
PSY1102

Introduction to Applied Psychology

Class 2

Nature, nurture, and diversity (part 1)

Victor Emerson

vemerson@uottawa.ca

Agenda for today

1. Behaviour genetics

- Genes and chromosomes
- Twin and adoption studies
- Temperament & heredity
- Heritability
- Molecular genetics

2. Evolutionary Psychology

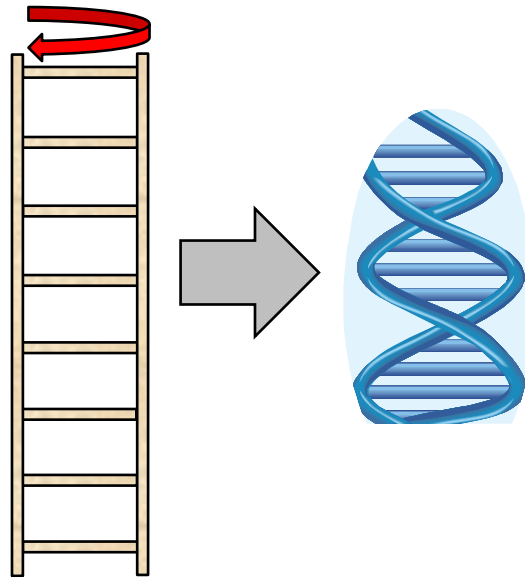
- Natural selection
- Evolution of human sexuality

1. Behaviour genetics

- a. Genes and chromosomes
- b. Twin and adoption studies
- c. Temperament and heredity
- d. Heritability
- e. Molecular genetics

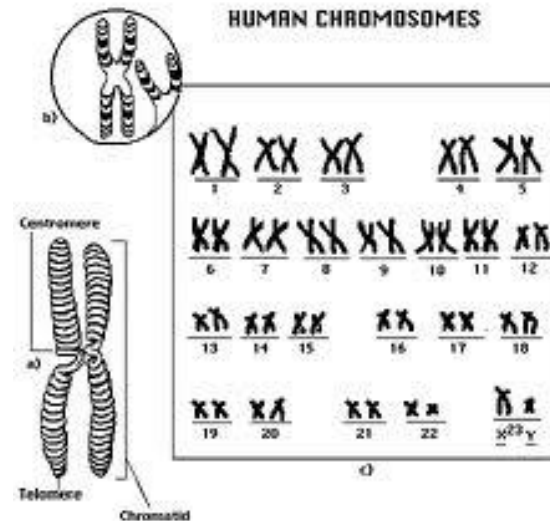
1a. Genes and chromosomes

- Inside the nucleus of each of our cells is a complex molecule called deoxyribonucleic acid, or DNA.
- This molecule is most easily pictured as a very tall ladder, the bottom of which is fixed to the ground and the top of which is twisted into a corkscrew shape.



1a. Genes and chromosomes (continued)

- These complex molecules make up our chromosomes.
- Humans have 46 chromosomes:
 - 23 came from the mother, and
 - 23 came from the father.



- Each chromosome is made up of many, many genes, which are small pieces of the DNA molecules.
- Humans have a total of about 30,000 genes; in the aggregate, this is called the human genome.

1a. Genes and chromosomes (concluded)

- We know from basic genetics studies (e.g., Gregor Mendel) that certain traits are heritable – that is, they can be passed on from one generation to the next.
- In humans, traits such as eye colour, hair colour, and others are determined genetically.
- In other words, these aspects of the human person are under genetic control and are not influenced by the environment in which the person is raised.
 - An ethical footnote: Josef Mengele was a Nazi physician who carried out horrendous “experiments” on concentration camp inmates. One of these “experiments” tried to determine whether he could change the colour of the human eye.

1b. Twin and adoption studies

- Most children live with their biological parents, so why are we interested in twin and adoption studies?
- The answer lies in research methodology, the discipline that concerns the design of research studies.

1b. Twin and adoption studies: nature-nurture

- Simply put, the nature-nurture argument has debated whether human traits are inherited (nature) or are shaped by the environment in which the human is raised (nurture).
- It is clear that the values of many physical attributes are determined genetically (nature).
- However, for other human attributes (sometimes called traits), the source is not clear. For example, is your sense of humour *inherited* from your parents, or is it shaped by your upbringing?
- To get an answer to this question, we need a way to separate – in a single human being – the effects of genetics from the effects of the environment.

1b. Twin and adoption studies: research logic

- Here's the logic of twin studies and adoption studies.
 - Most humans are raised by the biological parents that created them, and so the effects of genetics and the environment are confounded – that is, they cannot be separated.
 - Adoption: However, when a child of couple A is adopted by couple B, the child carries the genetics of A but experiences the environment (nurture) of B.
 - Twins: Identical twins develop from a single fertilised egg. When it divides in two, one half becomes one twin and the other half becomes the other twin. However, these identical twins share their genetic material – in other words, for all practical purposes they are genetically identical.
 - By contrast, fraternal twins (which may be of different sexes) come from separate eggs; they share the same uterine environment, but are genetically no more similar than siblings.

1b. Twin and adoption studies: identical twins

- Identical twins adopted by different parents (separated twins) are a valuable source of information, because although their genetic make-up is identical, the environment in which they were raised is likely (but not always) different.
- The Minnesota Twin Family Study (<http://mctfr.psych.umn.edu/>) locates and tests identical twins raised separately to help characterise the degree of similarity between these twins and to argue for genetic influences on personality traits.

1b. Twin and adoption studies: heritable traits?

- For several traits, your likelihood of exhibiting the trait is increased more if your identical twin has the trait than if your fraternal twin does.

Characteristic	If present in identical twin	If present in fraternal twin	Baseline
Alzheimer's disease	60% risk	30% risk	
Divorce	5.5 times	1.6 times	same

1b. Twin and adoption studies: Cyril Burt and fraud

- Cyril Burt was an eminent British psychologist whose career in twin studies was largely responsible for supporting the case for heritability of traits.
- However, just before his death in the 1970s Burt was accused of falsifying data (suspiciously accurate to 3 decimal places across studies).
- Moreover, in several cases his separated twins lived in the same neighbourhood and not only attended the same school but knew each other and played together.
 - Because of this, they can hardly be considered to have been raised separately (i.e., in different circumstances), and so it has been argued that Burt overstated the case for heritability of traits.

1b. Twin studies: Twinsburg, Ohio festival

- Here's a great research opportunity:
www.bbc.co.uk/news/world-us-canada-19151969

1c. Temperament and heredity

- Humans have different temperaments, and these different temperaments are often visible in infants.
- Some babies are easy and open; others are slow to warm up to changes; still others are difficult.
- Identical twins tend to have the same temperament more than do fraternal twins.
- Moreover, there is evidence (see text) that temperament is a lasting attribute (or trait) that can be carried through life.

1d. Heritability

- The heritability of a trait is defined (in the text) as the extent to which variation among individuals can be attributed to their differing genes.
- As an example, if the heritability of intelligence is 50%, this means that half of the variability in intelligence among individuals is attributable to genetic factors.
- It does not mean that you can thank your biological parents for half of your intelligence and that the other half is from – like, you know – your friends and the food you eat.

1d. Heritability (continued)

- “The food you eat” is, in fact, a good example.
- Historically, several societies were of shorter stature than they are today, such as the English and the Japanese.
- As these societies became more open to the outside world and accepted new foods into their diets, individuals within these societies grew to be taller than previous generations.
- Thus, their genetic make-up (nature) supported greater stature, but required the nutritional contribution from the environment (nurture) to bring it to fruition.
- This shows that one thing we have inherited is the ability to adapt to different environments.

1d. Lamarckian evolution

- Lamarckian evolution is an idea that has long been discredited in the biology of multi-celled organisms.
- Briefly, Lamarckian evolution proposes the heritability of acquired characteristics.
- Lamarckian evolution posits that (for example), if you cut the tail off an adult mouse, then cut the tail off its offspring, then off the next generation of offspring, you will eventually breed mice that do not have tails.
- Some people have argued that cultural evolution can follow Lamarckian principles.

1e. Molecular genetics

- Molecular genetics is a relatively new field which hopes to characterise the manner in which specific genes can influence behaviour.
- In one sense, this field is promising in that it may lead the way to developing cures for psychological disorders, such as schizophrenia or bipolar disorder.
- However, there is also a potential ethical dilemma in that the technology may permit prospective parents to test their fetus for genes associated with a disorder, and then abort “imperfect” fetuses.
- An analogous practice is followed in some societies where female fetuses are aborted because they are less valued than males.

2. Evolutionary Psychology

- a. Natural selection
- b. Evolution of human sexuality

2a. Natural selection

- Over 150 years ago, Charles Darwin wrote his seminal book *On the Origin of Species*. Darwin's work, described in this book and his other works, promoted the idea of natural selection, also described as “survival of the fittest”.
- The idea behind natural selection is that organisms with adaptive traits will survive when faced with environmental challenges, and so their DNA (and the trait) will survive.
- Organisms that are less fit – for example, those that lack a particular trait – will be less successful. In the extreme case, they will die, and their DNA will not be passed along to the next generation.
- By contrast, everyone in this room is an example of successful evolution.

2a. Natural selection and behaviour

- Although it's accepted that natural selection applies to physical traits, the application of this mechanism to psychological (behavioural) traits is less widely accepted.
- We accept that this mechanism works in dogs, because different types of dogs exhibit remarkably different behaviours.

- Toss a ball for a retriever, and the dog will chase it and bring it back to you.



- Do the same thing with a terrier, and the dog will look at you.
- By implication, these dog breeds have been selected for different behaviours.

2a. Natural selection and behaviour (continued)

- However, humans are not dogs, and the evidence that human behavioural traits can be selected is not widely accepted.
- British geneticist Richard Dawkins proposed in his book *The Selfish Gene* (1976) that genes are biological entities designed to ensure their own survival, and memes are behavioural elements designed to ensure their survival.
- In Dawkins' view, the human body and behavioural repertoire are simply the “suitcase” that our genes and memes have developed to maximise the chances of their own survival. All the rest – beauty, speech, etc. – is, in effect, window-dressing whose purpose is to maximise the likelihood of successful mating.
- In other words, “we” do not ensure the survival of our genes; rather, genes have created us to ensure their own survival.

2b. Evolution of human sexuality

- Human sexuality is, as most people know, not a simple issue.
- Without question, sex serves a biological function in that it is necessary to propagate the species by creating the next generation.
 - In this sense, sex is a fundamental drive that humans describe as sexual desire or lust.
- However, sexual behaviour in humans – as in many other species – typically also involves a “courtship ritual”.
- Science has shown us that our mating behaviour differs from that of frogs (for example).
- Does it also differ from the mating behaviour of our closest living relatives?

2b. Evolution of human sexuality: energetics

- From the perspective of energetics – that is, the energy budget (or energy requirements) of the individual – mating requires a much smaller investment from a male mammal than from the female.
- The biological role of the male mammal is to manufacture sperm and to inseminate one or more females to propagate his DNA. In a biological sense, his role is done once he has mated.
- By contrast, the biological role of the female mammal is to mate with a male when she is fertile, then to gestate the fertilised egg (pregnancy) and eventually give birth to one or more live offspring, and then nurse them for a period of time and perhaps care for them afterwards.

2b. Evolution of human sexuality: energetics

- A man living to age 80 will produce about 2.6 trillion sperm during his lifetime.
- By contrast, a woman will produce approximately 500 eggs, usually released one at a time as part of the menstrual cycle.

You may find this BBC article amusing, but it won't be on the exam!

www.bbc.com/earth/story/the-making-of-me-and-you

2b. Evolution of human sexuality: strategies

- Given that reproduction involves a significantly greater investment (in time and energy) for female mammals than for males, it is not surprising that males and females have different strategies related to mating – that is, to ensuring that their DNA will continue.

Gender	Male	Female
Investment	Small	Large
Strategy	Inseminate as many females as possible to maximise the chances that DNA will continue.	Ensure that mate is fit to maximise the chances that DNA will continue.

2b. Evolution of human sexuality: humans

- Humans become capable of reproduction at puberty.
- Males produce sperm constantly.
- Females are born with a supply of eggs, which are released from an ovary – usually one egg at a time – approximately every four weeks as part of the menstrual cycle.
- Thus, mating has the greatest chance of resulting in a pregnancy if the female mates with a male during her fertile period, approximately 2 weeks after her last menstrual period.

2b. Human sexuality: a musical interlude

Hello, I'm back again
 Haven't seen you since I don't know
 when
 It's been so long but you seem so
 cold
 Is it something you've been told?
 She said, "So this is what you think
 of me
 Going with some whore somewhere
 out in Germany"
 I said "Baby, baby can't you see
 It's nothing to do with you and me"
 Nothing to do with my heart
 Nothing to do with my head
 Nothing to do with our home
 Nothing to do with our bed

It's just B I O L O G Y
 Can't you see?
 It's just biology
 Biology, coming in between you
 and me

Your biology lesson starts here
 And first of all we should make it
 clear
 That the species known as males
 Have these little white things
 with little white tails
 Which multiply and start to shout
 It's getting crowded down here,
 let us out
 Once relieved they start again
 It's not a process controlled by
 the brain
 It's nothing to do with their hearts
 Nothing to do with their heads
 Nothing to do with their home
 Nothing to do with their beds

It's just B I O L O G Y
 Can't you see?
 It's just biology
 Biology, coming in between you
 and me

She said thanks, I'm so relieved
 What you're saying I can well
 believe
 Now I know, I feel no shame
 About Dave and Tony and Phil
 and James
 I said, "Baby, baby, this can't be
 true"
 She said "Well what's right for
 you
 Has to be right for me
 In any case I'm sure you'll see"
 It's nothing to do with our hearts
 Nothing to do with our heads
 Nothing to do with our home
 Nothing to do with our bed

It's just B I O L O G Y
 Can't you see?
 It's just biology
 Biology, coming in between you
 and me

www.youtube.com/watch?v=wmMSoigohhs

2b. Evolution of human sexuality: meet the family



Chimpanzee



Bonobo



Orangutan



Mountain gorilla



Western gorilla

2b. Evolution of human sexuality: the bonobo

- Sexual behaviour in humans seems closely related to that of the bonobo.

“One of the most significant and defining characteristics of bonobo societies is sexual behavior. Sex serves purposes other than reproduction such as appeasement, affection, social status, erotic games, reconciliation, excitement, and stress reduction (de Waal 1997). Sex occurs in virtually all partner combinations and in a variety of positions.”

- Fact sheet for bonobo (*Pan paniscus*), National Primate Research Center, University of Wisconsin – Madison
(<http://pin.primate.wisc.edu/factsheets/entry/bonobo/behav>)

2b. Evolution of human sexuality: the chimp

- Sexual behaviour in humans also has similarities to that of the chimpanzee.

“The majority of chimpanzee reproductive behavior is promiscuous, with females mating with multiple males opportunistically during estrus, though the majority of copulation occurs during the 10-day period of maximal tumescence (Goodall 1986). There are other types of reproductive strategies that are recognized as well. Restrictive mating, where the dominant male restricts other males from mating with estrous females in the community, consortship mating, where an adult pair leave the community for several days to weeks, and extra-group mating, where females leave their communities and mate furtively with males from nearby communities (Goodall 1986; Gagneux et al. 1999).”

- Fact sheet for chimpanzee (*Pan troglodytes*), National Primate Research Center, University of Wisconsin – Madison (<http://pin.primate.wisc.edu/factsheets/entry/chimpanzee/behav>)

2b. Evolution of human sexuality: the gorilla

- Sexual behaviour in humans also has similarities to that of the gorilla.

“There is no evidence of birth seasonality and mating occurs year-round (Watts 1991; 1998). A female will initiate copulation by pursing their lips and slowly approaching a male, establishing prolonged eye contact. If he does not respond she may reach towards him, touch him, or slap the ground in front of her to attract his attention (Sicotte 2001). In groups with multiple males, solicitation is taken as indication of female preference, though females may be coerced to mate with multiple males during the estrus period (Sicotte 2001). A male initiates copulations by approaching the female and displaying at her or touching her and giving a "train grunt" vocalization (Watts 1991).”

- Fact sheet for gorilla (Gorilla), National Primate Research Center, University of Wisconsin – Madison
(<http://pin.primate.wisc.edu/factsheets/entry/gorilla/behav>)

2b. Evolution of human sexuality: the orangutan

- There are two types of male orangutans: flanged (mature adult) and unflanged (subadult).



“Unflanged males do not have a secure territory and are transient, roaming over wide areas and searching for receptive adult females. When they encounter a female in estrus, they force copulation and successfully impregnate her. This rape behavior is different than the strategy of a flanged male that uses long-calls to advertise his location and waits for receptive females to find him (Utami et al. 2002; Setchell 2003). Because females preferentially mate with flanged males, this process of sit-and-wait is effective for fully developed males. Females may also seek out flanged males for protection from sexual harassment by unflanged males (Fox 2002).”

(<http://pin.primate.wisc.edu/factsheets/entry/orangutan/behav>)

2b. Evolution of human sexuality: attraction

- Moving away from cross-species comparisons, psychology is also concerned with what constitutes attraction between human males and females.
- Factors to consider:
 - Olfactory cues
 - Visual cues
 - Auditory cues
 - Behavioural cues
- We will discuss human sexual behaviour more fully when considering development.

Summary: Class 2

- Genes, chromosomes, and the fundamentals of genetics.
- Heritability of physical characteristics vs. behavioural characteristics.
- Behaviour genetics research tools: twin and adoption studies.
- The promise and ethical challenges of molecular genetics.
- Natural selection and behaviour: non-humans and humans.
- Evolution of human sexuality – gender roles and strategies, our closest living relatives, and areas to consider when studying sexual attraction.