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Kevin Brewer

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orsettpsychologicalservices@phonecoop.coop

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Kevin Brewer BSocSc, MSc

An independent academic psychologist, based in England, who has written extensively on different areas of psychology with an emphasis on the critical stance towards traditional ideas.

A complete listing of his writings at <http://psychologywritings.synthasite.com/>. See also material at <https://archive.org/details/orsett-psych>.

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1. RUGBY UNION AND CONTACT

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1.1. OWENS ET AL (2021)

It has been estimated that professional rugby union players experience well over 10 000 contact events per season (eg: 20-30 games), which occur in tackles, collisions, mauls, rucks, and scrums (Owens et al 2021).

These contact events have been associated with disruption of brain functions, and consequent neurodegeneration (Owens et al 2021).

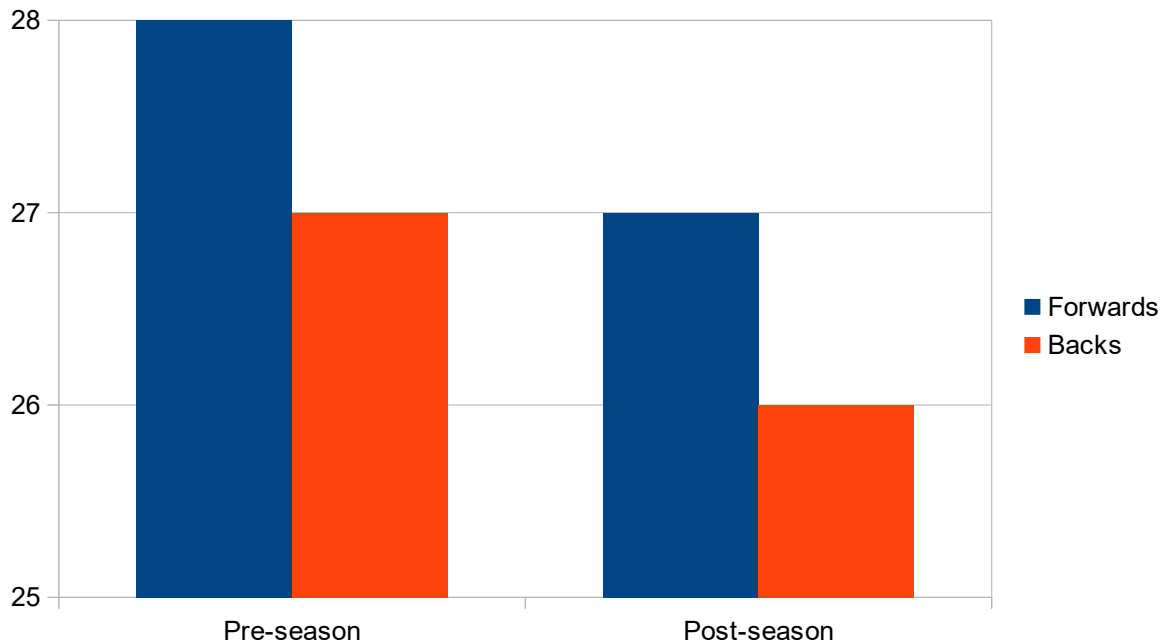
Owens et al (2021) followed twenty-one players (thirteen forwards and eight backs) over the whole season of the Guinness PRO14 season. Data were collected pre-season, mid-season, and post-season. Concussion history was established from medical records, player recall, and completion of the Sports Concussion Assessment Tool (SCAT5) (Echemendia et al 2017) (table 1.1) (appendix 1A). Blood samples and physiological measures were taken, and cognition was assessed by the Montreal Cognitive Assessment (MoCA) (Nasreddine et al 2005) (eg: draw clock face showing particular time; name drawings of animals; recall five words; repeat three digits backwards)¹. Each game in the season was recorded and scored for contact.

1. Immediate/on-field assessment (including):
 - "Red flags" (eg: loss of consciousness; double vision; vomiting).
 - Observable signs (eg: facial injury; vacant or blank look).
 - Memory assessment (Maddocks questions; Maddocks et al 1995) (eg: what venue are we at today; what half is it; did your team win the last game).
2. Off-field/office assessment (including):
 - Symptom evaluation.
 - Cognitive screening (eg: what month is it; immediate recall of 5 or 10 words; repeat 3-6 digits in reverse order; 5-minute delayed recall of words).
 - Neurological and balance screening.

Table 1.1 - Structure of SCAT5.

¹ MoCA is mostly used to assess neurodegeneration in older individuals.

Not surprisingly, forwards had significantly more contacts than backs, and a higher rate of concussions (12.9 per 1000 match hours vs 4.2 for backs). All players showed a small (non-significant) decline in MoCA scores between pre- and post-season measures (figure 1.1). The physiological measures were able to show changes in the brain (eg: vascular nitric oxide).



(Data from Owens et al 2021 table 1 p1973)

Figure 1.1 - Mean MoCA scores (out of 30).

The study had no non-contact control group, and the sample was small. Also, Owens et al (2021) admitted, "data for contact events sustained during training were not available, and therefore we cannot rule out the potential contribution this had towards the overall contact load endured" (p1977). Details were not given of non-rugby events.

Concerning the decline in MoCA scores, Owens et al (2021) advised "interpretative caution" around the reliability of the measure.

Owens et al (2021) concluded that "it appears that exposure to contact events in rugby promotes a decline in cerebral haemodynamic function and cognition across the season, subsequent to an elevation in systemic OXNOS [oxidative-nitrosative stress] that may prove the fundamental 'unifying' molecular pathway predisposing to

cognitive decline" (p1977).

1.2. ZIMMERMAN ET AL (2021)

Using the terminology, mild traumatic brain injury (mTBI), Zimmerman et al (2021) quoted the estimate of 14.8 such events per 1000 player match hours in rugby league (National Rugby League in Australia) compared to 20.4 in professional rugby union in the UK.

Do these mTBIs lead to lasting brain injury, like chronic traumatic encephalopathy (CTE)? Studies of retired rugby players, for example, find higher self-reported rates of cognitive impairment compared to controls, and there are a small number of high profile cases of CTE in ex-players (Zimmerman et al 2021).

Standard neuroimaging often cannot show any brain injuries after mTBI, so there is a need for advanced technologies of magnetic resonance imaging (MRI) (eg: susceptibility weighted imaging; SWI). Zimmerman et al (2021) used such technologies with thirty-seven elite male and three female rugby union players, and four male rugby league players in the UK. Assessments were made twelve months apart between July 2017 and March 2019.

Three control groups were recruited:

- i) Non-sport - university students (n = 12);
- ii) Sport - non-contact university athletes (eg: swimmers; rowers) (n = 15);
- iii) Longitudinal - sixteen individuals with non-sport-related TBI.

As well as the scans, there were a battery of neuropsychology tests.

Twenty-one of the rugby players were assessed shortly after a mTBI.

The rugby players showed "abnormalities of brain structure" (p14) not seen in the control groups (eg: "unexpected reductions in white matter"; p1). Zimmerman et al (2021) explained: "The rugby players studied had an average age of 25 years old and the oldest was 31 years old. In this age range reductions of white matter volume are abnormal and may be an early sign of an active neurodegenerative process that might increase the risk of neurodegenerative disease in later life. The pathological correlates of abnormal white matter volume we detected with advanced neuroimaging in rugby players is unknown and requires more investigation" (p14).

The control groups were opportunist, and so there

was no matching on certain variables (eg: exercise; level of sport competition). There was also no matching for body mass index (BMI), which Zimmerman et al (2021) admitted, "limits our ability to exclude the effect of high-level sporting participation on our results" (p15).

Zimmerman et al (2021) ended with the important point that their findings "are not directly comparable to play at the community or youth levels. The overall health benefit of participating in sports and physical exercise have been well established including the reduction in mortality and chronic diseases such as dementia..." (p15).

1.3. HIND ET AL (2021)

One consequence of a concussion history could be depression. This was investigated by the UK Rugby Health Project (Hind et al 2021).

Data were collected from 189 retired elite (ER) and amateur rugby (AR) players (from both union and league) between 2016 and 2018, and sixty-five former non-contact (NC) athletes as controls. The questionnaire included items on sport-related concussion (SRC) and non-SRC, and measures of mental health.

Previous or current depression was reported by 49% of the ER group, 34% of the AR group, and 21% of the controls, and anxiety by 42%, 23% and 31% respectively. Concussion was higher in the ER group, and this was associated with negative mental health, and sleep disruption. There was no difference in alcohol consumption between the three groups.

An interesting observation was that "depression and anxiety were more prevalent in rugby players who retired because of injury when compared to those who did not retire due to injury" (Hind et al 2021 p9). Also, it was found that "one in five elite rugby code players reported that they would not turn to anyone if they had a problem or were upset about anything, with almost half suffering from, or having a history of, depression. In addition, one in ten elite rugby players reported that they often feel that 'life is hardly worth living'" (Hind et al 2021 pp6, 9).

This study confirmed the high level of negative mental health among former rugby players, especially those who had suffered multiple concussions.

The study involved volunteers (ie: risk of non-response or selection bias), self-reported data (ie: risk of recall bias or false information), and it was not

possible to establish causality.

How do these findings compared to previous research?

a) Current rugby players - Current professional rugby league players with three or more SRCs had a twofold greater risk for adverse mental health symptoms (Du Preez et al 2017).

b) American football - Retired players with multiple concussions had adverse psychological symptoms (eg: Didehbani et al 2013).

c) General population - Mood disorders were three times more common in individuals who had experienced concussion (Hellewell et al 2020).

1.4. APPENDIX 1A - SCAT

Diagnosing sports-related concussion is "complicated by factors such as non-specific concussion symptoms, variable time-frame for symptom onset, imprecise thresholds for symptom detection and symptom duration, dynamic and changing symptoms over time, lack of definitive biomarkers and lack of clarity in the definition of concussion" (Bruce et al 2021 p557). Consequently, SCAT has become an "imperfect 'gold standard'" (Bruce et al 2021).

First developed in 2004 (McCrorry et al 2005), then revised in 2008 (SCAT2) (McCrorry et al 2009), and 2012 (SCAT3) (Guskiewicz et al 2013), no SCAT4, and SCAT5 in 2017 (Bruce et al 2021).

Recent changes include the number of words to recall immediately or after a delay (five to ten), and administration instructions (Bruce et al 2021).

Bruce et al (2021) evaluated SCAT5 using National Hockey League (NHL) (ice hockey) players in the 2018-19 season, and in particular the move from five- to ten-word lists to recall. The five-word list had a ceiling effect (ie: the majority of players achieved the maximum score), which was not found with the ten-word list. "The increased challenge posed by the 10-word lists appear better suited to capture more subtle learning and recall deficits" (Bruce et al 2021 p563).

1.5. REFERENCES

Bruce, J.M et al (2021) Use of the Sport Concussion Assessment Tool 5 (SCAT5) in professional hockey, part 2: Which components differentiate concussed and non-concussed players? British Journal of Sports Medicine 55, 10, 557-565

Didehbani, N et al (2013) Depressive symptoms and concussion in ageing related NFL players Archives of Clinical Neuropsychology 28, 5, 418-424

Du Preez, E.J et al (2017) Depression, anxiety, and alcohol use in elite rugby league players over a competitive season Clinical Journal of Sport Medicine 6, 530-535

Echemendia, R.J et al (2017) Sports concussion assessment tool (5th edition) (SCAT): Background and rationale British Journal of Sports Medicine 51, 11, 848-850

Guskiewicz, K.M et al (2013) Evidence-based approach to revising the SCAT2: Introducing the SCAT3 British Journal of Sports Medicine 47, 289-293

Hellewell, S.C et al (2020) Characterising the risk of depression following mild traumatic brain injury: A meta-analysis of the literature comparing chronic mTBI to non-mTBI populations Frontiers in Neurology 11: 350

Hind, K et al (2021) Mental health and well-being of retired elite and amateur rugby players and non-contact athletes and associations with sports-related concussion: The UK Rugby Health Project Sports Medicine (<https://link.springer.com/article/10.1007%2Fs40279-021-01594-8>)

Maddocks, D.L et al (1995) The assessment of orientation following concussion in athletes Clinical Journal of Sport Medicine 5, 32-33

McCrory, P et al (2005) Summary and agreement statement of 2nd International Conference on concussion in sport, Prague 2004 British Journal of Sports Medicine 39, 78-86

McCrory, P et al (2009) Consensus statement on concussion in sport: The 3rd International Conference on concussion in sport held in Zurich, November 2008 British Journal of Sports Medicine 43, Sup 1, i76-i84

Nasreddine, Z.S et al (2005) The Montreal Cognitive Assessment, MoCA: A brief screening tool for mild cognitive impairment Journal of the American Geriatrics Society 53, 695-699

Owens, T.S et al (2021) Contact events in rugby union and the link to reduced cognition: Evidence for impaired redox-regulation of cerebrovascular function Experimental Physiology 106, 1971-1980

Zimmerman, K.A et al (2021) White matter abnormalities in active elite adult rugby players Brain Communications 3, 3, fcab133

2. DENISOVANS AND OTHERS

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- 2.2. Denisovans
 - 2.2.1. Genomic insights
- 2.3. Homo longi and others
- 2.4. Human movements
- 2.5. Evolution of humans
 - 2.5.1. Archaeological evidence
 - 2.5.2. Miscellaneous
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2.1. OVERVIEW

It is now clear that "multiple hominin species walked the earth" (Wong 2020 p66). In the "human saga... there is no single missing link that bridges apes and humankind, no drumbeat march of progress toward a pre-destined goal" (Wong 2020 p67).

This is a very long way from the dominant idea of the early nineteenth century of polygenism ², which saw the various human "races" of the world as having separate origins. Implicit in the idea was the superiority of Europeans over Africans. "It was science in the service of slavery and colonialism" (Jennifer Raff in Wong 2020).

However, the notion that "our evolution unfolded in linear fashion from simple to complex, primitive to modern" (Wong 2020 p68) has remained prominent until very recently. For example, the study of mitochondrial DNA in living individuals and working backwards led to the conclusions in the 1980s of a shared common ancestor 200 000 years ago called "mitochondrial Eve" (Cann et al 1987). "Some mitochondrial DNA does not encode protein, and tracking the rate of change as this DNA accumulates mutations over time provides a 'molecular clock'" (Willoughby 2021 p193).

It is also becoming clear that different body parts evolved at different rates. For example, bipedalism has been attributed to Australopithecus afarensis (around 3 million YA), while the large brain growth is much younger (Wong 2020).

"Sometimes evolution even doubled back on itself. When one examines a hominin fossil, it can be difficult to discern whether the species retained a primitive trait such as small brain size from an earlier ancestor or whether it lost the characteristic and then re-evolved

² Monogenism is the accepted alternative that all humans share a common ancestor (Wong 2020).
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it" (Wong 2020 p69).

The overlapping of species is another "messy" element of the story. For example, four species of hominins lived in Africa between 3.6 to 3.3 million YA (eg: Australopithecus afarensis; Australopithecus deyiremeda), while early Homo sapiens with other Homo species 300 000 YA (Wong 2020). "By around 30 000 to 15 000 years ago, with the end of the Neanderthals in Europe and the Denisovans in Asia, H. sapiens was alone in the world" (Wong 2020 p69).

The analysis of DNA is now showing the interbreeding of Homo sapiens and Neanderthals, and with Denisovans (Wong 2020). For example, Schaeffer et al (2021) estimated that 1.5 to 7% of the human genome is unique (while the rest was shared by Neanderthals and Denisovans).

2.2. DENISOVANS

"For hundreds of thousands of years, a mysterious group known as the Denisovans lived in the east of Asia - even as our species was emerging in Africa and beginning to spread around the world. Their homeland spanned thousands of kilometres and they existed as a group longer than we have as a species. Yet they were utterly unknown until 2010, when they were identified from DNA preserved in a bone fragment. A decade later, the Denisovans remain enigmatic" (The Leader 2021a p5). Slowly, though, a picture is being pieced together of the Denisovans from a few disputed fossils (including tools and jewellery) (Marshall 2021a) ³.

Denisova Cave in southern Siberia was the source of archaic hominin remains, related to Neanderthals, which were named "Denisovans". As well as here, potential Denisovan fossils have been found in north China, and genetic links in Melanesia (Marshall 2021a).

Zavala et al (2021) reported the recovery of fossils of a dozen hominins, which included both Neanderthals and Denisovans. This suggested that "Denisova Cave was a contact zone between these archaic hominins. However, uncertainties persist about the order in which these groups appeared at the site, the timing and environmental context of hominin occupation, and the association of particular hominin groups with archaeological

³ "Studies of the Denisovans carefully avoid calling them a species. Whereas Neanderthals have the species name Homo neanderthalensis, Denisovans are referred to as a 'population'. This partly reflects the fact that we know so much less about them..." (Marshall 2021a p38).

assemblages" (Zavala et al 2021 p399). The dating of fossils may be as much as 50 000 years ago (YA). There is also evidence of modern human DNA more recently in evolutionary terms (Zavala et al 2021).

These researchers analysed 175 sediment samples from different parts (and layers of sediment) of the Denisova Cave (Main, East and South Chambers). Each chamber has been dated, and mitochondrial DNA found in that area is thus also dated (in simple terms).

Genetically, Denisovans are a "sister group" to Neanderthals, and they diverged about 400 000 YA, and this shared ancestor split from the line that led to Homo species 600 000 YA (Marshall 2021a).

Key questions include the reason for the split between Denisovans and Neanderthals (eg: due to expanding Arctic ice that created two separate populations), and the reason(s) for the Denisovans dying out (eg: due to interbreeding with other hominins, lethal disease, or climate change) (Marshall 2021a).

An attempt was made to deduce the appearance of Denisovans from their genome (see Callaway 2019), but it was widely dismissed (Marshall 2021a).

2.2.1. Genomic Insights

"Near Oceania" (including New Guinea and the Solomon Islands) was first populated by humans 45 000 YA, and "Remote Oceania" (rest of the Pacific) 35 000 YA according to archaeological evidence (Choin et al 2021). The genomes of 317 individuals from twenty populations in those areas were analysed by Choin et al (2021) to understand the ancestry.

Substantial Neanderthal and Denisovan ancestry was found among these Pacific Islanders. Papuan-related groups appeared to have interacted particularly with the Denisovans (based on genetic mix). Some immune-related functions may have been inherited from Denisovans.

Choin et al (2021) concluded that their analyses showed that "interbreeding between modern humans and highly structured groups of archaic hominins was a common phenomenon in the Asia-Pacific region" (p588).

It is possible that Denisovans also interbred with Homo erectus (who disappeared 100 000 YA), according to DNA studies (Barras 2020).

Ancient DNA, however, does not survive for very long periods in warm conditions. So researchers have focused

on proteins extracted from ancient bones (eg: "enamel proteome" in teeth), and these encode information similar to DNA (Barras 2020). This is the growing field of palaeoproteomics (eg: Welker et al (2019) and Gigantopithecus enamel proteome).

2.3. HOMO LONGI AND OTHERS

A skull found in northern China in the 1930s, and recently dated to 146 000 YA, has been called "Dragon Man" (or more correctly, Homo longi) (Ji et al 2021). These researchers, who named it, placed it as a closer relative of humans than Neanderthals, while others think the skull could be a Denisovan (Gibbons 2021).

The skull was given to a Chinese museum after the death of the owner, and so there was no geological context (Gibbons 2021).

Homo longi "received a frosty welcome. Many researchers think that although the enormous skull used to name the species doesn't seem to have been from a modern human or Neanderthal, it was unnecessary to give it a new species name. Some speculate that the skull belonged to one of the mysterious Denisovan people" (George and Marshall 2021 p10).

New groups of ancient humans are being found regularly in recent times. For example, in mid-2021, a hominin named "Nesher Ramla Homo" was found in modern-day Israel (Herschkovitz et al 2021) (dated as living there between 420 000 and 120 000 YA; The Leader 2021b). Not everyone agrees with the interpretation, and "[I]t is to the credit of the Israeli team that it has refrained from giving the Nesher Ramla Homo a species name. With only a handful of bones to go, not enough even to determine the individual's sex, giving it such a title would surely be premature. The population it came from appears to be a distinct group, but for now that is all we can say" (The Leader 2021b p7). Palaeoanthropologist Philip Rightmire described the skull as looking like an "early, rather archaic-appearing, Neanderthal" (quoted in Jones 2021).

Both the "Dragon Man" and "Nesher Ramla Homo" studies are "based on analyses of the size, shape and structure of fossilised bones - methods that are subject to individual judgement and interpretation" (Jones 2021 p20).

2.4. HUMAN MOVEMENTS

Homo sapiens moved out of Africa, and the question is when did they arrive in western Europe. Archaeological sites, for example, in the UK and Italy suggest 45 000 YA, but mitochondrial DNA from bone fragments in Bacho Kiro Cave, Bulgaria, put it earlier (Hublin et al 2020).

Concentrating on the latter, Hublin et al (2020) stated: "The excavations yielded a wealth of bone artefacts, including pendants manufactured from cave bear teeth that are reminiscent of those later produced by the last Neanderthals of western Europe. These finds are consistent with models based on the arrival of multiple waves of H. sapiens into Europe coming into contact with declining Neanderthal populations" (p299).

Genomic data from five human specimens from Bacho Kiro Cave confirmed that "several distinct modern human populations existed during the early Upper Palaeolithic in Eurasia" (Hajdinjak et al 2021 p257) (ie: from 47 000 YA onwards). Three of the individuals had "Neanderthal ancestors a few generations back in their family history, confirming that the first European modern humans mixed with Neanderthals and suggesting that such mixing could have been common" (Hajdinjak et al 2021 p253).

Early human migration more widely included understanding the peopling of the Americas. Willerslev and Meltzer (2021) explained: "It is now evident that the initial dispersal involved the movement from north-east Asia of distinct and previously unknown populations, including some for whom there are no currently known descendants. The first peoples, once south of the continental ice sheets, spread widely, expanded rapidly and branched into multiple populations" (p356). A "land bridge" between Asia and America existed between 30 000 and 12 000 YA (Willerslev and Meltzer 2021).

Genomics are crucial in this picture, and the first ancient American genome was mapped of a child from the Anzick Clovis site in Montana (USA) and dated to 12 800 YA (Rasmussen et al 2014).

2.5. EVOLUTION OF HUMANS

Ben-Dor and Barkal (2021) described the Pleistocene situation: "The genus Homo underwent an extensive set of physiological, cultural, and behavioural changes during the Pleistocene (roughly 2.6 million to 11.7 thousand years ago). At the end of this period, humans had

established themselves as a species of unprecedented ecological dominance. Most notable among these changes was the directional increase in brain volume in the lineages leading to *H. sapiens*, the habitual use of fire, periodical change of stone-tool technologies, big-game hunting, resource intensification, food production, and animal and plant domestication" (p1).

The issue is what factor (or factors) led to these major changes. Ben-Dor and Barkal (2021) reported the "unifying hypothesis" that the decline in large prey was "a prominent agent of selection in human evolution and cultural change" (p1). They argued that "*H. erectus* evolved to become a carnivore, specialising in large prey beginning 2 million years ago. Later, as prey size declined, humans adapted to acquire and consume smaller and smaller prey while adapting to maintain a constrained bioenergetic budget" (Ben-Dor and Barkal 2021 p1).

Large prey, not only provided higher net energy return and fat content but tended to be easier to catch, they are slow to escape and killing is straightforward (eg: close up with a thrusting spear). Smaller prey, however, were faster to flee, which "usually requires hunting from a distance by the use of more complex projectile weapons" (Ben-Dor and Barkal 2021 p5).

Humans were faced with declining easy-to-catch prey, and "the expansion of various cognitive abilities met the ecological challenge of obtaining calories and fat from smaller prey at acceptable energetic costs. Brain expansion allowed humans to partly or wholly mitigate the potential additional energetic expenses on locomotion by tracking and linguistic communication of prey location, and facilitating economic smaller prey acquisition and exploitation by accumulating and transferring knowledge, and maintaining fire, and producing shaped and complex tools" (Ben-Dor and Barkal 2021 p10). For example, the development of tracking ability.

Liebenberg (2006) distinguished between systematic tracking, where trackers follow the successive spoor of the animal being followed, and speculative tracking. With this method, "speculative trackers skip some potential spoor and proceed to where they speculate that the animal has headed, such as a water hole, an area of shade, or a food patch. Speculative tracking is more suitable for hunting smaller animals, which leave less conspicuous signs of their passage. Speculative tracking advances the hunter more rapidly on a shorter route and improves the tracking process's energetic efficiency" (Ben-Dor and Barkal 2021 p11). Furthermore, speculative tracking is a skill to be mastered with learning and

experience (ie: it requires the development of cognitive capacity and abilities).

Other factors that have been proposed to explain brain expansion include language, and the control of fire, but Ben-Dor and Barkal (2021) saw these as part of the change brought about by the move from large to small prey. These researchers also hypothesised that the decline in prey size was "a significant driver of Neanderthal extinction" (Ben-Dor and Barkal 2021 p14).

2.5.1. Archaeological Evidence

The dating of the evolution of modern humans depends upon archaeological evidence, particularly "technological innovations" (eg: tools; art). Evidence of the collection of "non-utilitarian objects" is important. "Their deposition presumably had some symbolic purpose: a sign that their collectors were behaviourally modern people" (Willoughby 2021 p194).

Wilkins et al (2021) reported such finds at Ga-Mohana Hill on the edge of the Kalahari Desert, dated around 105 000 YA - burnt ostrich eggshell fragments and calcite crystals ⁴. This is earlier than previous evidence of cultural development (eg: Diepkloof Cave, South Africa, 60 000 YA, Texier et al 2010; Blombos Cave, South Africa, 100 000 YA, Henshilwood et al 2009) (Willoughby 2021).

Wilkins et al (2021) viewed their findings as evidence for "a polycentric origin for the emergence of *H. sapiens*" (p252), while that and other evidence for later *Homo sapiens*, Willoughby (2021) felt, "now indicates that there does not seem to be any single pattern of technological and social development over time" (p194).

2.5.2. Miscellaneous

Analysis of DNA from ancient teeth found evidence of the viruses behind the common cold and cold sores (Nielsen et al 2021). Shared ancestors of the adenoviruses were estimated at 700 000 YA, which could suggest that hominins before *Homo sapiens* were infected (Marshall 2021b).

⁴ "Crystals have been linked to spiritual beliefs and ritual for many time periods across the world, including Stone Age southern Africa" (Wilkins et al 2021 p249). Middle Stone Age = 300 000 - 30 000 YA; Later Stone Age after 40 000 YA (Willoughby 2021).

2.6. REFERENCES

- Barras, C (2020) Beyond ancient DNA New Scientist 12th September, 39-43
- Ben-Dor, M & Barkal, R (2021) Prey size decline as a unifying ecological selecting agent in Pleistocene human evolution Quaternary 4, 7
- Callaway, E (2019) First portrait of mysterious Denisovans drawn from DNA Nature 573, 475-476
- Cann, R.L et al (1987) Mitochondrial DNA and human evolution Nature 325, 31-36
- Choin, J et al (2021) Genome insight into population history and biological adaptation in Oceania Nature 592, 583-589
- George, A & Marshall, M (2021) More tangles in our human story New Scientist 3rd July, 10-11
- Gibbons, A (2021) Stunning "Dragon Man" skull may be an elusive Denisovan - or a new species of human Science (<https://www.science.org/content/article/stunning-dragon-man-skull-may-be-elusive-denisovan-or-new-species-human>)
- Hajdinjak, M et al (2021) Initial Upper Palaeolithic humans in Europe had recent Neanderthal ancestry Nature 592, 253-257
- Henshilwood, C.S et al (2009) Engraved ochres from the Middle Stone Age levels at Blombos Cave, South Africa Journal of Human Evolution 57, 27-47
- Herschkovitz, I et al (2021) A middle Pleistocene Homo from Nester Rama, Israel Science 372, 1424-1428
- Hublin, J-J et al (2020) Initial Upper Palaeolithic Homo sapiens from Bacho Kiro Cave, Bulgaria Nature 581, 299-302
- Ji, Q et al (2021) Late Middle Pleistocene Harbin cranium represents a new Homo species The Innovation 2, 3, 100132
- Jones, N (2021) Fossils expand human family tree - but questions remain Nature 595, p20
- Liebenberg, L (2006) Persistence hunting by modern hunter-gatherers Current Anthropology 47, 1017-1026
- Marshall, M (2021a) The other humans New Scientist 30th January, 34-39
- Marshall, M (2021b) Did Neanderthals get the sniffles? New Scientist 10th July, p12
- Nielsen, S.H et al (2021) 31 600 year-old human virus genomes support a Pleistocene origin for common childhood infections bioRxiv (<https://www.biorxiv.org/content/10.1101/2021.06.28.450199v1>)
- Rasmussen, M et al (2014) The genome of a late Pleistocene Psychology Miscellany No. 159; January 2022; ISSN: 1754-2200; Kevin Brewer

human from a Clovis burial site in western Montana Nature 506, 225-229

Schaeffer, N.K et al (2021) An ancestral recombination graph of human, Neanderthal, and Denisovan genomes Science Advances 7, eabc0776

Texier, P-J et al (2010) A Howiesons Poort tradition of engraving ostrich eggshell containers dated to 60 000 years ago at Diepkloof Rock Shelter, South Africa Proceedings of the National Academy of Sciences, USA 107, 6180-6185

The Leader (2021a) A twist of human fate New Scientist 30th January, p5

The Leader (2021b) Our complex history New Scientist 3rd July, p7

Welker, F et al (2019) Enamel proteome shows that Gigantopithecus was an early diverging pongine Nature 576, 262-265

Wilkins, J et al (2021) Innovative Homo sapiens behaviours 105 000 years ago in a wetter Kalahari Nature 592, 193-194

Willerslev, E & Meltzer, D.J (2021) Peopling of the Americas as inferred from ancient genomes Nature 594, 356-364

Willoughby, P.R (2021) Early Africans living inland collected unusual objects Nature 592, 193-194

Wong, K (2020) The origin of us Scientific American September, 65-70

Zavala, E.I et al (2021) Pleistocene sediment DNA reveals hominin and faunal turnovers at Denisova Cave Nature 595, 399-403

3. BIODIVERSITY CRISIS

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- 3.2. Preserving nature
- 3.3. Anthropocentric climate change
 - 3.3.1. Human impact
 - 3.3.2. Landscape fire smoke pollution
- 3.4. Ocean
 - 3.4.1. Water
 - 3.4.2. Miscellaneous
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- 3.6. References

3.1. EXTINCTION DENIAL

The International Union for the Conservation of Nature (IUCN) produces a "red list" of "critically endangered (possible extinct)" species, which includes 143 amphibian, 22 bird, and 41 reptile, and 29 mammal species, while 75 species are classified as "extinct in the wild" (Lees et al 2020). At the same time, Lees et al (2020) talked of "the creeping rise of extinction denial".

Lees et al (2020) explained: "Denial of scientific evidence and rejection of scientific methods are not new phenomena, but represent an increasingly serious problem, especially when driven by politically well-connected and well-funded antagonists seeking to sabotage evidence-based policy for political and/or financial gain. Terms such as 'science denial' and 'science denialism' are employed as monikers for such anti-scientific enterprises, seeking to discredit, for example, the health impacts of smoking, climate science, the teaching of evolution in schools and vaccination campaigns. There is an emerging body of literature characterising the nature of these activities, and the personal, organisational and economic inter-linkages between them" (p1440).

Building on Cohen's (2001) ideas about the denial of atrocities, Lees et al (2020) distinguished three types of extinction denial:

- i) "Literal denial" - rejects the scientific data on species extinctions.

ii) "Interpretive denial" - accepts the scientific data, but suggests that they are exaggerated.

iii) "Implicatory denial" - accepts that there is a problem, but rejects the need for radical action.

The challenge for science is great, however, because establishing the extinction of a species is hard, and then that human activity caused that extinction (Lawton 2021a).

3.2. PRESERVING NATURE

Protected Areas (PAs) are key to biodiversity conservation, and so are "other effective area-based conservation measures" (OECMs).

A PA is defined as "A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values" (Dudley et al 2008 quoted in Maxwell et al 2020). While an OECM is defined as "A geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity, with associated ecosystem functions and services and, where applicable, cultural, spiritual, socio-economic, and other locally relevant values" (IUCN WCPA 2019 quoted in Maxwell et al 2020). Together they are "area-based conservation measures" (Maxwell et al 2020).

The Convention on Biological Diversity (CBD) in 2010 set a ten-year target of 17% of terrestrial and inland water areas and 10% of coastal and marine areas in the world to be conserved. One hundred and sixty-eight countries agreed to the target (Maxwell et al 2020).

Between 2010 and 2019, PAs did expand in line with the target, but, at the same time, areas were removed from protection. The latter are classed as "protected area downgrading, downsizing and degazettement" (PADDD) events (eg: 23 PADDD events at natural World Heritage sites between 1997 and 2014) (Maxwell et al 2020). "Potentially of greatest concern are the many PADDD events that are going undocumented, particularly in marine systems and on private land" (Maxwell et al 2020 p223).

Reflecting on the decade since the CBD 2010 target, Maxwell et al (2020) concluded: "Area-based conservation

will remain the cornerstone of biodiversity conservation long into the twenty-first century, but governments have markedly under invested in protected areas and OECMs and been weak in legally protecting them" (p225).

3.3. ANTHROPOCENTRIC CLIMATE CHANGE

The efforts to decrease emissions of greenhouse gases "should be taken if the cost involved is smaller than the social cost - the monetary value of future damage caused by letting the gas escape to the atmosphere" (Hammitt 2021 p514). But calculating the future damage involves modelling and estimating the costs.

For example, Nitrous oxide (N₂O) is "a long-lived stratosphere ozone-depleting substance and greenhouse gas with a current atmospheric lifetime of 116 ±9 year" that has increased by 20% between 1750 and 2018 (Tian et al 2020). Its release into the atmosphere is linked to temperature, water and oxygen levels, and acidity of the soil (and the use of nitrogen fertiliser), for instance (Tian et al 2020).

It is expected that N₂O emissions will continue to increase at 2% per decade due to growing demand for food and energy, and from industrial processes. The United Nations Framework Convention on Climate Change (UNFCCC) reports anthropogenic N₂O emissions annually. Tian et al (2020) saw these figures as an underestimate, which they showed with their calculations of natural and anthropogenic sources. They found a recent growth (since 1980) that exceeded "some of the highest projected emission scenarios, underscoring the urgency to mitigate N₂O emissions" (Tian et al 2020 p248).

3.3.1. Human Impact

Ramaswami (2021) emphasised that urbanisation is both good and bad - wealth-creating, but also polluting, for instance. When considering climate change and how cities should respond, it is important to note that "cities aren't concrete jungles that stop abruptly at their official limits, but complex, dynamic systems that extend much further and, like living organisms, have their own metabolism. Only by thinking of them in this way can we start to make them more liveable" (Ramaswami 2021 p43).

Synthetic chemicals, of which there are thousands of different ones, are a major pollutant, including (Lawton 2021b):

- Asbestos - Silicate minerals used as a fire retardant and thermal insulator in buildings in the 20th century.
- Heavy metals (eg: lead, mercury, arsenic) - Toxic.
- Hazardous pesticides - Maybe over 300 "highly hazardous pesticides" still used.
- Chlorofluorocarbons (CFCs) - impact on the ozone layer of the atmosphere.
- Endocrine disrupters (EDCs) - eg: polychlorinated biphenyls (PCBs).
- Environmentally persistent pharmaceuticals.

3.3.2. Landscape Fire Smoke Pollution

"Landscape fires" (LFs) involve the open burning of vegetation and organic soils. They "adversely affect public health in many ways, such as promoting infectious diseases via ecological effects, causing direct mortality, and destroying homes. The most harmful public health effect of landscape fires is the air pollution, and exposure to toxic fine particles, they produce. Inhalation of these particles has been linked to adverse health outcomes, such as total mortality, cardio-respiratory diseases, birth defects, and other health impacts" (Xue et al 2021 pe588).

Xue et al (2021) focused on the impact of LF smoke on child mortality in low- and middle-income countries (LMICs). The data came from 132 Demographic and Health Surveys (DHS) in fifty-five LMICs between 2000 and 2014. Based on satellite data, the impact of LFs was modelled for an area. Children who died in such areas (n = 188 516) were matched with living siblings (n = 363 639).

This was a "super-linear curvature of the association" (pe593) (figure 3.1) between exposure to LF smoke pollution and child mortality. So, "landscape fire smoke significantly and robustly increased the risk of premature death in children in LMICs" (Xue et al 2021 pe595). There was an exposure-response function (ie:

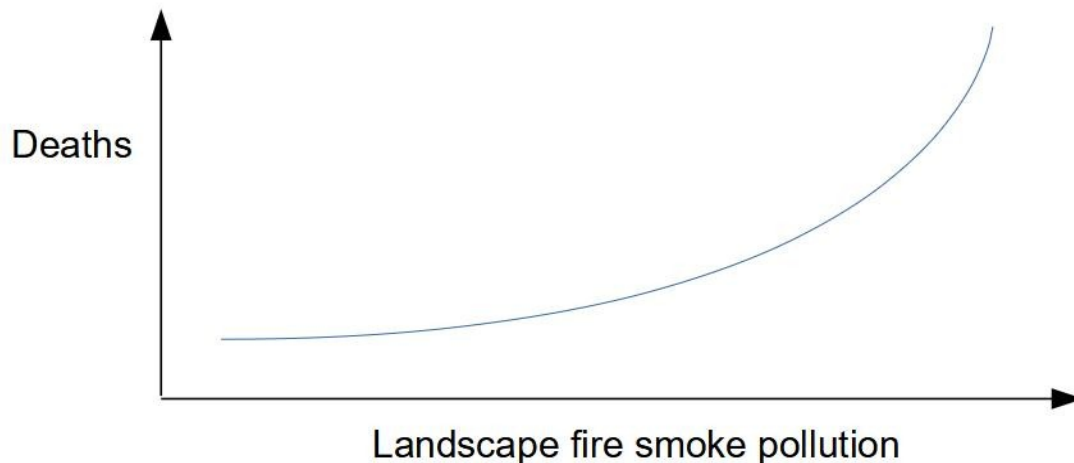


Figure 3.1 - A super-linear curve.

greater exposure to LF smoke was associated with a greater number of deaths).

Previous studies on the subject include case studies, for example, the extreme Indonesian fires of 1979 were estimated to be associated with 15 600 infant and foetal deaths (Xue et al 2021). While epidemiological studies have, for instance, looked at mortality among firefighters and occupational smoke exposure (Xue et al 2021). Few epidemiological studies have covered child mortality as Xue et al (2021) did.

3.4. OCEAN

If there is a biodiversity crisis, then there must be data from the past to show the declines claimed today. Here there is a role for archival documents. This is "historical ecology", which can "help address the conundrum conservation biologists face posed by the 'shifting baseline syndrome' (Jackson et al 2011), wherein successive generations redefine that which is regarded as 'natural' based on their own temporally truncated mindset and casual acceptance of a progressively depauperate natural world as the normal status quo" (France 2021 p55).

This is applicable to marine species. Archival documents, originally created for other reasons, like explorers' reports, travellers' diaries, and naturalists' journals, can be used (France 2021).

France (2021) made use of anecdotal evidence of non-lethal entanglements in fishing gear. "Entanglement is widely believed to be a modern phenomenon corresponding to the advent and widespread use of plastic since the middle of the twentieth century..., with little or no occurrence before that time..., due to the assumption that materials consisting of hemp, cotton and other fibres will 'lose their resilience in usage and if lost or discarded at sea [will] tend to disintegrate quickly' (Gregory, 2009)...[but]... Although it is certainly true that earlier ropes and nets would have deteriorated more rapidly than their modern-day synthetic equivalents, it is erroneous to suppose that such materials were not of sufficient durability as to justify their ubiquitous and continued maritime use..., nor their consequent ability to pose an entanglement threat to susceptible wildlife" (France 2021 p55).

Of particular interest are animals that escape capture, "possibly pulling entangled gear behind them as a legacy of their near brush with death. Indeed, the sea serpent literature is filled with accounts documenting that strong swimmers such as recognised cetaceans, pinnipeds, large fishes or unknown 'monsters' could muscle their way through gillnets made of cotton twine or hemp, sometimes, in the process, making off with portions of the net and its accompanying floats in tow" (France 2021 p56).

France (2021) examined eye witness accounts of 214 "unidentified marine objects" (UMOs) around the British Isles between 1809 and 2000. Put another way, the sightings of "sea serpents" are assumed to be misconstrued entangled animals.

The eye witness accounts included references to:

a) Body shape - eg: "an enormous worm" (p59).

b) Body "humps" - eg: "undulating portions of the body... above the surface" (p60); "I counted with the binoculars twelve or perhaps thirteen humps at almost perfectly regular distances the one from the others" (p61).

c) Body "hair" - eg: "showing a brown and hairy body" (p63).

d) Swimming motion - eg: "Its elongated body was fairly on the surface of the water and it progressed with an undulating or quivering motion" (p63).

France (2021) observed: "At first blush, it might seem odd that so many eyewitnesses could mistake entangled fishing gear for the body of a sea serpent. However, it takes but a brief glance at nineteenth-century fishery illustrations and photographs of long strings of net floats... to realise that if seen at a distance, possibly festooned with strands of matted netting or kelp to give an impression of solidity, and bobbing along atop the surface of the water in an undulating motion while accompanied by water disturbance created through being pulled behind an entangled animal, that it would certainly not be surprising for an observer's expectant confirmatory bias to kick in and a conclusion reached that it was indeed a classic sea serpent that was being glimpsed" (p67).

The anecdotal evidence shows the impact of human behaviour on the marine environment over a longer period, specifically that entanglements happened before the arrival of synthetic fishing materials. France (2021) ended that "marine fauna in the British Isles have been subjected to pressure not only from direct fishery exploitation... but also from being by-catch due to entanglement in that deployed gear for a much longer period than is commonly presumed, that is extending back at least for several centuries" (p68). This challenges "the narrative of a destructive modernity as distinguished from a glorified past" (Anonymous reviewer quoted in France 2021).

3.4.1. Water

"The flowing waters of surface rivers and streams efficiently transport sediment, organic material and nutrients, among other things, from hillsides and overland areas to downstream lakes, reservoirs and the ocean. Along the way, rivers and streams... provide important resources for our communities and support rich, complex ecosystems" (Jaeger 2021 p335).

Non-perennial rivers and streams (or intermittent rivers and ephemeral streams; IRES) that do not flow all the year are less reliable than perennial ones. Messenger et al (2021) estimated the proportion of global rivers and streams that are non-perennial to model water availability. It was calculated that 51-60% do not flow at least one day per year, and 44-53% are dry for at least thirty days per year. These figures are higher for rivers and streams in hot, dry regions.

3.4.2. Miscellaneous

Azidothymidine (AZT) for HIV was approved in 1987, and it was modelled on sponge compounds from species discovered off the coast of Florida in 1945 (Heffernan 2020). This is an example of serendipity of findings in the natural world. Thus the importance of protecting life on land and in the seas.

3.5. ANIMALS

"Pharmaceuticals are ubiquitous in aquatic ecosystems globally and are recognised as environmental contaminants of concern" (Reisinger et al 2021 p2). Simply, humans excrete or dump pharmaceuticals into the water supply. The concentrations are very low when measured in the environment generally, and are "below the threshold at which most pharmaceuticals are lethal to model organisms tested using standard ecotoxicology methods" (Reisinger et al 2021 p2). But acute exposure (ie: high concentrations) or chronic exposure (ie: long-term) can have non-lethal effects on ecosystems (Reisinger et al 2021).

Reisinger et al (2021) focused on the anti-depressant, selective serotonin reuptake inhibitors (SSRIs), which increase serotonin levels in the human brain, and the freshwater crayfish. Changes in the behaviour of this species from the pharmaceuticals will alter the whole ecosystem.

The researchers had created artificial stream ecosystems in their laboratory in the USA. There were four conditions - control (no crayfish and no SSRI), crayfish only, SSRI (citalopram) only, and crayfish/SSRI. Three male spinycheek crayfish (*Faxonius limosus*) (figure 3.2) were used in each condition, and the experiment lasted fourteen days.

The behaviour of the crayfish was scored for boldness (eg: time to leave shelter to seek food), and aggression (eg: approaching other males) in a specially designed maze.

The males exposed to SSRI were significantly bolder than controls as shown by a shorter time to emerge from shelter (mean 67 vs 119 seconds). The SSRI-exposed crayfish spent more time foraging than controls, but avoided conspecifics.

The increase in boldness and spending more time foraging in a real environment would make the crayfish



(Source: Andreas R Thomson; in public domain)

Figure 3.2 - Spinycheek crayfish.

more vulnerable to predators. Reisinger et al (2021) summed up: "Overall, the behavioural changes caused by citalopram exposure could reduce crayfish population sizes by increasing vulnerability to predation, but they could also increase per capita impacts of crayfish on the environment by increasing foraging rates" (p14).

The study lasted 14 days, and it may be that the effects of SSRIs take longer (eg: 4-12 weeks to accumulate within the body). Consequently, the researchers were unable to detect changes in the ecosystem due to the behaviour changes of the crayfish, though there were hints of possible effects. For example, if the crayfish exposed to SSRI spent more time foraging, their food sources could be depleted (eg: invertebrates).

An "environmentally realistic" concentration of citalopram was used (0.5 microgram per litre; $\mu\text{g/L}$), though higher levels have been found in real-world studies. Note also that some experiments directly injected SSRIs into the animals studied (Reisinger et al 2021).

3.5.1. Trout

Illicit drugs also escape into the streams and rivers via wastewater systems that are not designed to extract them.

Horky et al (2021) showed the consequences experimentally with methamphetamine (Meth). The researchers placed sixty brown trout (*Salmo trutta*) in a tank with Meth at a concentration of 1 microgram per litre, and sixty trout in a control tank for eight weeks. Then all the fish were placed in a tank with two streams of water, one containing Meth and one not. The preference for the stream of water was measured - 51% of trout from the Meth tank were found in the Meth stream of water compared to 42% of the controls. This was taken as a sign of addiction (Research Highlights 2021).

3.5.2. Caterpillars

Artificial light at night (ALAN) (eg: urban street lighting) is "an increasingly recognised threat to biodiversity and ecosystem processes and has recently been proposed as a driver of insect decline" (Boyes et al 2021 p1).

Moths are potentially particularly impacted. They are "functionally important for terrestrial ecosystems, including as pollinators, prey for both vertebrates (eg: birds and bats) and invertebrates (eg: spiders and social wasps), and hosts for parasitoids, and thus, these changes are expected to have substantial cascading consequences for ecosystems" (Boyes et al 2021 p1).

Boyes et al (2021) investigated the impacts of nighttime lighting on wild caterpillars in southern England. Twenty-six pairs of sites (transects) (hedgerows and grass margins) were selected - one of each pair was lit by streetlights, and the other was not. The sites were sampled on one day for caterpillar abundance, which was "substantially lower in habitat areas illuminated by streetlights" (Boyes et al 2021 p1). This was 47% less in lit versus unlit hedgerows, and 33% less in lit versus unlit grass margins ⁵. In total, over 2500 caterpillars were counted.

Possible explanations for the findings include less eggs laid in lit areas, increased predation, and differences in the food plants (eg: physically tougher in lit areas) (Boyes et al 2021).

Boyes et al (2021) reported another interesting finding: "Moth caterpillars sampled from lit transects were typically heavier than those from unlit areas, likely because ALAN heightened developmental rates" (p2).

⁵ Van Grunsven et al (2020) reported only a 14% decline in adult moths over five years in lit areas. Psychology Miscellany No. 159; January 2022; ISSN: 1754-2200; Kevin Brewer

The study used existing street lighting (rather than experimental lighting as in Van Grunsven et al 2020), and carefully matched sites. Boyes et al (2021) stated: "Although we cannot eliminate the possibility of unknown confounding factors influencing our results entirely, we are confident that differences between lit and unlit transects were not affected by dissimilarity in botanical composition, road verge management and levels of urbanisation surrounding the transects. Streetlights usually exist for one of two reasons: safety at junctions or proximity to urbanised areas. It is possible that lit transects, some of which were near junctions, might have experienced slightly elevated car noise, air pollution (eg: NO₂), or headlight glare, but we expect that the influence of such factors would have been minor compared to the effect of streetlights" (p3).

The sites varied in street lighting technology (eg: light-emitting diodes (LEDs) and high-pressure sodium (HPS) lamps), and the categorisation of lit/unlit based on light intensity (lux) was "based on human vision, and thus potentially ecologically relevant spectral information can be omitted when using this unit. Identical measurements of lux may not correspond to the same illumination as perceived by a caterpillar" (Boyes et al 2021 p5).

3.6. REFERENCES

Boyes, D.H et al (2021) Street lighting has detrimental impacts on local insect populations Science Advances 7, eabi8322

Cohen, S (2001) States of Denial: Knowing About Atrocities and Suffering Cambridge: Polity Press

Dudley, N et al (2008) Guidelines for Applying Protected Area Management Categories Switzerland: IUCN

France, R.L (2021) Historical anecdotes of fishing pressure: Misconstrued "sea serpent" sightings provide evidence for antecedent entanglement of marine biota in the British Isles Fish and Fisheries 22, 54-71

Gregory, M.R (2009) Environmental implications of plastic debris in marine settings - entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions Philosophical Transactions of the Royal Society B 364, 2013-2025

Hammitt, J.K (2021) The future costs of methane emissions Nature 592, 514-515

Heffernan, O (2020) Help for the high seas Nature 580, 20-22

Horky, P et al (2021) Methamphetamine pollution elicits addiction in wild fish Journal of Experimental Psychology 224, 13, jeb242145

IUCN WCPA (2019) Guidelines for Recognising and Reporting Other Effective Area-Based Conservation Measures Switzerland: IUCN

Jackson, J.B.C et al (2011) Shifting Baselines: The Past and the Future of Ocean Fisheries Washington DC: Island Press

Jaeger, K.L (2021) Most rivers and streams run dry every year Nature 594, 335-336

Lawton, G (2021a) Extinctions? What extinctions? New Scientist 13th March, p14

Lawton, G (2021b) Earth's chemical crisis New Scientist 24th July, 36-42

Lees, A.C et al (2020) Biodiversity scientists must fight the creeping rise of extinction denial Nature Ecology and Evolution 4, 1440-1443

Maxwell, S.L et al (2020) Area-based conservation in the twenty-first century Nature 586, 217-227

Messenger, M.L et al (2021) Global prevalence of non-perennial rivers and streams Nature 594, 391-397

Ramasawami, A (with Spinney, L) (2021) "Many people see cities as villains. I prefer a more nuanced narrative" New Scientist 12th June, 42-45

Reisinger, A.J et al (2021) Exposure to a common anti-depressant alters crayfish behaviour and has potential subsequent ecosystem impacts Ecosphere 12, 6, e03527

Research Highlights (2021) Something in the water: Trout get hooked by meth Nature 595, p335

Tian, H et al (2020) A comprehensive quantification of global nitrous oxide sources and sinks Nature 586, 248-256

Van Grunsven, R.H.A et al (2020) Experimental light at night has a negative long-term impact on macro-moth populations Current Biology 30, R694-R695

Xue, T et al (2021) Associations between exposure to landscape fire smoke and child mortality in low-income and middle-income countries: A matched case-control study Lancet Public Health 5, e588-e598

4. GOSSIP AND REPUTATION

- 4.1. Gossip
- 4.2. Indirect reciprocity
- 4.3. Competitive gossip
 - 4.3.1. Research with co-operative games
 - 4.3.2. Competitive altruism
- 4.4. References

4.1. GOSSIP

Co-operation among unrelated individuals is not unique to humans, but it is "one of the most prominent features of human societies that makes life together highly successful. Assigning reputation to others, sharing reputations of others and conditioning behaviour on reputation are among the main driving forces of such co-operation" (Szamado et al 2021 p1).

"A reputation can be seen as an evaluation of an individual based on their past action(s). The importance of such a reputation is that it will determine how others will treat/react to them in future encounters. This reputation can be solely based on individual experiences (eg: based on past interactions and/or observations of the ego), or it can be based on the aggregated experiences of a group. The resulting reputations can be stored privately (eg: in the brains of the individuals within the group), allowing different individuals to have different reputational assessments of the same person; or they can be stored publicly (eg: a public webpage of tax evaders)" (Szamado et al 2021 p2).

Szamado et al (2021) outlined the issues related to the evolution of reputation-based systems. There needs to be certain elements:

- a) A set of rules by which to evaluate individual behaviour ("social norms").
- b) A communication system to share information about individual's reputation.
- c) A set of rules on how to treat individuals based on their reputation ("behavioural norms").
- d) The appropriate cognitive skills (eg: large working memory to store reputational information).

Concentrating on the communication of reputation

information, gossip is important ⁶. "A wealth of empirical studies shows that the 'threat of gossip' can promote co-operative behaviour. This threat of gossip refers to situations where individuals know that they are being observed and that these observations can be communicated to other group members. A general conclusion is that individuals will behave more co-operatively under the threat of gossip than they would do otherwise. This clearly shows that humans are aware of the importance of reputations and of the importance of gossip as a mediator in reputation building in systems of aggregated reputation" (Szamado et al 2021 p3). However, the "threat of gossip" must be backed up by sanctions against non-co-operators or else co-operation will collapse (Szamado et al 2021).

4.2. INDIRECT RECIPROCITY

Gossip has a role in "indirect reciprocity". This is where "individual A helps (harms) another individual B, then individual C learns about this behaviour and subsequently decides to help (harm) A when they meet" (Dores Cruz et al 2021a p1).

Dores Cruz et al (2021a) investigated gossip and indirect reciprocity in everyday life using experience sampling. The participants were 309 Dutch adults, and the study covered ten consecutive days. Each day the participants received randomly four text messages which directed them to an online survey about recent gossip. In total, there were just under 10 000 responses.

In terms of the content of gossip, "participants frequently reported gossip as being relevant to evaluating the target's trustworthiness (60.6% [of responses]), warmth (61.0%), competence (59.2%) and dominance (61.1%), with no significant difference in the frequency of these dimension... Thus, gossip enabled people to frequently share information relevant to evaluating other's reputations on four key dimensions of person perception" (Dores Cruz et al 2021a p4). Gossip related to norm violation was evident in 15% of reports. Receivers of gossip did evaluate the information as accurate (eg: known conflict between the sender and target of gossip). Dores Cruz et al (2021a) admitted: "Our current data do not allow inferences about whether

⁶ Dores Cruz et al (2021b) defined gossip as "a sender communicating with a receiver about a target who is absent or unaware of the content" (quoted in Hess and Hagen 2021). Hess and Hagen (2021) added that many other definitions include a "valence dimension (that gossip can be positive or negative), and an (in)formality dimension (gossip is informal rather than formal communication)" (p2). Psychology Miscellany No. 159; January 2022; ISSN: 1754-2200; Kevin Brewer

the gossip was truthful or not, but we do know that people overwhelmingly believed the gossip they received" (pp6-7).

The participants reported the intention to change their behaviour towards a target based on gossip heard (both positive and negative change). But Dores Cruz et al (2021a) "only measured behavioural intentions, which hinders drawing conclusions about how gossip impacts actual co-operative behaviour towards targets. It is possible that there is a gap between intentions and behaviour" (p7).

Another limitation was that "as participants reported to the researchers, they may have refrained from reporting certain kinds of gossip, such as negative or false gossip" (Dores Cruz et al 2021a p7).

4.3. COMPETITIVE GOSSIP

The "social competition" explanations of gossip see it as "a means of manipulating reputations to the benefit of oneself, one's kin, and one's allies" (Hess and Hagen 2021 p2). This makes gossip a form of "indirect" or non-physical aggression, and "it functions to increase access to resources and mates by harming competitors' reputations or by excluding competitors from the group. Gossip about negative deeds and qualities will decrease a target's reputation, thus decreasing a target's access to group resources – with the effect of increasing one's own access to those resources" (Hess and Hagen 2021 p2).

Hess and Hagen (2021) tested one of social competition explanations called "informational warfare theory". This proposes that "allies should deter negative gossip and increase one's ability to harm competitors with gossip" (Hess and Hagen 2021 p2).

In Study 1, 609 adults, recruited online, were asked to read a short vignette about an individual in a work or family situation (table 4.1). Then they read ten positive and negative gossip statements about the target and indicated how likely they would be to tell the information to another person (on a scale of 1 ("very unlikely to tell") to 9 ("very likely to tell")). The researchers varied the degree of competition in various ways.

Hess and Hagen (2021) made four predictions to test:

1 - There will be more gossip specific to the area of competition than other areas of life. This was support with higher likelihood to gossip scores for work-related

- "Office scenario: imagine you work in an office with about 10 co-workers, half men and half women. Your office is one division of a company that has done well in the last year. Elizabeth is one of your co-workers. Your desk is next to Elizabeth's, so you know more about her than most other people in the company know" (p3).
- Positive statement - "Elizabeth is enthusiastic with customers at work".
- Negative statement - "Elizabeth is unenthusiastic with customers at work".

Table 4.1 - Example of materials used by Hess and Hagen (2021) in Study 1.

than family-related statements in the work scenario, and vice versa for the family scenario. Neutral statements on taste in art and literature were unaffected by the scenario.

2 - There will be more negative gossip when there is competition for a valuable resource. The researchers varied the size of the salary increase with the promotion as either "small" or "large". The tendency to share negative gossip was greater for the large than small salary increase. Thus supporting this prediction.

3 - There will be more negative gossip when the competition is for scarce resources. The number of co-workers competing for the promotion was varied, and "[A]s predicted, a scarcer resource resulted in an increased tendency to relate negative gossip" (Hess and Hagen 2021 p8).

4 - Negative gossip will be less about a competitor who is a strategic ally. This was tested by making the competitor for promotion a good friend in one experimental condition. There was less negative gossip in this situation compared to a competitor who was not a friend. Again, support for the prediction.

Study 2 confirmed these findings with a sample of 74 US university students and an imaginary college sorority.

Overall, the two studies supported the informational warfare theory, and that negative gossip is a strategy in competitions. However, the two studies used short imagined scenarios, and participants self-reported their intentions to gossip. Hess and Hagen (2021) admitted:

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"Our sample was heavily female-biased, which could have influenced our results. Most tests, however, did not reveal significant sex differences" (p10).

4.3.1. Research with Co-operation Games

"Explanations that link gossip to co-operation are valid only if we assume that gossip contains real information and negative gossip targets those individuals who attempted to exploit co-operation efforts. Gossip, however, is not necessarily honest and credible. Distortion might occur from misinterpretation of actions.., but it could also be the result of strategic manipulation by the sender" (Samu and Takacs 2021 p2).

Samu and Takacs (2021) investigated three aspects of the credibility of gossip:

i) A conflict of interests between the sender of the gossip and the target of it (ie: they are competitors).

ii) Dishonest gossip is deterred if there are other sources of information (ie: it is possible to cross-check information).

iii) Gossip can strengthen the social bond between the sender and receiver, but only if the information is honest.

The researchers recruited 234 students at a university in Hungary to play a two-person "Prisoner's Dilemma" (PD) game. This is a commonly used form of co-operation game with different pay-offs for different decisions. It is imagined that there are two partners in crime (prisoners) in separate rooms being questioned, and each prisoner must decide to co-operate (ie: not tell the police any information) or defect without knowing what the partner will do. If they both co-operate the pay-off is highest compared to one co-operating and one detecting, or both defecting (table 4.2).

	Prisoner A Co-operate	Prisoner A Defect
Prisoner B Co-operate	1500 each	A 200/B 0
Prisoner B Defect	B 200/A 0	500 each

Table 4.2 - Pay-off options (units) used by Samu and Takacs (2021).

Participants played a number of rounds of PD, and the researchers manipulated variables related to the three aspects of gossip credibility above. Playing in groups of 20 via computer, two individuals were randomly selected for each round. After each game the participants could send two messages about their opponent to any two players in the group. This was the gossip. After six rounds, participants could assign reputation scores to other participants.

In terms of the manipulation of variables:

i) Competition between sender and target of gossip was created by introducing small rival groups (selected randomly by the researchers).

ii) Cross-checking was introduced by allowing participants to ask for a second gossip about the same target.

iii) Social bonding was created by allowing reciprocal gossip.

The baseline level of co-operation before gossip was introduced was 39% of PD games. Co-operation increased initially with gossip (to 52%), but subsequently declined after multiple rounds to 30%.

Overall, a reliable reputation system developed during the rounds and it influenced participants' decision to co-operate. This was despite dishonest gossip about rivals.

So, "while overall individuals trusted gossip, neither cross-checking nor bonding opportunities increased co-operation. However, when there was a stronger competition for reputation, this tended to increase co-operation" (Szamado et al 2021 p4).

Samu and Takacs (2021) commented that "gossip was implemented in a very simplified form, as transmission of evaluative social information (sending an emoticon) about the target. This certainly limits the generalisability of our results to empirical situations in which the power of gossip is enhanced in extensive communication" (p7).

4.3. Competitive Altruism

Reputation building is important in a "market for co-operators" (Noe and Hammerstein 1995) (ie: a choice of partners to co-operate with). "Large groups can be seen as a market-place in which individuals would trade as

buyers and sellers of co-operation in order to form the most successful coalitions" (Giardini et al 2021 p1). This has been called "competitive altruism" (Roberts 1998).

Giardini et al (2021) studied this and gossip using the "Public Good" game (PGG). Players begin with a certain number of points, and they can put as much as they want into a common fund. The total amount of the fund is doubled, say, and redistributed to the players. The amount shared is the measure of co-operation. In an ideal situation, for example, four players each with 50 points, who share it all (ie: 200 points), would end up with 100 points each (ie: $200 \times 2 \div 4$). But defectors (who share nothing) still gain. For instance, three players share forty points each and one defector, all receive back 60 points (ie: $120 \times 2 \div 4$). The defector gains most (60 + original 40 unused = 100).

The participants of Giardini et al's (2021) study were 160 students at a university in Spain, and the points were worth small amounts of money at the end of the experiment. Half of the participants were in the competitive (COMP) condition and half in the non-competitive (NCOMP) one.

Groups of four played ten rounds of the PGG (Phase 1), starting with fifty points, and the total in the fund was multiplied 1.5 times. Players knew how much each one contributed to the fund. After Phase 1, players could share messages about the other players' co-operation (gossip) to other groups.

Phase 2 involved ten more rounds of the PGG in new randomly allocated groups of four, followed by gossip opportunities. Phase 3 allowed players to choose who would be in an eight-person group for one round of the PGG with a triple multiplication of the fund. In the COMP, the most generous group was rewarded with a bonus, whereas in NCOMP all groups received a bonus. The three phases of the experiment were explained at the start, and the whole experiment took place via individual computers.

Overall, participants in the COMP shared more throughout the experiment, and highly co-operative players sent more truthful messages about low co-operative players. "This result can be interpreted as co-operators increasing the number of truthful messages and gossip reliability to gain a better reputation and emerge from the crowd as better contributors to be chosen right before the partner selection of phase 3" (Giardini et al 2021 p5). Highly co-operative players were competing to be chosen in Phase 3 in the COMP. Defectors (or low co-operators) obviously shared less, but also their gossip

was unreliable. Giardini et al (2021) explained: "If co-operation has signalling value, then investing in it is beneficial only if the gossip about co-operators is honest, and they can be reliably identified and selected for future partnerships. In a complementary way, our results show that defectors actively try to undermine the reliability of gossip by spreading false information" (p7).

Giardini et al (2021) ended that their study "determined that competitive altruism can explain gossip reliability and that gossip strategies are correlated with material co-operation" (p7).

4.4. REFERENCES

Dores Cruz, T.D et al (2021a) Gossip and reputation in everyday life Philosophical Transactions of the Royal Society B 376, 20200301

Dores Cruz, T.D et al (2021b) An integrative definition and framework to study gossip Group and Organisational Management 46, 2, 252-285

Giardini, F et al (2021) Gossip and competitive altruism support co-operation in a Public Good game Philosophical Transactions of the Royal Society B 376, 20200303

Hess, N.H & Hagen, E.H (2021) Competitive gossip: The impact of domain, resource value, resource scarcity and coalitions Philosophical Transactions of the Royal Society B 376, 20200305

Noe, R & Hammerstein, P (1995) Biological markets Trends in Ecology and Evolution 10, 336-339

Roberts, G (1998) Co-operative altruism: From reciprocity to the handicap principle Proceedings of the Royal Society B 265, 427-431

Samu, F & Takacs, K (2021) Evaluating mechanisms that could support credible reputations and co-operation: Cross-checking and social bonding Philosophical Transactions of the Royal Society B 376, 20200302

Szamado, S et al (2021) The language of co-operation: Reputation and honest signalling Philosophical Transactions of the Royal Society B 376, 20200286