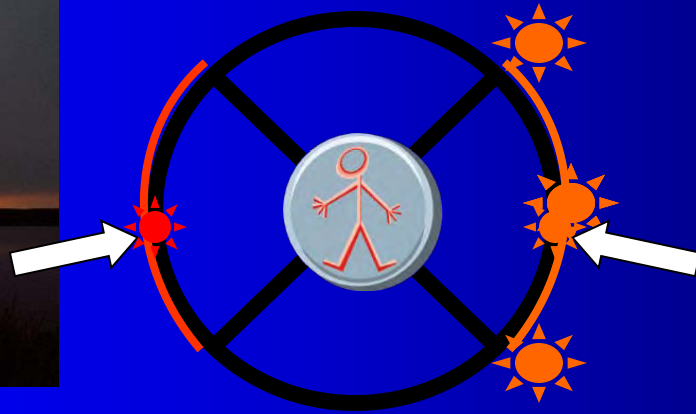


# Medicine Wheel ... "lived relationships"



# Medicine Wheel

layered pattern (weave towards resonance):  
natural                      ideal                      abstract



sunset  
WEST

sunrise  
EAST



**PATTERN**

Grandfather Sun & Mother Earth  
... "lived relationships"



natural

← ADD

ideal

← ADD

abstract

ideal

natural

(layering)

# Medicine Wheel - multiple layers -



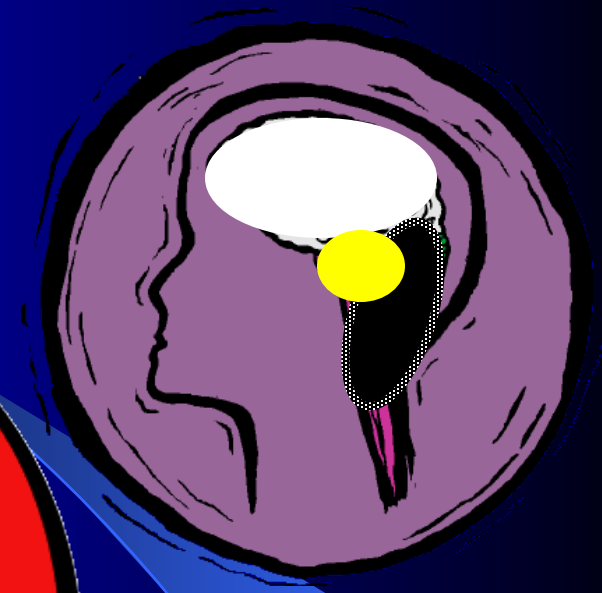
spiritual



in the **patterns** of the animals  
... lessons for humans

**PATTERN**

**cognitive**



**spiritual**



**physical**

**emotional**







**weave PATTERN**

Artist Basma Kavanagh



life affirming



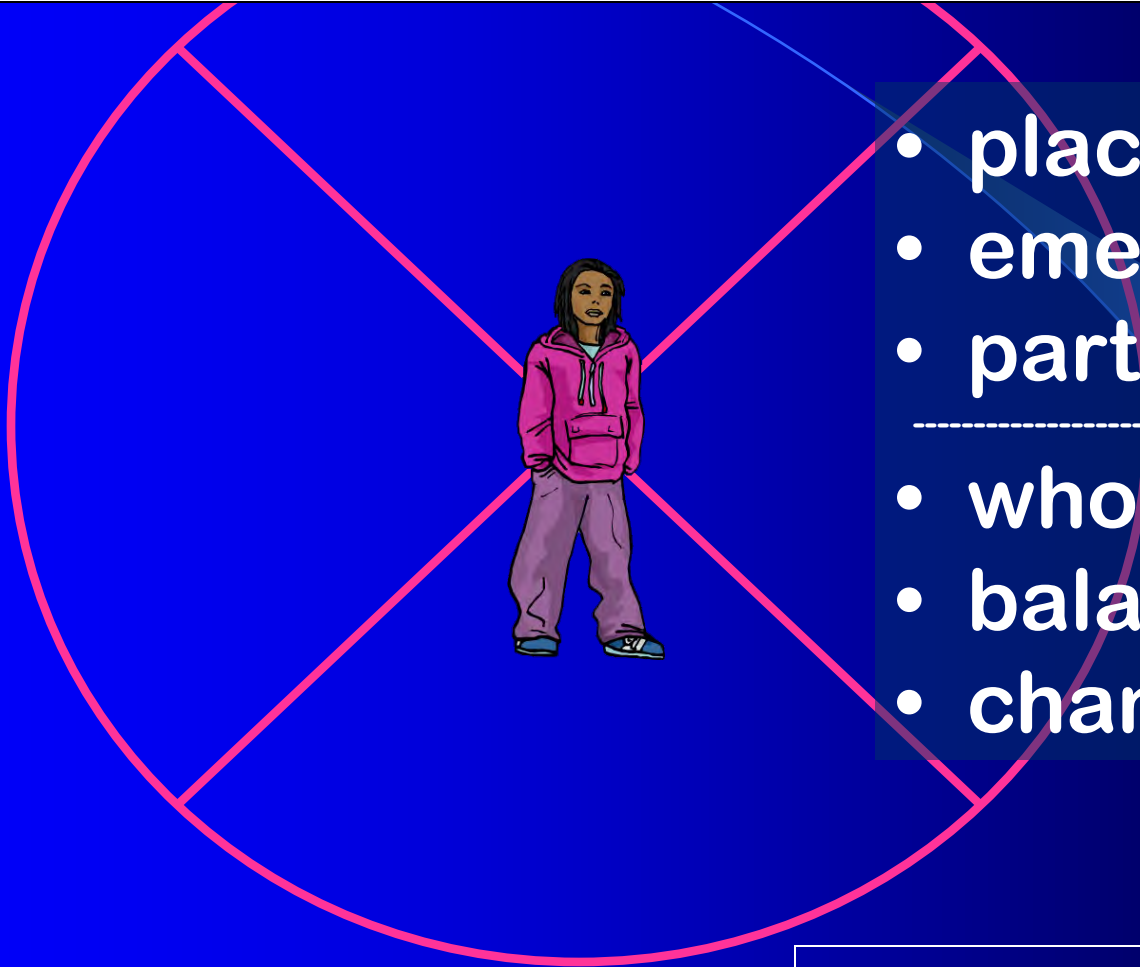
## weave PATTERN

- relationship
- respect
- reverence
- reciprocity
- ritual
- repetition
- responsibility

Artist Basma Kavanagh



sense of ... "my lived relationships"

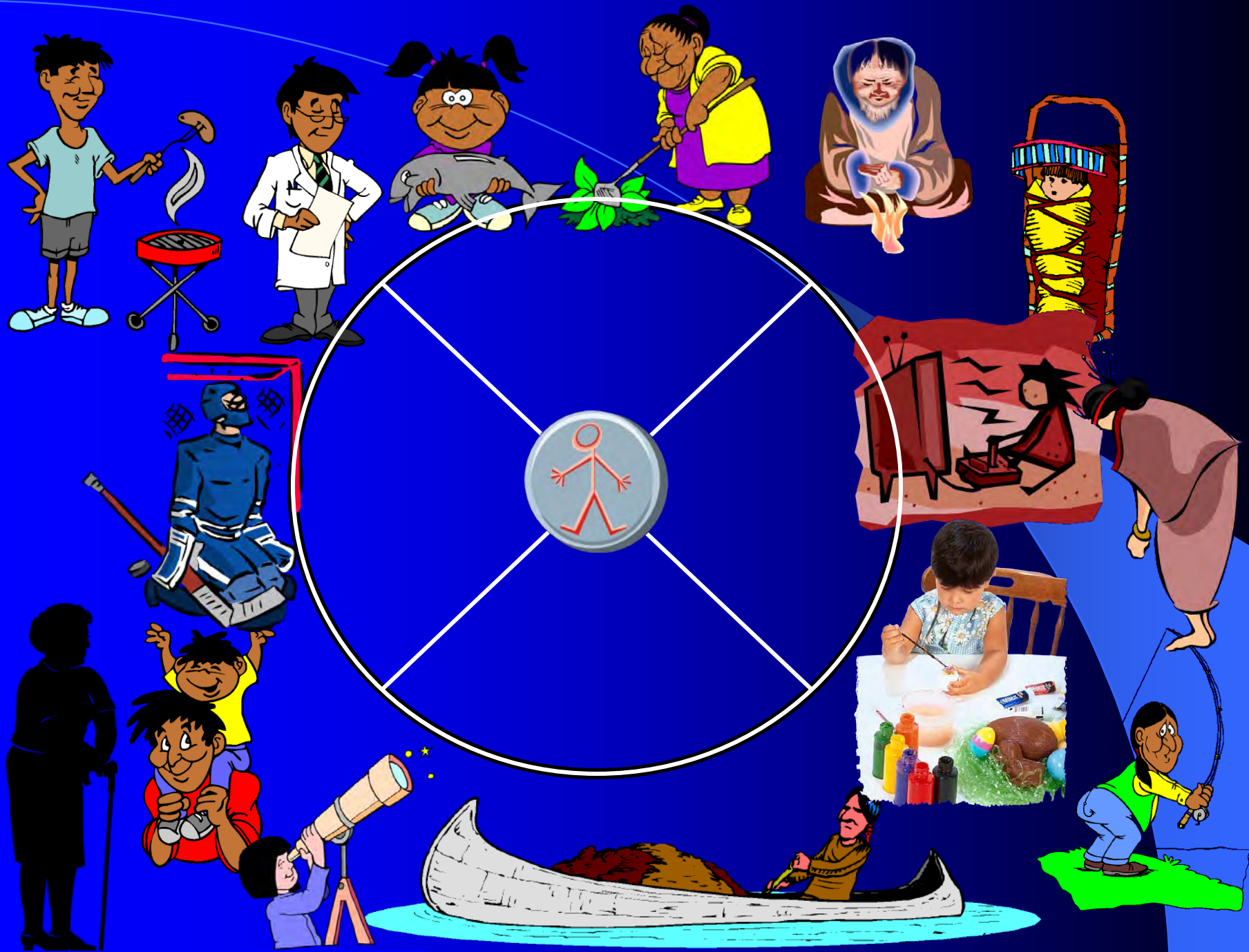


- place
- emergence
- participation

---

- wholeness
- balance
- change

Medicine Wheel

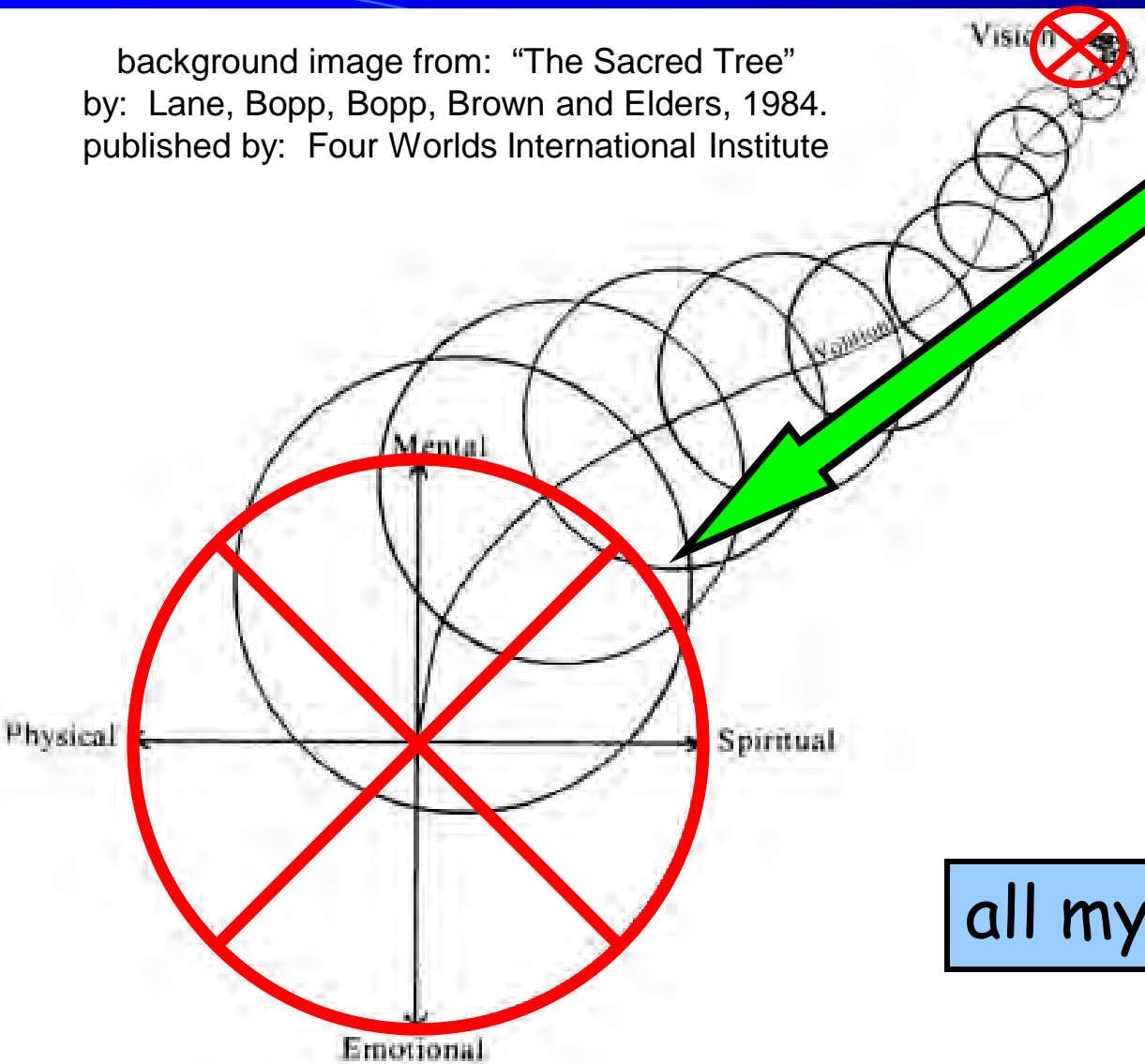




# Murdena Marshall, Elder, Eskasoni First Nation



background image from: "The Sacred Tree"  
by: Lane, Bopp, Bopp, Brown and Elders, 1984.  
published by: Four Worlds International Institute

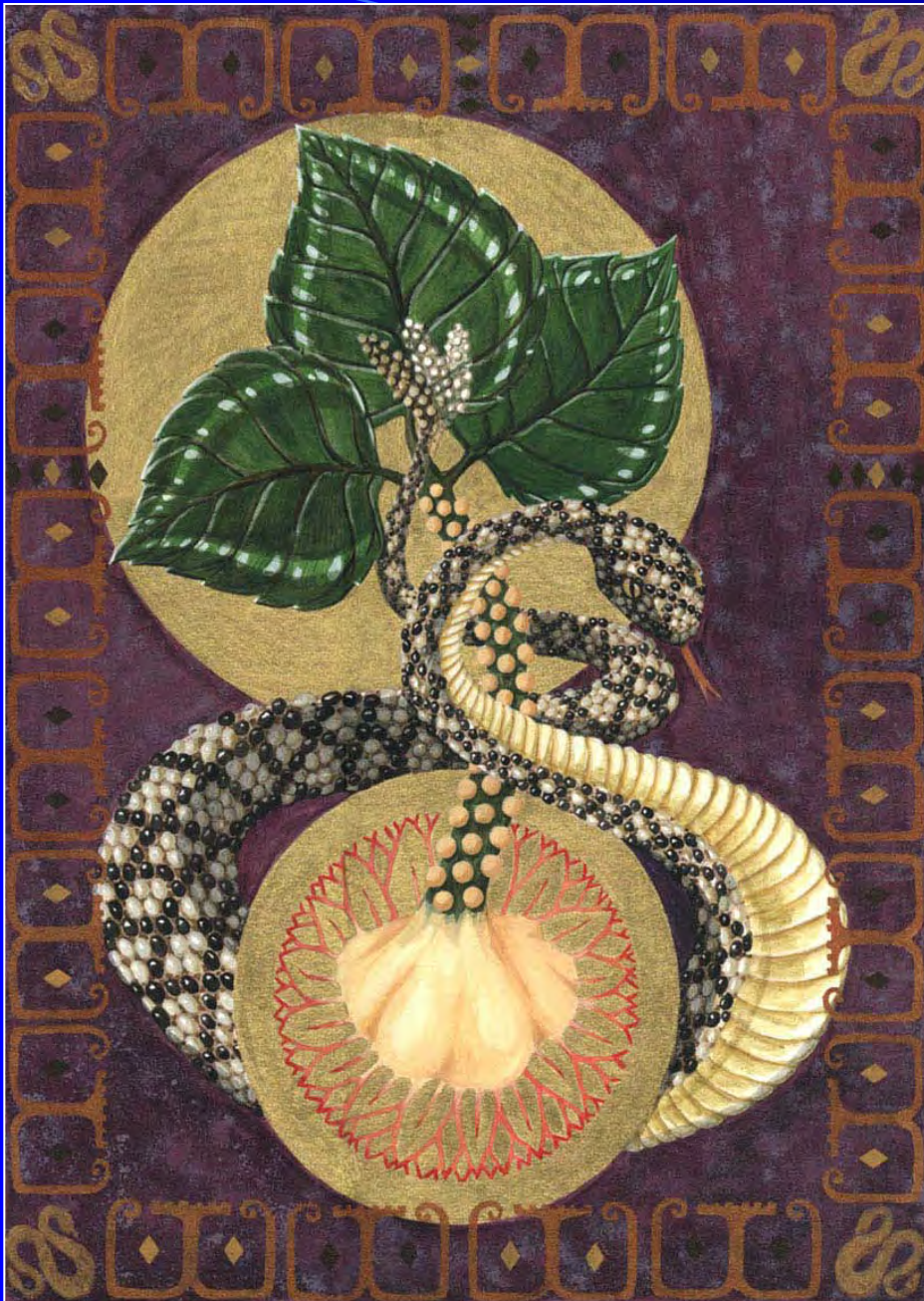


all my relations

expanding sense of  
wholeness and connectedness



spiritual



Artist Basma Kavanagh





spiritual



PATTERN

- RECOGNIZE
- TRANSFORM
- WEAVE

inner – outer – inner – outer

expanding sense of ...  
... pattern within pattern

Artist Basma Kavanagh





**weave PATTERN  
... to create new PATTERN**

**resonance of understanding  
“oral, living knowledge”**

**expanding sense of  
wholeness and connectedness**

# pattern awareness ... into knowledge



... a resourceful capacity of being that creates the context and texture of life, a living process to be absorbed and understood ...

... in a specific ecological context

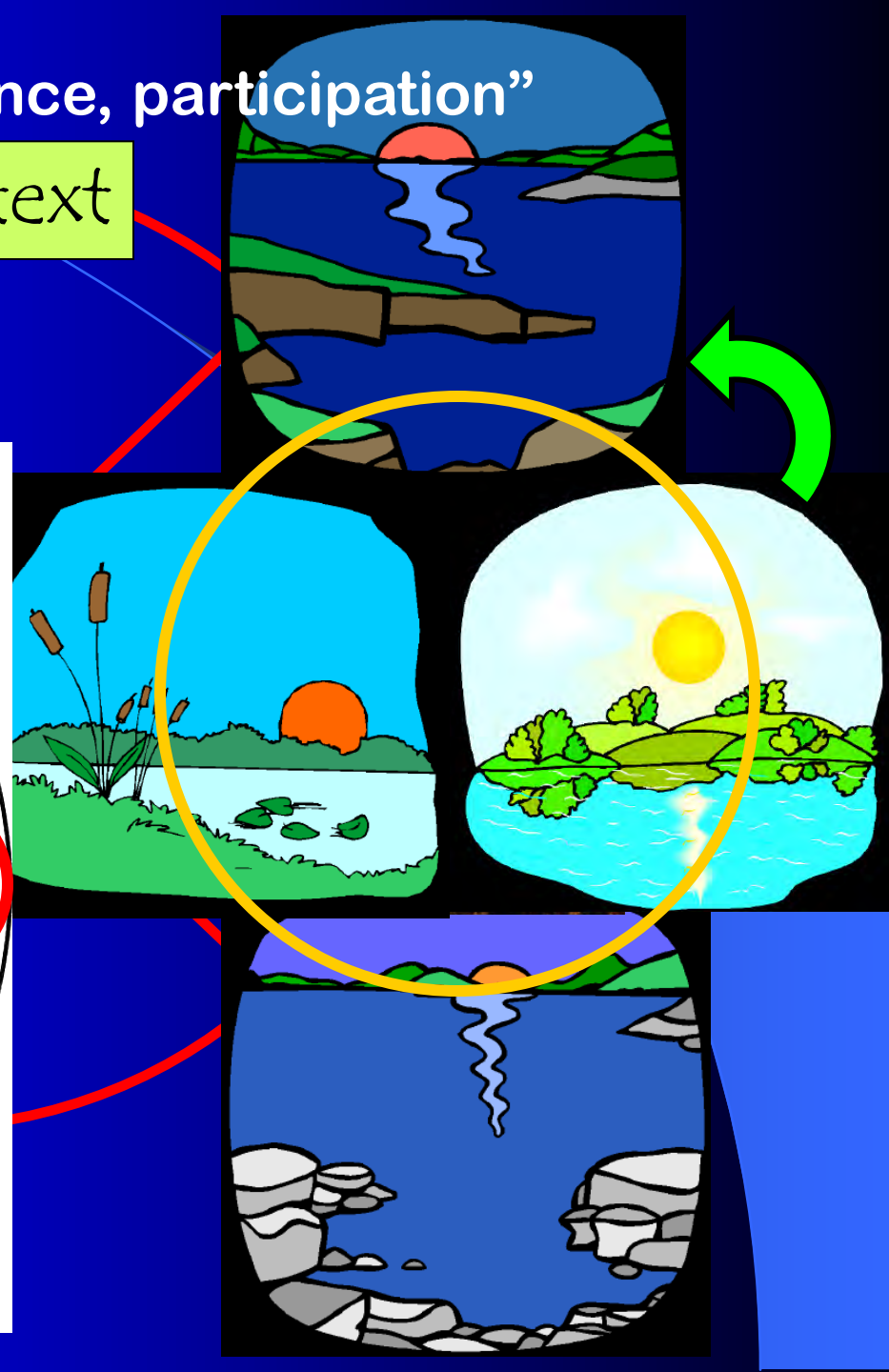
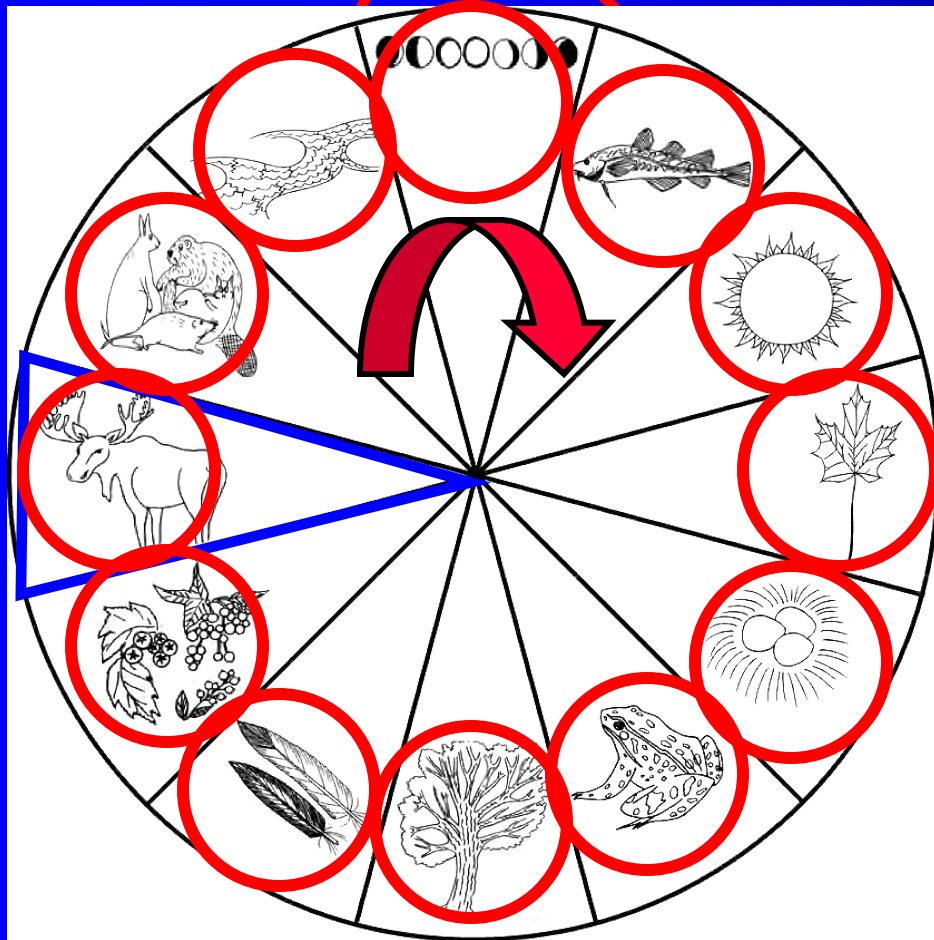
Battiste 2002





lived “sense of place, emergence, participation”

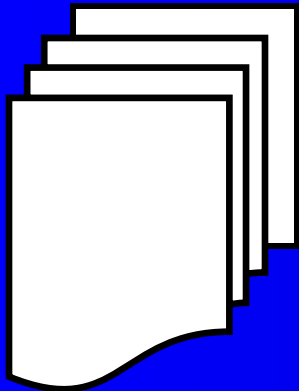
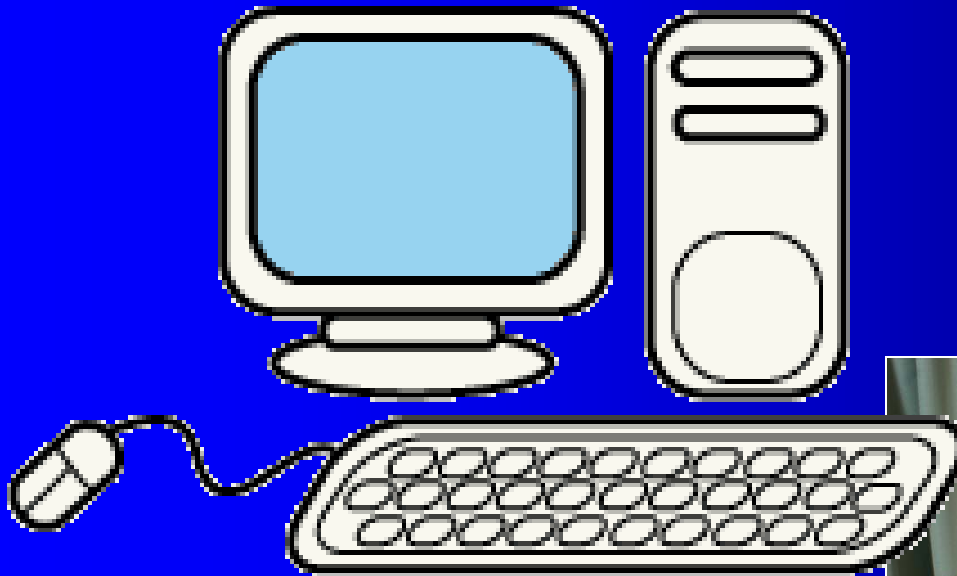
... specific ecological context



# Western Science Knowledge

... "detached"

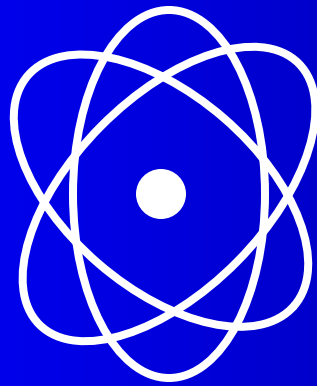
masterful  
prediction  
&  
control





# Periodic Table of the Elements

layered pattern (un-weave to re-build):  
natural                      ideal                      abstract

A standard periodic table of elements. The element Silicon (Si) is highlighted with a white box and a black border. The table includes element symbols, atomic numbers, and names. The lanthanide and actinide series are shown below the main table.

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

**PATTERN**



# Fibre-optical features of a glass sponge

Some superior technological secrets have come to light from a deep-sea organism.

## Fibre-optical features of a glass sponge

### Some superior technological secrets have come to light from a deep sea organism



Sponges are constructed from amorphous, hydrated silica<sup>26</sup>. *Euplectella* builds an intricate cage (Fig. 1a), which typically houses a mating pair of shrimp (hence its nickname, 'Venus flower-basket') and is composed of a lattice of fused spicules<sup>27</sup> that provide extended structural support.

A network of anchorage spicules (basalia) extend outwards in a crown-like formation. These spicules are generally 5–15 cm long and 40–70 μm in diameter; their native cross-section is homogeneous and they have no structural boundaries. Under stress or etching, the spicules reveal a characteristic layered morphology<sup>28</sup> and cross-sectional variations in composition that appear as three distinct regions: a pure silica core of about 2 μm in diameter that encloses an organic filament; a central cylinder that has the greatest organic content of the three; and a striated shell that has a gradually decreasing

layers, connected by organic ligands at the fibre's exterior, provide an effective crack-arresting mechanism and enhance fracture toughness<sup>29,30</sup>. Another superior feature of the spicules is their formation under ambient conditions, a process that is regulated by organic molecules<sup>31</sup>. This ambient-temperature process, unlike the high-temperature manufacture of man-made fibres, allows the structure to be doped with specialized impurities that improve the refractive index and therefore the wave-guiding properties. Our preliminary elemental analysis

minating sponge should also shed light on low-temperature, biologically inspired processes that could give rise to better fibre-optical materials and networks.

Vikram C. Sundar\*, Andrew D. Yablon<sup>†</sup>, John L. Grazul<sup>‡</sup>, Michal Ilan<sup>†</sup>, Joanna Aizenberg\*

\*Bell Laboratories/Lucent Technologies,

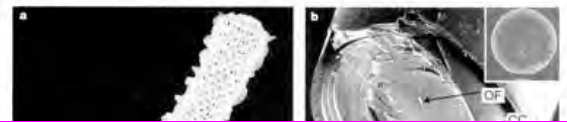
Murray Hill, New Jersey 07974, USA

†e-mail: jayzenberg@lucent.com

‡DPS, Murray Hill, New Jersey 07974, USA

§Department of Zoology, Tel Aviv University,

Tel Aviv 69978, Israel



## constructed understanding

### “theory, written knowledge”



## in the patterns of the animals

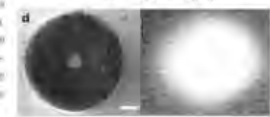
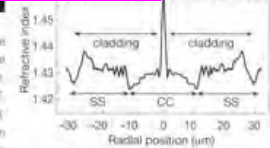
### ... lessons for humans

# PATTERN

rounds the core; and an oscillating pattern with progressively increasing refractive

index. The spicules' core-filament endsow properties, including waveguiding — the ability to confine light — that are similar to those of optical fibres. The refractive index is highest in the core and lowest in the cladding. The light filling the entire cladding, because of the enhanced refractive-index contrast

**Figure 1.** Structure and fibre-optical properties of spicules in the sponge *Euplectella*. **a**, The glass sponge, showing the basket-like cage structure and basal spicules (arrow). Scale bar, 5 cm. **b**, Mechanically cleaved spicules show three structural regions: OF, organic filament; SS, striated shell; CC, central cylinder. **c**, Smooth cross section of a laterally cleaved spicule. **d**, Histogram (left) and corresponding refractive-index profile (bottom) of a spicule. Dashed line indicates the refractive index of vitreous silica. **e**, Wave guiding by individual spicules upon coating with silver light. Spicules embedded in epoxy act as single-mode or few-mode waveguides (left). One branching spicule acts as multi-mode waveguide (right). Scale bar, 10 μm. Further details are available from the authors.





... "detached"

**Challenge:** How to re-connect with life  
... people, communities, ecosystem ...  
in ways that are deeply meaningful and  
in ways that will be followed?

e.g. medicine: nutrigenomics

constructed understanding

"theory, written knowledge"

Western Science Knowledge

# Integrative Science

awareness

patterns

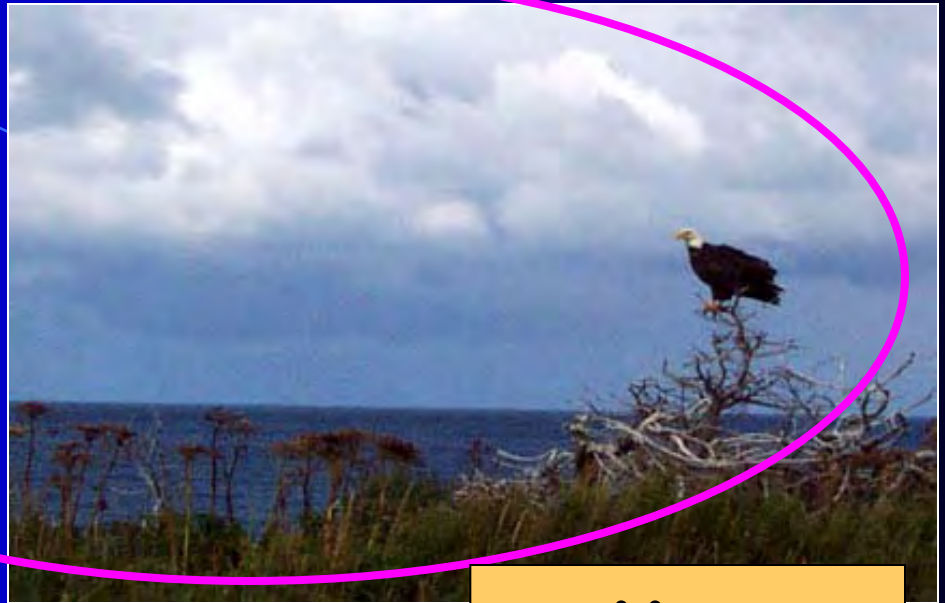


Artist Basma Kavanagh



FEAR

unknown



patterns

Douglas J. Cardinal

known



**Mother Earth**  
... especially, the patterns  
of the animals

**“must become PATTERN-able”**

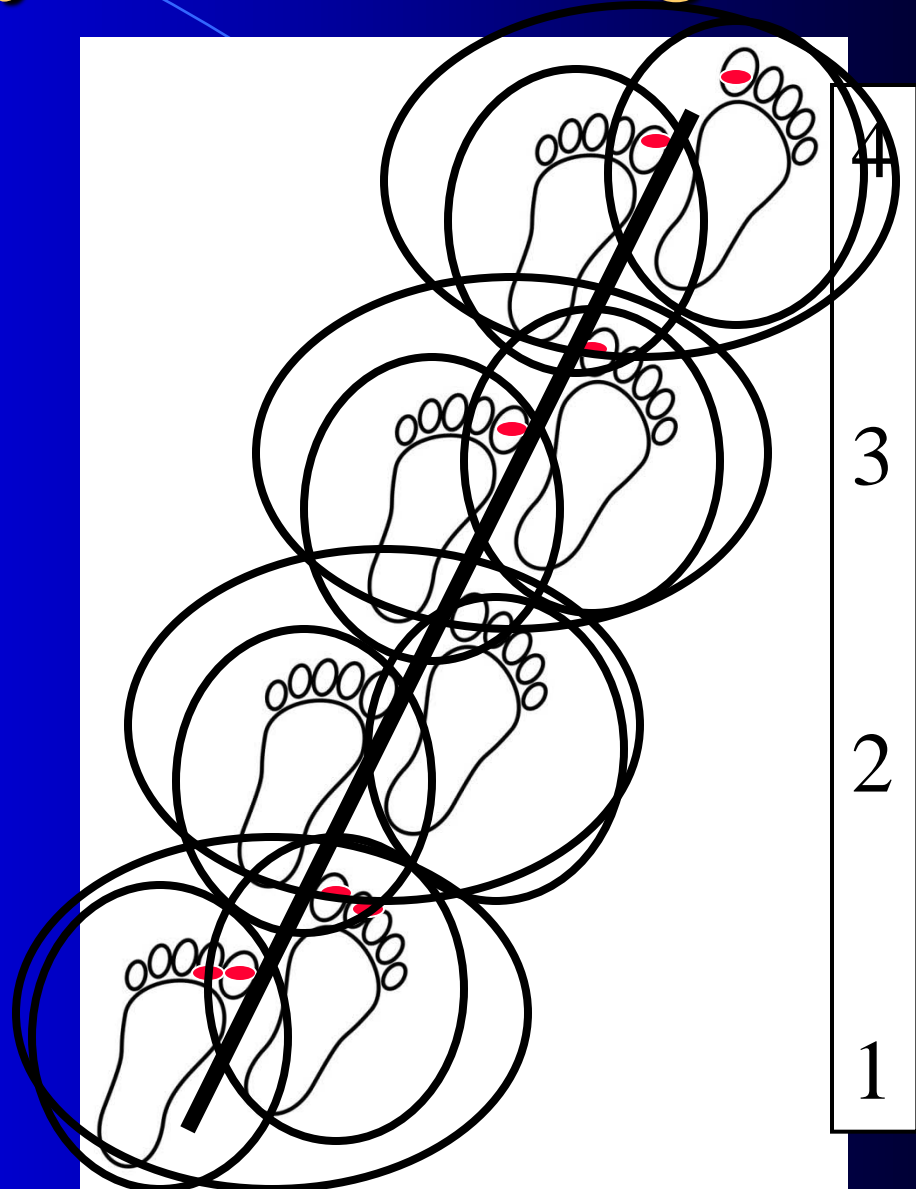
# 4 yr university science degree

W 2 + L courses



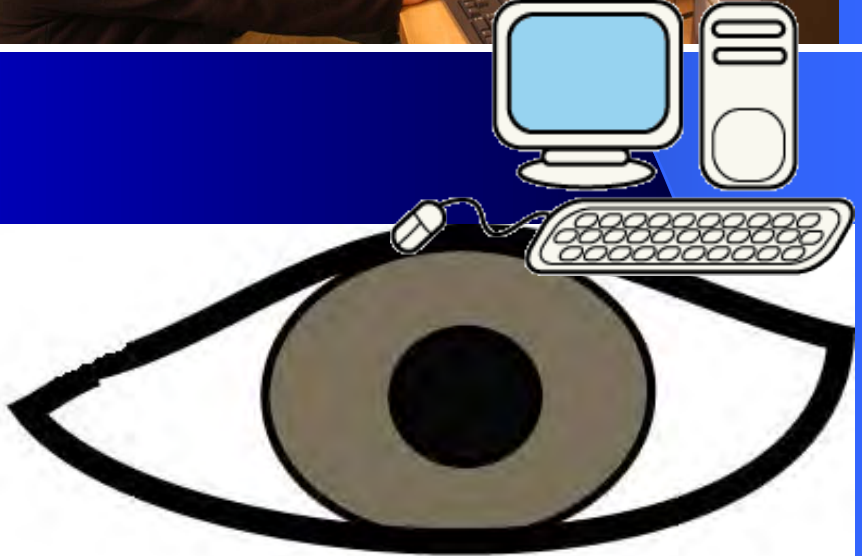
Integrative Science

**PATTERN**





# Integrative Science



Artist Basma Kavanagh

# Integrative Science

- What
- Why
- How  
... research
- Where  
... research

pattern awareness ... into knowledge

 Social Sciences and Humanities  
Research Council of Canada

SSHRC

Our Journey, forward ...  
together

enriching the common ground ...

pattern recognition  
... into science curricula



Artist Basma Kavanagh

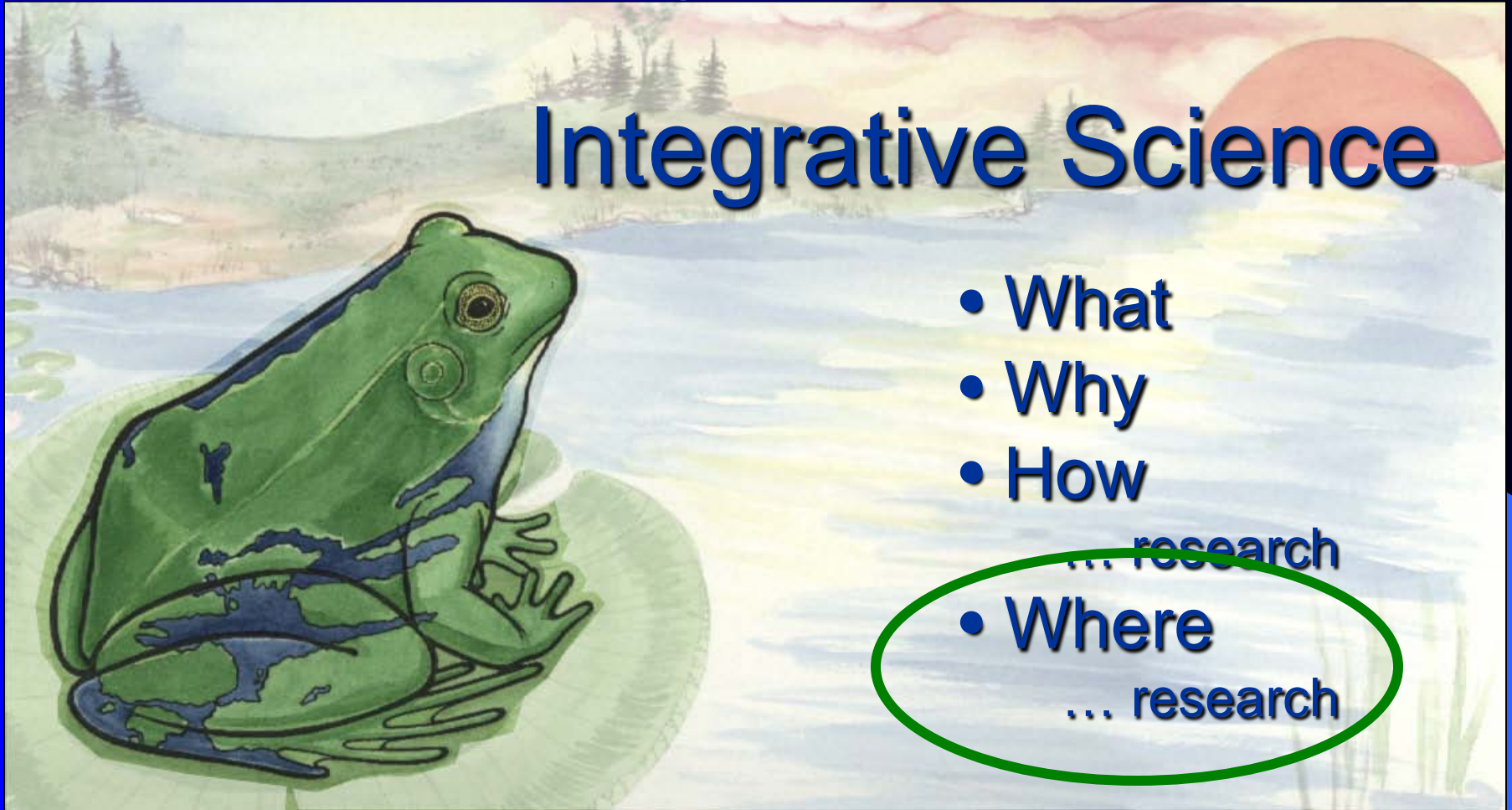
# Integrative Science

- What
- Why
- How

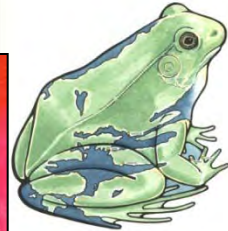
... research

- Where

... research



# Integrative Science ... relevance:



**Community**

**Resource management**

**Health**

**“Sense of ...”**

**Stewardship/Sustainability**

**Environmental issues**

**Ecology**

**Interpretation**

**Education**



Artist Basma Kavanagh

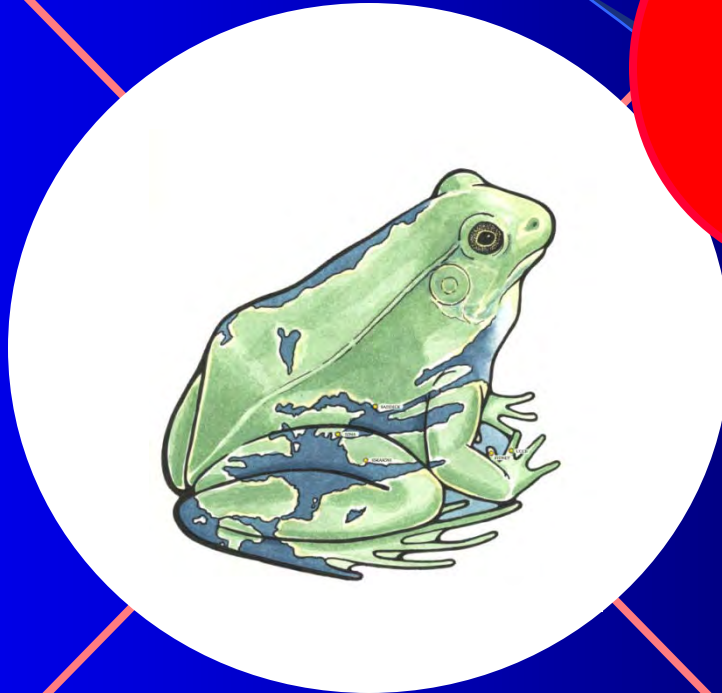


living systems

4 sacred elements

air

land



fire

water



# Environmental Planning

substance abuse

suicide

crime

air

climate change

mental health

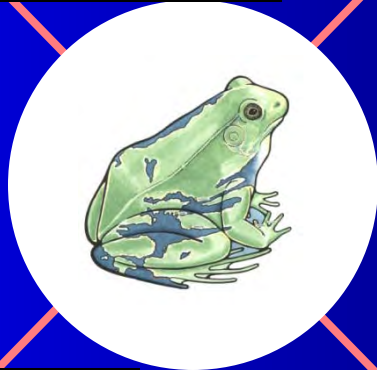
mining

emissions

energy of change

roads, cottages

land



fire

clear cutting

erosion & siltation

runoff



invasive species

water

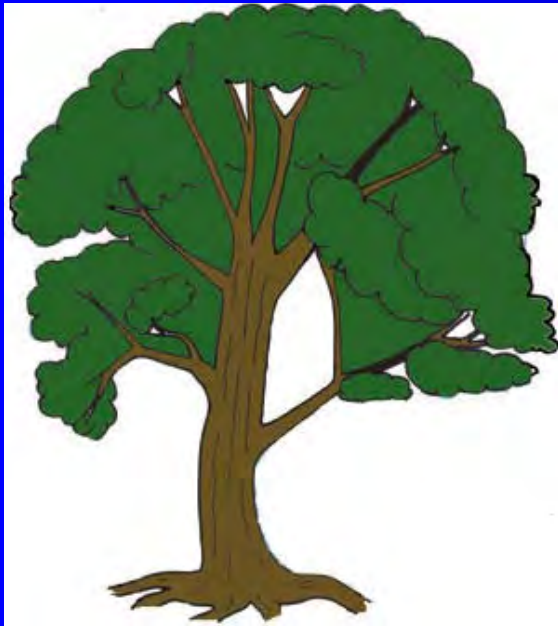
sewage

munitions

over fishing



# Health



## CIHR - IAPH Community Based Participatory Action Research

Integrative Health & Healing:  
co-learning our way to expanding  
wholeness through restoration of  
relationships with the land

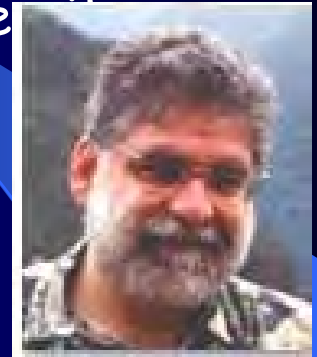
# multi-disciplinary team

## university researchers



Cheryl Bartlett, PhD  
CRC in Integrative  
Science, UCCB

Laurence Kirmayer, MD, Social  
& Transcultural Psychiatry,  
McGill University



John Jacono, PhD  
Prof Nursing,  
St.F.X. & UCCB



Nancy Comeau, PhD  
Psychology,  
Dalhousie University



Sherry Stewart, PhD  
Psychology,  
Dalhousie University



Pat McGrath, PhD,  
CRC Pediatric Pain,  
Dalhousie University

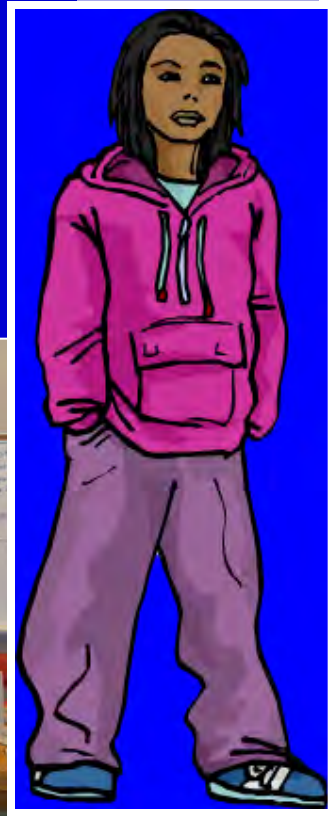
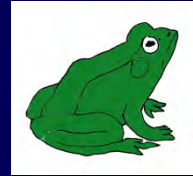
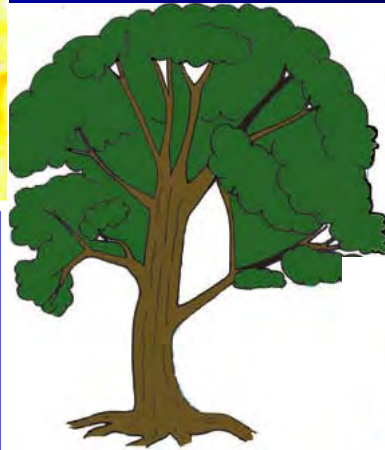
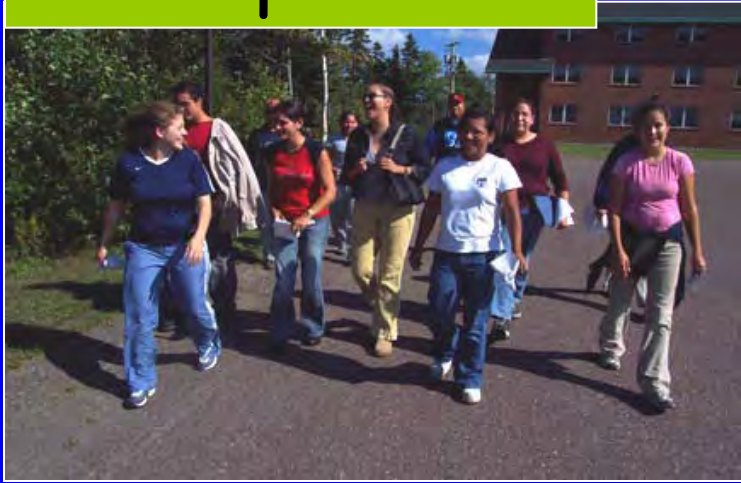




relational  
"eco-centric"

sense of identity and self

"bio-spiritual"



relational

"eco-centric"

"bio-spiritual"

sense of identity and self

There are two central themes evident in youth suicide. They are, first, the young person's deep sense of inadequacy, and second, a loss of connection to this world.

Morrissette 1998

Into the daylight; a wholistic approach to healing

MI'KMA'KI





learn together



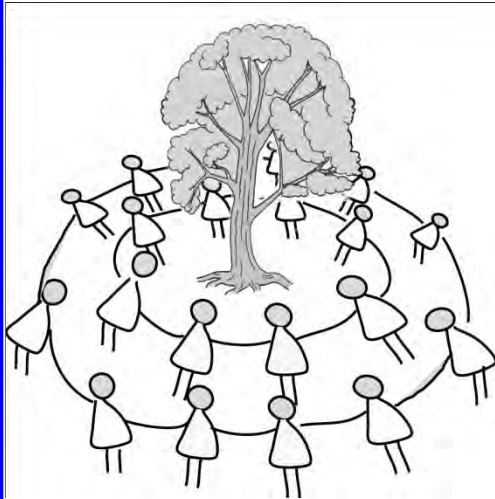
learn from each other



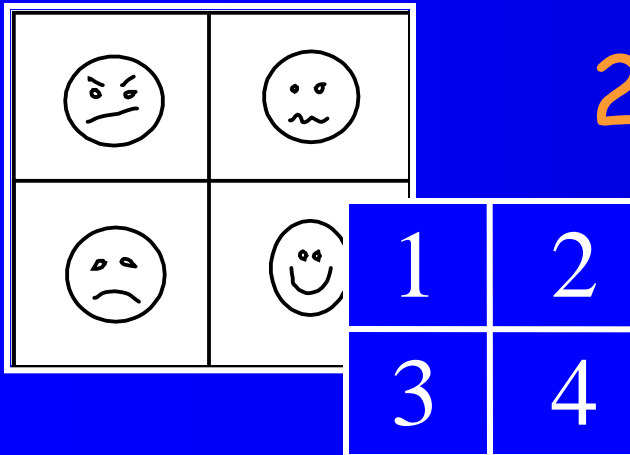
learn the common

# Co-Learning

two ways to ...  
explore & express  
understandings



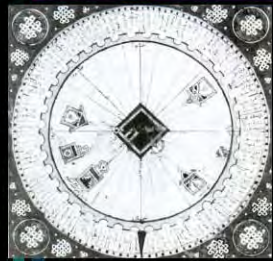
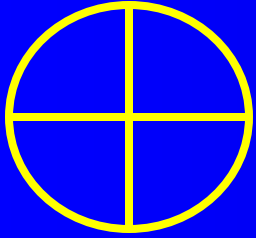
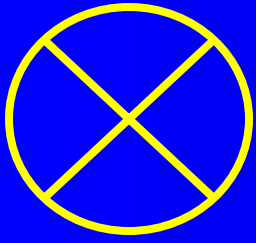
1) "VIGOUR" LANGUAGE



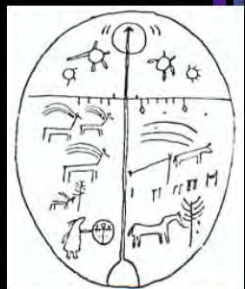
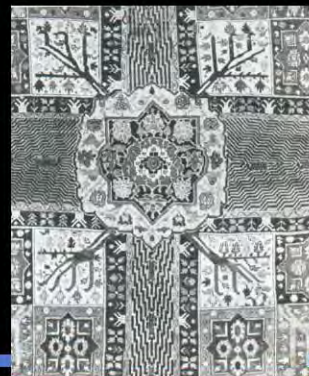
2) "RIGOUR" LANGUAGE



# Medicine ... in many, many cultures: "that which heals, that which helps"



Medicine Wheels



"Together we are growing"

# Toqikutimk





# Mi'kmaq legends ... enacted in puppet shows

NOVA SCOTIA  
**Health  
Research**  
FOUNDATION



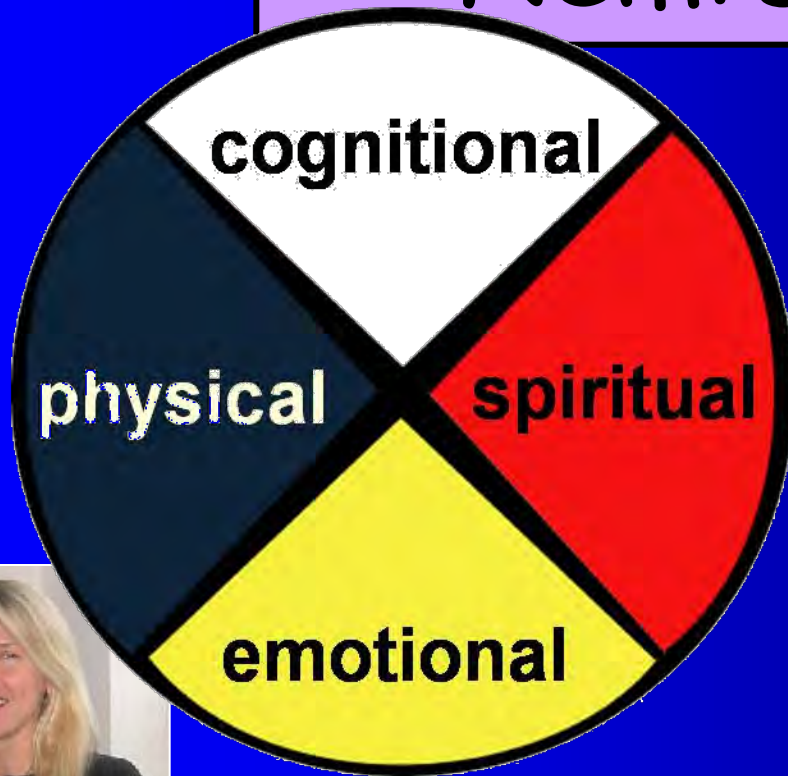
Douglas J. Cardinal: “especially, patterns of the animals”





Toqikutimk

Nemi'simk



About You:  
Eskasoni Youth



Dr. Nancy Comeau

image by Arlene (Dozay) Christmas for  
Mi'kmawey Debert Cultural Centre





# acknowledgments



Canada Research  
Chairs

Chaires de recherche  
du Canada

Social Sciences and Humanities  
Research Council of Canada

Conseil de recherches en  
sciences humaines du Canada



Thank you  
Wela'liog

Artist Basma Kavanagh

