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     A complete listing of his writings at http://psychologywritings.synthasite.com/.

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1. SYNAESTHESIA: SOME RECENT IDEAS

1.1. SYNAESTHESIA

Synaesthesia (Syn) is "a blending of the senses, where exposure to a triggering stimulus (eg: music and letters of the alphabet) causes an immediate additional sensation (eg: colours and tastes)" (p1) [1], which "naturally affects" 1-4% of people (Fisher and Tilot 2019).

The phrase "naturally affects" is important because different methods have been used to induce Syn in non-Syn individuals, including cognitive training on letter-colour associations, psychedelic drugs, and sensory deprivation (Fisher and Tilot 2019) (appendix 1A).

Ward (2019) emphasised a holistic framework (table 1.1), which saw the individual's profile of Syn linked to other cognitive abilities, like mental imagery (appendix 1B), and attention-to-detail.

Smees et al (2019) studied a cohort of 2037 children in Scotland [2], of which fifty-one were identified with grapheme-colour Syn. Tests to establish Syn were made at 11-12 years old, and data on vocabulary were available for five and ten years old.

"After accounting for demographic differences, children in the synaesthesia group showed modestly higher expressive and receptive vocabulary, without significant differences in sentence comprehension, as well as reporting higher academic self-concept for reading, but not for numeracy" (Fisher and Tilot 2019 p2). It appeared that the Syn group had increased their vocabulary faster than the control group between five to ten years old (Fisher and Tilot 2019).

This study (and others) suggested connections between Syn and language/literacy, and that "grapheme-colour synaesthesia builds on normal language processing"

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[1] Note that "synaesthetic experiences are nearly always reported as unidirectional; that is a grapheme may induce a colour concurrent experience, but the presentation of a coloured stimulus will typically not elicit a grapheme experience" (Schwartzman et al 2019 p2).

[2] The "Growing Up in Scotland" (GUS) Cohort, which followed children born in 2004-5 in different areas in Scotland.

- Ward (2019) argued that "synaesthesia is not on a continuum with neurotypical cognition. Synaesthesia is special: its phenomenology is different; it has distinct causal mechanisms; and is likely to be associated with a distinct neurocognitive profile. However, not all synaesthetes are the same, and there are quantifiable differences between them. In particular, the number of types of synaesthesia that a person possesses is a hitherto underappreciated variable that predicts cognitive differences along a number of dimensions (mental imagery, sensory sensitivity, attention to detail). Together with enhanced memory, this may constitute a common core of abilities that may go some way to explaining why synaesthesia might have evolved" (p1).

- Ward (2019) summarised the three main characteristics of Syn:

i) It "consists of an inducer (the triggering stimulus) and a concurrent (the elicited synaesthetic experience). Both the inducer and concurrent coexist so, for instance, a sound-vision synaesthete would both hear a sound (the inducer) as well as see it (as a synaesthetic concurrent)" (p2).

ii) It is involuntary (ie: not under volitional control); also called "automaticity".

iii) Syn experiences are perceptions (eg: colours), though the inducer could be a concept (eg: letter).

- Syn is "special" in the case of "phenotypically distinct" (ie: there are not "half-synaesthetes").

Table 1.1 - Ward (2019).

(Fisher and Tilot 2019 p2) [3] [4].

     Though Syn runs in families (eg: 42% of synaesthetes have a first-degree relative with Syn; Root et al 2019), "the specific grapheme-to-colour associations of a synaesthete (which letter is which colour) cannot be attributed to genetic predispositions, since graphemes are part of a culturally defined, learned writing system — we are not born knowing letters" (Root et al 2019 pp1-2). Thus, "the propensity to develop synaesthesia is plausibly genetic, the specific manifestation (including which letter is associated with which colour) is shaped by environmental and learning influences" (Root et al 2019 p2).

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[3] Adult synaesthetes have been found to have better recall of word lists than controls, and advantages in creativity and perceptual processing, for example (Smees et al 2019).

[4] The dual-coding hypothesis (eg: Clark and Paivio 1991) is one explanation of the findings. "In this account, synaesthetes may have improved memory (eg: for vocabulary items) because these are encoded with additional information (here, colours), making their memory representations more robust. Evidence for this theory has come from studies showing, for example, that a group of letter-colour synaesthetes had superior letter-spans, but not number-spans" (Smees et al 2019 p10). Smees et al (2019) rejected this idea because improved memory could not fully explain the vocabulary advantages of synaesthetes. All the researchers could say was that "[O]nce it emerges, synaesthesia appears to correlate with other cognitive differences" (Smees et al 2019 p10).

Root et al (2019) concentrated on the "specific manifestation" with the "locked in" theory for which letter is associated with which colour. "As a result of this 'locking in' mechanism, synaesthetes, when asked to report a grapheme-colour association for an experiment, will report an association that was formed at a specific moment in development. By contrast, non-synaesthetes, whose associations were never 'locked in', report an association that they generate in the present moment" (Root et al 2019 p2).

To test this idea, Root et al (2019) made use of cultural gender stereotyping in the form of the colour pink and young girls. They stated: "we test the hypothesis that the gender-colour stereotype 'pink is for girls' influences girls' grapheme-colour associations, and is 'locked in' in female synaesthetes, but disappears in adult female non-synaesthetes" (Root et al 2019 p2).

Firstly, Root et al (2019) asked seventeen 5-7 year-old non-synaesthetes in San Diego to match colours with letters. They were significantly more likely to associate pink with the letter that was their first initial (eg: "L" - Lisa) than with other letters in the alphabet.

This tendency disappears in adulthood, but remains locked-in with female grapheme-colour synaesthetes. Data from previous studies with English- and Dutch-speaking synaesthetes were re-analysed. It was found that these individuals were three-four times more likely to perceive pink with their first initial than another colour, whereas adult female non-synaesthetes showed no association (ie: when choosing a favourite colour).

1.2. OVERLAP WITH OTHER CONDITIONS

Families with multiple relatives experiencing Syn suggest the influence of genetic factors on the condition, though the "precise nature of these factors is poorly understood" (Tilot et al 2019 p2). There is the possibility that shared genes for Syn may also link to other conditions related to brain differences, like schizophrenia and autism spectrum disorders (ASD) ("putative trait overlaps"; Tilot et al 2019). For example, there is an increased prevalence of Syn among individuals with ASD as compared to healthy controls (eg: 20%; Baron-Cohen et al 2013), but possibly only for savant individuals (Hughes et al 2017).

"SynGenes" was started in 2013 to recruit and genotype unrelated individuals with grapheme-colour Syn (n = 723 and 2181 non-Syn controls). It was found that there was "a significant relationship between aggregate genetic risk for schizophrenia and synaesthesia" (Tilot et al 2019 p7), but not for ASD and Syn, nor high body mass index and Syn (Tilot et al 2019).

Differences in perception have been reported between individuals with Syn and those with ASD (eg: increased attention to details and poorer global processing).

van Leeuwen et al (2019) provided evidence from two studies in the Netherlands. In Study 1, 76 Dutch-speaking synaesthetes (of different kinds) were recruited online and compared with seventy-nine controls (online participants and students). Syn was self-reported, and participants completed the Autism Spectrum Questionnaire (AQ) (Baron-Cohen et al 2001) [5], and the Glasgow Sensory Questionnaire (GSQ) (Robertson and Simmons 2013) [6]. The AQ has five sub-scales - Attention to detail; Social skills; Communication; Attention switching; and Fantasy. The Syn group did not score significantly higher than the controls on the total AQ, but they did on the Attention to detail sub-scale, for example, and on the GSQ.

The participants also completed two visual tasks:

a) Motion Coherence Task (MCT) - Two hundred white dots moved swiftly on a computer screen and a sub-set moved at a different pace [7]. Participants indicated the direction of movement [8]. Individuals who attend to individual dots have a poorer performance. Synaesthetes needed more dots in the sub-set to detect the direction of movement of all dots (ie: poor performance - decreased global processing).

b) Leuven Embedded Figures Task - A target figure is hidden in a larger line drawing. The ability to find the target is evidence of local perception (ie: accuracy and speed measured). Synaesthetes outperformed controls, suggesting enhanced processing of local elements. "The findings resemble atypical sensory sensitivity and a bias towards local perception as reported for autism, suggesting that synaesthetes share these atypicalities" (van Leeuwen et al 2019 p8).

Study 2 used the same materials with twenty-one sequence-space synaesthetes (who see a sequence like days of the week in space) and 21 controls. The findings confirmed the previous study.

1.3. APPENDIX 1A - INDUCING SYNAESTHESIA

Schwartzman et al (2019) reviewed the work on the methods of inducing Syn:

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[5] Fifty statements like "I tend to notice details that others do not" (this is a positive item and expects agreement for individuals with ASD), and "I find social situations easy" (this is a negative item which expects disagreement for individuals with ASD).

[6] Forty-two questions - eg: "Do you find certain sounds/or pitches annoying?".

[7] The size of the sub-set was varied.

[8] Video example at https://www.youtube.com/watch?v=Cx5Ax68Slvk (accessed 24th February 2020).

i) Trained Syn - eg: participants perform the colour consistency test where they choose a colour to go with a letter. If this is performed for long periods, non-synaesthetes become consistent in their choices similar to synaesthetes. But there was "a lack of perceptual presence for trained synaesthesia, akin to natural synaesthesia" (Schwartzman et al 2019 p4).

ii) Pharmacologically induced Syn - Limited research with psychedelic drugs, and "drug-induced synaesthesia-like experiences seem to lack consistency, do not occur automatically and can be influenced by the current state of the individual, whereas a (natural) synaesthetic concurrent is consistent, automatic and unaltered by an individual's current state of mind" (Schwartzman et al 2019 p4).

iii) Hypnotically induced Syn - Highly suggestible individuals can be given post-hypnotic suggestion that mimics Syn in some ways (eg: consistency), but not in others (eg: perceptual presence). Such studies have low sample size (eg: four participants) (Schwartzman et al 2019).

iv) Syn during sensory deprivation - eg: blindfolding sighted participants for periods of time can induce Syn-like visual experiences, but "the similarities with natural synaesthesia are likely only superficial" (Schwartzman et al 2019 p6).

v) Syn after brain injury - Rare cases of Syn-like experiences after injury to the brain - eg: damage to part of the thalamus of one patient led to auditory stimuli producing tactile sensations (Ro et al 2007).

Table 1.2 summarises the similarities between natural and artificial Syn.

Method	Consistency (eg: letter reported as same colour each time)	Automaticity (not under volitional control)	Perceptual presence (ability to tell the real colour from Syn colour - eg: letter "a" in black ink induces "red")
Trained	Yes	Not really	No
Pharmacological	No	No	Not clear
Hypnotic	Some	Some	No
Sensory deprivation	No	No	No
Brain injury	Limited	Yes	Not clear

Table 1.2 - Natural and artificial synaesthesia.

1.4. APPENDIX 1B - MENTAL IMAGERY

O'Dowd et al (2019) explored the relationship between mental imagery and Syn in two experiments.

Experiment 1 - Thirty individuals were recruited at a science exhibition in Dublin. Ten of them experienced mirror-touch Syn (MTS) ("automatically and consistently experiences a physical sensation of touch on their own body when viewing touch on another's body"; O'Dowd et al 2019 p2), ten had another form of Syn (non-MTS), and 10 controls with no Syn. Participants were screened by questionnaire (table 1.3).

- How frequently do you experience a sensation of touch on your body when viewing touch on another person's body in everyday life? (1 = never, to 7 = all the time).

- Synaesthesia is described as a curious mingling of the senses. For example, some people see colour or experience taste when they hear sounds. Do you always experience colour to any of the following stimuli: (i) letters and/or numbers (ie: indicating grapheme-colour synaesthesia), (ii) music (auditory- colour synaesthesia), (iii) while eating (gustatory-colour synaesthesia), or (iv) another form of synaesthesia not listed.

(Source: O'Dowd et al 2019 p4)

Table 1.3 - Screening of participants in Experiment 1.

The participants were asked to imagine feeling various objects (eg: ice cube; sandpaper) and rate the vividness of the image (tactile mental imagery tasks; TMI), and to observe images of being touched and report their experience (somatosensory mental imagery tasks; SMI).
Not surprisingly, the MTS group scored higher on the SMI tasks than the other two groups, while the non-MTS group scored marginally lowest. The MTS group also scored highest in the TMI tasks (figure 1.1). This was "somewhat surprising" to the researchers, and it suggested that "synaesthesia is associated with imagery within the tactile domain that is triggered by a stimulus in another modality (vision)" (O'Dowd et al 2019 p7).

However, the data were self-reported, and the screening of Syn was done in a short time. The sample was self-selecting in who came to the exhibition and who volunteered for the experiment.
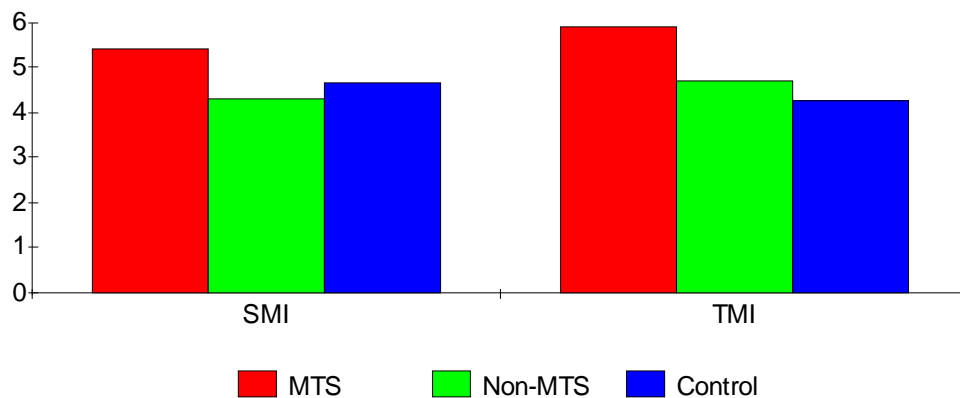
Figure 1.1 - Mean scores in Experiment 1.

Experiment 2 - Sixteen grapheme-colour synaesthetes (who see colours in response to letter and digit stimuli [9]) and 22 age-matched controls at a university in Dublin were recruited. On a computer screen, participants were shown two colour patches and asked to balance them on an fulcrum, or two letters (figure 1.2). This method was designed by Pinkerton and Humphrey (1974) to assess whether different colours are linked to differences in the tactile property of weight.

Adjust to give balance
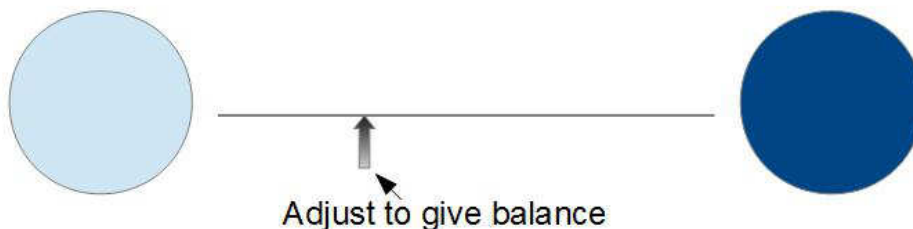
(Based on figure 1 p164 Pinkerton and Humphrey 1974)

Figure 1.2 - Representation of fulcrum task in Experiment 2.

Both groups judged colours to be "heavier" than white patches, and red or blue as "heavier" than yellow. When presented with letters, the synaesthetes showed the same perceive differences in weight, whereas the controls did not. For example, a letter that triggered the colour blue was perceived as heavier than a letter that triggered yellow. These findings suggested a "perceptual

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[9] Such an individual might say: "The letter R is sky-blue" (Root et al 2019).

reality" to the experience of Syn.

The researchers took the findings of the two experiments as evidence that "synaesthesia is associated with a general ability to imagine other stimuli within the same modality, as well as influencing perceptual associations in other modalities" (O'Dowd et al 2019 p10).

O'Dowd et al (2019) continued: "Although our study does not directly address the issue of causality, there may be more to the 'suspicious co-incidence' that enhanced imagery is found in synaesthetes. For example, it may be that both synaesthesia and vivid imagery arise from higher baseline excitability within sensory cortices than in the general population" (p10).

Spiller et al (2019) made the following criticisms of such studies:

a) Self-reports of imagery vividness used.

b) The recruitment of synaesthetes from pre-existing databases. "They are therefore aware that they are being recruited for a study due to the presence of their synaesthesia, leading to potential bias in their responses or behaviour. By contrast, the comparison non-synaesthete 'control' group is recruited from university populations or acquaintances of the researcher and may not have the same motivations for taking part in the research. Furthermore, this method also raises the possibility of excluding participants from the sample who are unaware that they have synaesthesia, resulting in an unrepresentative sample of synaesthetes. Indeed, Simner [2013] has suggested that results showing synaesthetes reporting enhanced imagery may be driven by this recruitment bias, as those synaesthetes with vivid imagery are more likely to be aware of their synaesthesia, and so in turn, more likely to self-refer to researchers" (Spiller et al 2019 p3).

To overcome these problems, Spiller et al (2019) recruited from the general population and did not mention Syn until late in the experiment. Seventy participants at a London university were involved, and they were asked to select a colour that they felt was associated with a number or letter presented (colour-picking consistency (CPC) task). Over many trials, "people who are more consistent in their colour choices are more likely to be synaesthetes" (Spiller et al 2019 p3). This was the (proxy or indirect) measure of Syn rather than asking participants to self-report.

Mental imagery was tested in two different ways:

i) Animal Tails Test (ATT) - Participants were given

the name of an animal and had to visualise if the tail was long or short in proportion to the body. They answered by moving a cursor on a computer screen to indicate length.

ii) Mental Rotations Task (MRT) - Participants were presented with the drawing of a 3D shape and mentally rotated it to say which of three others it matched.

The participants also completed self-reported measures of imagery vividness afterwards.

CPC score for letters (but not numbers) was associated with performance on the ATT only. Spiller et al (2019) stated: "Using the consistency score as a proxy measure of grapheme-colour synaesthesia, we provide more evidence for the suggestion that synaesthetic experience is associated with enhanced mental imagery, even when participants are naive to the research topic" (p1).

The fact that there was no association of the CPC score with the MRT was "potentially a very interesting finding", and suggested that while "grapheme-colour synaesthetes have enhanced object imagery abilities, they may not have enhanced spatial imagery abilities" (Spiller et al 2019 pp7-8).

The use of the CPC task as a proxy measure of grapheme-colour Syn reduced "demand effects", and "had the benefit of potentially recruiting participants who have synaesthesia but may not be aware of it and so would not normally volunteer to take part in synaesthesia research. Although conscious awareness of grapheme-colour pairings is one of the defining features of grapheme-colour synaesthesia, it is not uncommon to encounter people who have been aware of their own grapheme-colour pairings for as long as they can remember but do not believe it is a form of synaesthesia because they have incorrectly assumed 'doesn't everyone do that?'" (Spiller et al 2019 p8). On the downside, there are always concerns about the validity of proxy and indirect measures of behaviour.

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2. THE ANTHROPOCENE, CLIMATE CHANGE, AND MODERN ISSUES

2.1. THE ANTHROPOCENE

The term "Anthropocene" has been used by geologists to describe a new epoch, "one in which humans permanently mark the stratigraphic record with their 'technofossils' (Zalasiewicz et al 2014). Other earth scientists adopt the notion to signal humanity's catastrophic effects on the planet's physical and biochemical systems" (Hecht 2018 p109).

However, the term has moved out of geology and into common usuage, as, what Reddy (2014) called, a "charismatic meta-category". Crutzen and Stoermer (2000) is attributed as beginning the wider debate about the Anthropocene epoch (Binczyk 2019).

There is also debate about the start date - varying from the beginning of human agriculture, to industrialisation in Western Europe in the eighteenth century, or the first nuclear weapons test in 1945 (Hecht 2018).

"Early start dates, for example, risk naturalising the Anthropocene as part of the human experience, depoliticising its causes and exonerating energy-intensive capitalism. Some feel that the very term obscures massive inequalities: attributing the unfolding catastrophes to an undifferentiated humanity elides crucial differences in responsibility and lived experience. Others contest claims that the Anthropocene signals a new awareness of ecological harm: the history of nineteenth-century climate science and industrial

pollution shows that previous evidence and warnings were politically marginalised... Still others object that the Anthropocene attributes too much agency to humans, sidelining non-human forces. This array of concerns has prompted alternative proposals, such as the Capitalocene (Moore 2015) [10]. Or the Chthulucene, the monstrous metaphor used by the ever-humorous Donna Haraway (2015...) to invoke 'myriad temporalities and spatialities and myriad intra-active entities-in-assemblages — including the more-than-human, other-than-human, inhuman, and human-as-humus'" (Hecht 2018 p110).

Hecht (2018) wanted "to treat the Anthropocene as the apotheosis of waste... Much of what has massively increased is the quantity, extent, and durability of discards: consider the planetary production of particulates, the millennial futures of microplastics and radioactive waste" (p111). There is a violence done here, particularly as "industrial capitalism has long relied on 'cheap nature' (Moore 2015) - the assumption that earthly materials are there for the taking" (Hecht 2018 p118).
Anthropocene also "asserts scalar enormity" (Hecht 2018) - both in terms of large time periods, and in involving the whole planet.

Binczyk (2019) outlined "philosophical paradoxes" emerging in debates about the Anthropocene in the 21st century:

i) "A shocking confrontation of timeframes" - Human history (measured in centuries) vs geological time (measured in millions of years). Put simply, what used to be discussed in geological terms (environmental change) is now in historical terms. "Changes transpiring over the course of hundreds of thousands of years can be seen as overwhelming, which may in turn only intensify the apathy affecting pro-environment policy and the attitude of repression (denialism) towards such problems as biodiversity loss or climate change" (Binczyk 2019 p5).

ii) "The drama surrounding the risk of losing the future" - The possibility of human extinction produces a new understanding of time. "A forfeiture of the future complicates the linear understanding of time, which relies on a past-present-future formula, rendering impossible any further fantasy or speculation regarding progress and regarding that which is new and that which awaits us. This is a difficult and unprecedented cognitive challenge as most of our reasoning processes unfold in the scope of expectations concerning a possible

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[10] With the increased reports of wildfires around the world (largest number for at least sixteen years), Vaughan (2019) referred to the "dawn of the pyrocene".

and desirable future" (Binczyk 2019 pp5-6). The paradox is whether it is possible to "lose the future" (Binczyk 2019).

iii) "A bold reinterpretation of the basic philosophical concepts" - A challenge to the (hyper)agency of humans. "Deliberation on the hyperagency of man as a species at large also engenders philosophical and ethical reflection concerning the extent of human freedom and, by extension, human responsibility... What we need in the Anthropocene is not hyperagency, but rather a more responsible human agency... Freedom has hitherto been defined, with pride, as man's ability to withstand and oppose natural forces and nature's fatalism... Such a negative understanding of freedom, often also interpreted through a prism of individualism, no longer seems adequate. Today, in an epoch of climate change and biodiversity loss, it has been postulated in a new way that the freedom of Homo sapiens be redefined as a form of collective planetary responsibility, a multi-species eco-justice" (Binczyk 2019 p7).

iv) "The unification of different disciplines around a common research agenda" - There are other terms used, like "Technocene" (Hornborg 2015), "Capitalocene" (Moore 2016), and "Necrocene" (McBrien 2016), but "[T]o give up the concept of Anthropocene would mean giving up its rhetorical power" (Binczyk 2019 p8).

v) "The central problem of irreversibility" - "... while the problem of irreversibility means that the possibilities of human action are shrinking and the spectrum of available options is closing, it also means that each political and economic decision, and even passivity (the costs of inactivity), acquires unprecedented importance" (Binczyk 2019 p9).

vi) "The eschatological dimension of the debate" - Eschatology relates to the end of the world in theology, and the "climate catastrophe discourse, one that is tremendously significant in the debate on the Anthropocene, also engenders apocalyptic connotations and motifs" (Binczyk 2019 p10).

vii) "The debate as warning and a catalyst for political change" - The possibility that "a global alarm" (Pellizzoni 2019) could lead to a "new perspective crystallising" (Binczyk 2019).

2.1.1. Learning from the Past

Turvey and Saupe (2019) began: "The events of the past are widely recognised as having invaluable potential

for contextualising the present, predicting possible futures and guiding decision-making. Understanding past conditions, how those conditions have changed through time, and the consequences of those changes together form an integral component of academic and practical disciplines as diverse as statistics, psychiatry, education, medicine, political science and finance. Indeed, the forgetting of past experience and associated shift of socio-cultural baselines, a phenomenon known as historical or social amnesia, is understood to have dangerous implications for politics, policy and human rights" (p1).

These authors argued for insights from the past for understanding environmental changes in the future. This brings about interdisciplinary or synthetic disciplines, like conservation palaeontology ("application of geohistorical data, theories and analytical tools from palaeontology to biodiversity conservation"), or historical ecology (combining environmental anthropology, archaeology and geography) (Turvey and Saupe 2019).

On the other side, records "reveal a complex picture of constant biodiversity change in response to both past human activity and past environmental change, challenging identification of static baselines or idealised visions of the past that can be used to set current management and restoration goals" (Turvey and Saupe 2019 p2).

2.1.2. Changing Priorities

Costanza et al (2014) argued that gross domestic product (GDP) is no longer appropriate as an indicator of national prosperity in the Anthropocene. The use of GDP "encourages policies that increase industrial output, disregards the importance of healthy ecosystems, and pays no attention to social dynamics and inequalities... Moreover, it attributes no value to forms of economic activity that are informal, community based, and driven by collaboration and sharing" (Fioramonti et al 2019 p208).

Fioramonti et al (2019) preferred "well-being indicators" instead (eg: Sustainable Well-Being Index; SWI; Costanza et al 2016), particularly as "prosumerism" (Toffler 1980) will become more important in the future. This is the blurring of the line between producers and consumers as in the "sharing economy". "Consumers do not necessarily own products; instead, products are shared among users, extending the functional life of products and services via many consecutive users. The sharing of a product entails a more efficient use of financial and natural resources, and promotes the development of social capital by deepening connections among people" (Fioramonti et al 2019 p211).

Benetar et al (2018) observed: "Especially since the end of the Cold War and the collapse of Soviet communism, neoliberalism has triumphed as the prevailing and dominant paradigm of global capitalism. In terms of its consequences for the health of people and the planet, this 'triumph' may turn out to be a pyrrhic victory with negative consequences for health being felt, albeit unevenly and unequally, by everyone on the planet" (p156). There is an opportunity to consider alternatives to neoliberalism, these authors felt, particularly in relation to global health.

Not wanting to deny benefits from capitalism (neoliberalism), for example, "[A]bsolute poverty has been reduced over the past several centuries, but this reduction has been patchy and not sufficient to improve life for all to the point where nutrition, housing and education could allow all children to grow to maturity in good health with the potential to become independent citizens" (Benetar et al 2018 p157).

Global health showed similar inconsistencies - increased life expectancy for many, "[Y]et almost 10 million children continue to die of preventable causes under the age of 5 each year and many millions more continue to be poorly nourished, inadequately educated, uncared for and with grossly stunted potential for maturation and achievement of self-sufficiency" (Benetar et al 2018 p159).

Benetar et al (2018) concentrated on the need for an ethics where "solidarity, co-operation and social justice become central values" (p168) as the way to deal with the future. "A global agenda must thus extend beyond the rhetoric of universal human rights to include greater attention to duties, social justice, and interdependence. Health and ethics provide a framework within which such an agenda could be developed and promoted across borders and cultures... Developing a global state of mind about the world and our place in, it is perhaps the most crucial element in the development of an ethic for global health. [Achieving] this will require an understanding of the world as an unstable complex system... the balancing of individual goods and social goods... and the avoidance of harm to weak/poor nations through economic and other forms of exploitation that frustrate the achievement of human rights and wellbeing" (Benetar et al 2003 quoted in Benetar et al 2018).

Benetar et al (2018) concluded: "In our view, therefore, making progress towards a more sustainable and less unjust world with less suffering requires: (1) acknowledging the distortions of cherished values that underlie the paradigm that has shaped how we currently live, (2) acknowledging that compromised population health reflects profound systemic dysfunction, (3)

accepting the discomfort of insights into how the
structure of the global political economy, power
relations, cultural complexities, pervasive corruption
and poor global leadership... all perpetuate intractable
and dehumanising core/periphery disparities... and
threaten the lives of all, and (4) striving to enhance
the moral imagination (the ability of individuals and
communities to empathise with others) to effect change
through ethical and intellectual innovation that may
promote a shift towards a global frame of mind and
appropriate socio-political action" (p169).

2.1.3. "Doughnut Economics"

Raworth (2017a) stated that a "new model of human
well-being (appendix 2A) is emerging to guide humanity in
the Anthropocene. In essence, it recognises that well-
being depends on enabling every person to lead a life of
dignity and opportunity, while safeguarding the integrity
of Earth's life-supporting systems. The conceptual
framework of social and planetary boundaries — which has
come to be known as the Doughnut — contributes to this
paradigm by concisely visualising its ambition, and
so providing a compass for humanity's 21st century
progress" (pe48).

The "Doughnut" (Raworth 2012 quoted in Raworth
2017a) presents two concentric circles to depict the
social and ecological boundaries (figure 2.1). The inner
circle is social, and includes dimensions like hunger,
ill health, and illiteracy, which impact on well-being
("social shortfall"). These link to the United Nations'
Sustainable Development Goals.

The outer circle relates to ecological factors like
climate change, ocean acidification, and biodiversity
loss ("ecological overshoot") [11]. "Improving humanity's
well-being this century depends on eliminating this
social shortfall and ecological overshoot simultaneously"
(Raworth 2017a pe48).

Raworth (2017a) outlined four key implications of
the "Doughnut" for human well-being in the Anthropocene:

i) It shows the dependence of human well-being on
planetary health. "The Holocene is the only epoch in
Earth's history in which it is known that humanity can

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[11] Malhi et al (2020) outlined three themes for scientific research and climate change:

i) "Climate change threats and challenges to ecosystems" - eg: loss of biodiversity.

ii) "Opportunities to improve resilience to climate change" - eg: biodiversity conservation.

iii) "Solutions and practical applications" - eg: "nature-based solutions" or "natural climate solutions"
(Griscom et al 2017) - "integrating the ecosystem with the socio-economic system" (Malhi et al 2020
p4).
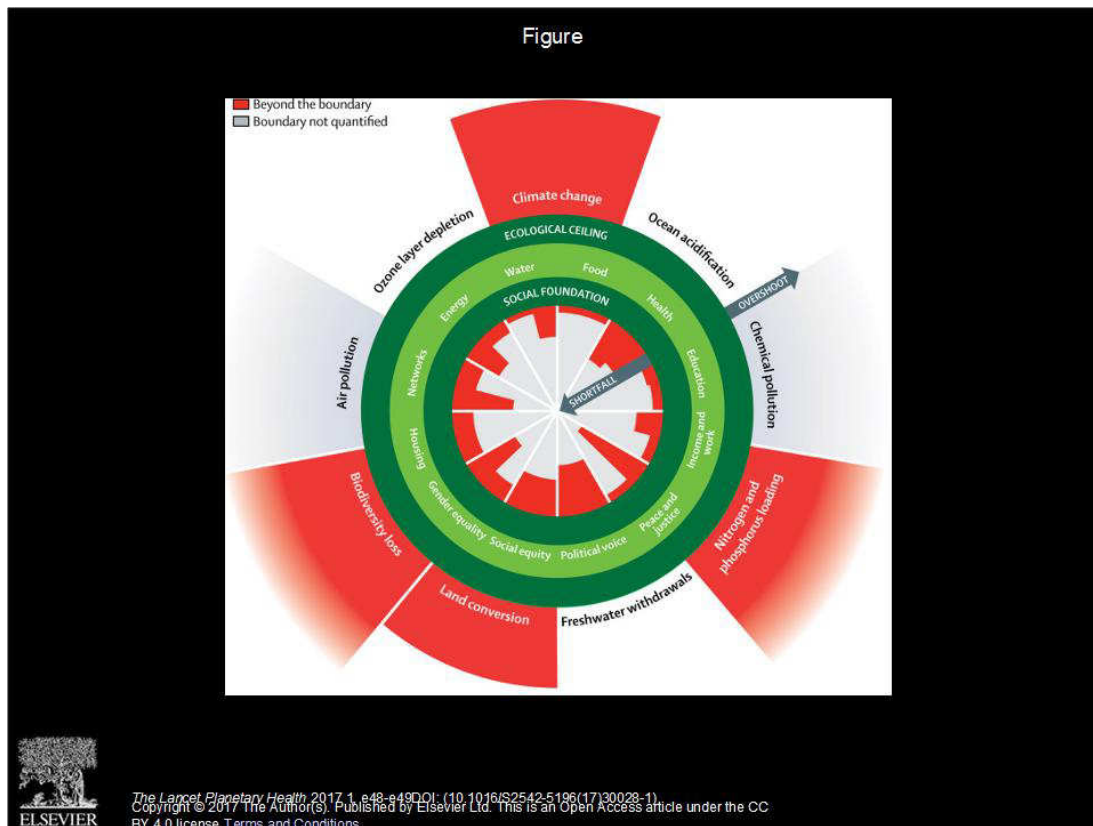
Figure

(Source: Raworth 2017a figure pe48)

Figure 2.1 - The "Doughtnut" model for social shortfall and ecological overshoot.

thrive. The best chance of enabling a life of dignity and opportunity for more than 10 billion people over the coming century therefore depends on sustaining Holocene-like conditions, such as a stable climate, clean air, a protective ozone layer, thriving biodiversity, and healthy oceans" (Raworth 2017a pe49).

ii) Social shortfall and ecological overshoot highlight "deep inequalities - of income and wealth, of exposure to risk, of gender and race, and of political power - both within and between countries" (Raworth 2017a pe49).

iii) The need to move economics away from focusing only on monetary growth (Raworth 2017b).

iv) To create "an effective map of the terrain ahead" (Raworth 2017a pe49).

2.1.4. Earth Shaped Humanity

The focus of the term Anthropocene is upon humanity

(re)shaping the planet, but Dartnell (2019) pointed out that "for most of our history, it is our environment that has shaped us".

Dartnell (2019) highlighted some examples of this shaping:

i) "How we emerged" - Major changes in the earth's temperature (eg: 5-8 °C) influenced evolutionary diversification (eg: lemurs appearing in higher temperatures over 50 million years ago (MYA)).

ii) "How we got smart" - Hominins appeared in the African Rift Valley, and the changing availability of water, vegetation, animals, and food favoured the evolution of large brains and flexibility (eg: extreme climate variability and new hominin species 2.6, 1.8 and 1 MYA).

iii) "How we took over the world" - Changing climates facilitated "big migrations" of hominins from Africa (eg: ice ages lowered sea levels and produced "land bridges" between continents).

iv) "How we built cities" - Facets of the environment that encouraged settled populations and agriculture (eg: fertile soils in Mesopotamia).

2.2. EFFECT OF CLIMATE CHANGE ON HUMANS

2.2.1. Heat

Anomalously warm temperatures are predicted as part of global climate change (ie: temperatures higher than the long-term local norms). One consequence for health relating to diseases increases is being studied, whereas increased deaths from injuries is not (Parks et al 2020).

Parks et al (2020) focused on deaths from unintentional injuries, like transport, falls, and drownings, and intentional injuries (eg: assault and suicide).

Parks et al (2020) used US data for 1980 to 2017 to model increased future temperatures and deaths. Monthly injury death rates were calculated at county level and compared with average and anomalously warm temperatures.

It was estimated that a 1.5 °C anomalously warm year would be associated with around 1600 additional injury deaths (ie: 0.75% increase on 2017 data) (mostly male, adolescent to middle age). "These would comprise increases in deaths from drownings, transport, assault and suicide, offset partly by a decline in deaths from falls in older ages" (Parks et al 2020 p65). A 2 °C anomalously warm year would be associated with around 2100 additional injury deaths (ie: 1% increase on 2017

data).

The researchers outlined some of the possible reasons for the extra deaths, including:

• More swimming and risk of drowning;

• Increased alcohol consumption and car crashes, particularly as more people driving;

• More people outside and meeting with the risk of conflict (as well as increased alcohol consumed);

• Higher temperatures exacerbate distress and link to suicide.

2.2.2. Water

Groundwater (ie: water underground as opposed to surface water) is the largest source of freshwater, but its unsustainable use exceeds recharge from rain and rivers (de Graaf et al 2019).

Much of the groundwater is pumped to irrigate food. "When the groundwater level drops, pumping costs increase, potentially resulting in a rise in food prices. When wells run dry, local and possibly larger-scale food security can be threatened" (de Graaf et al 2019 p90).

Declining groundwater levels also lead to land subsidence and so to increased flood risk in coastal cities (de Graaf et al 2019).

Using data modelling, de Graaf et al (2019) estimated that up to three-quarters of global groundwater could be pumped out by 2050 based on current usage. "Depletion hotspots" include the High Plains aquifier in North America, and the Upper Ganges and Indus basins in South Asia (de Graaf et al 2019).

2.2.3. Population Ageing

In reference to climate change, Harper (2019) pointed out that population ageing is "not occurring in a vacuum". Population ageing is the process by which a larger section of the population is older. "The convergence of climate change with the demographic trend of population ageing is clearly both complicated (knowable, predictable and controllable) and complex (unknowable nor predictable and thus difficult to control via interventions)" (Harper 2019 p401).

The key risks to consider globally are (Harper 2019):

• Rising sea levels and flooding of coastal cities (eg:

around nineteen vulnerable cities with populations of more than one million in Africa).

- Increasing desertification and problems with access to fresh water (eg: high risk in countries like Morocco and Sudan).

- Strain on the global food system.

- Air pollution and health consequences (eg: asthma).

- Extreme weather conditions and events.

"Most research concludes that older adults face higher risks from climate change compared to the rest of the population. For example, older adults are vulnerable to being trapped in poor environments through lack of mobility, disability and frailty. They are at increased risk of heat-related illnesses, compounded by living alone, co-morbidities, medication, and are at higher risk of dehydration than young people, due to the physiological changes that occur as part of the ageing process" (Harper 2019 pp402-403).

Harper (2019) continued: "Research has shown that older people face particular challenges during humanitarian crises bought on by climate events, including difficulty in accessing distant relief and service points. In addition most disaster response programmes lack explicit focus on older people, compounded by the view that families will provide for older members. Older populations are therefore likely to continue to be at higher risk and vulnerability with lower levels of resilience" (p403).

2.3. EFFECT OF CLIMATE CHANGE ON NON-HUMANS

Human (anthropogenic) noise pollution is an example of the effect of our presence on non-human species. Kunc and Schmidt (2019) quantified the impact in a meta-analysis of 108 experimental studies on 109 species.

The researchers summed up: "We found clear evidence that anthropogenic noise affects a wide range of species from a variety of different taxonomic groups. The overall model revealed that noise causes significant responses, but taxonomic groups did not differ in their response to noise" (Kunc and Schmidt 2019 p4).

The standardised mean difference was calculated, where zero means no effect of anthropogenic noise. Mammals were most impacted of the six taxonomic groups covered (figure 2.2).

Kunc and Schmidt (2019) stated that the "analysis quantifies whether there is an effect of noise, but it

does not imply that all changes caused by anthropogenic noise have to be biologically negative per se. Whether an effect may be negative or positive in a biological sense may depend on the species or a given context, and such complexities cannot be unravelled in such a large scale analysis" (p4). For example, noise reduces the hunting efficiency of bats (negative impact for them), but is consequently beneficial to their prey.

The studies included in the meta-analysis were experiments that mimicked the characteristics of anthropogenic noise, which is not the same as real-life studies.
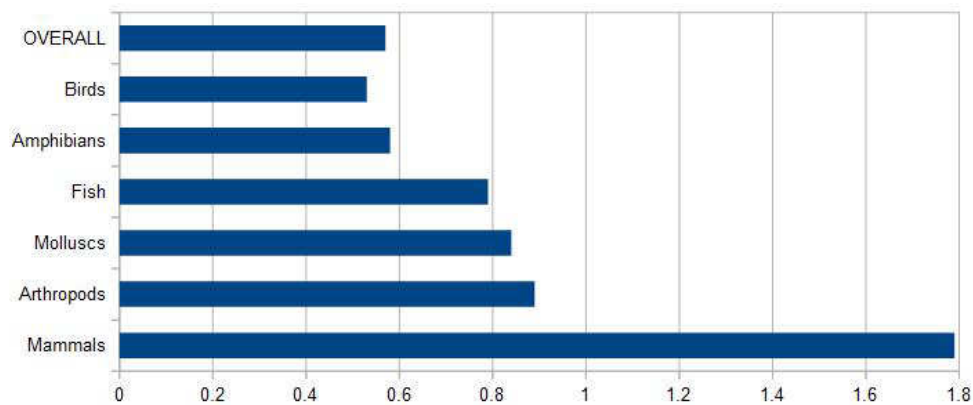
(Data from Kunc and Schmidt 2019 table 1)

Figure 2.2 - Standardised mean difference for anthropogenic noise (where zero = no effect).

Population densities of bird species is often lower near to busy roads due to a number of reasons including noise pollution and inability to communicate or detect prey and predators, light pollution, and air pollution as well as collisions with vehicles (Cooke et al 2019).

However, some species are more abundant near roads (eg: raptors who forage road-kill), while individuals may suffer poor body condition (eg: house sparrows) (Cooke et al 2019).

The evidence for these statements comes from bird surveys, and Cooke et al (2019) questioned if noise pollution was a source of error in such surveys. This included the inability to hear some species, but overestimate the birds habituated to humans.

Cooke et al (2019) reanalysed data on bird counts (based on sound and vision rather than capture) in Great Britain (2012-14) with reference to nearness to roads [12].

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[12] Simplistically, the researchers calculated the bird counts for each species when the observer was 100 metres of a road compared to the overall counts.

It was found that, of 51 species, thirty-six had a significant relationship to road noise, meaning that those with lower densities were 36% less likely to be detected in bird surveys (ie: under-detected) and those species with increased densities near roads were 52% more likely to be detected (ie: over-detected).

Cooke et al (2019) ended: "Currently, around half of the land area in Europe is within 1.5 km of transport infrastructure... and between 2010 and 2050 the global total road length is expected to increase by > 60%... For mitigation of road impacts to be properly planned and implemented, it is necessary for these impacts to be quantified accurately. As our findings suggest that roads might have significant effects on detectability, this effect should be accounted for in studies of road impacts on birds and possibly other taxa, too" (p15).

"Charismatic species", like giant pandas, elephants, and rhinoceroses, that are threatened with extinction gain most public attention, while "the majority of threatened species do not" (Pimm and Jenkins 2019 p164).

Small-ranged species that live in a specific area are at greater risk of extinction, and one solution is to connect "isolated forest fragments" as in projects in Brazil (Pimm and Jenkins 2019).

2.3.1. Light Pollution

Artificial light at night (ALAN) is "a common form of light pollution worldwide in both urban centres and non-urban areas including farms, airports, warehouses and even natural areas such as green spaces near roadways" (Kernbach et al 2019 p1).

Light cues are used to regulate body rhythms, both daily and seasonal, and so ALAN will disrupt these. The immune system shows rhythms linked to hormones, like melatonin (which is light sensitive), and this influences risk of infection (Kernbach et al 2019).

Kernbach et al (2019) studied this in house sparrows (Passer domesticus) in Florida in relation to West Nile virus (WNV). Sparrows are hosts for this virus, which affects other birds as well as humans. Forty-five captured birds were infected with WNV and kept in controlled conditions for up to 25 days. Half the birds were housed in ALAN and half in natural light in regimes of twelve hours light/twelve hours darkness.

The birds housed in ALAN were infected by WNV significantly longer (ie: two days on average) than the birds housed in natural light.

This study showed that, indirectly, ALAN increases the risk of WNV to humans as sparrows will be infectious for longer periods.

2.3.2. Insects

Saunders (2019) urged caution about headlines like "insect apocalypse" and "global ecosystem collapse". Though some recent studies have suggested a large decline in insect biomass (eg: Hallmann et al 2017 [13]), these studies are "localised and skewed towards particular taxa" (Saunders 2019 p148).

Saunders (2019) pointed out: "Ecological patterns observed in one location are affected by complex interactions between local animal communities, regional attributes, human activities, and the study methods used, among other factors. This essential context is often considered too complicated to include in sound-bite stories. But when we overlook this complexity, we are ignoring the very information we need to take action to save threatened insect populations" (p148).

Insect populations fluctuate, and cyclical changes in size are common, depending on resources available. Taking this into account, long-term monitoring programmes (eg: Rothamsted Research in UK) find declines in some insects (eg: large flies), but not others (eg: aphids) (Saunders 2019).

Separately, many academic journals are "averse to publishing null results", or observational studies are viewed as less methodologically rigorous (Saunders 2019).

Saunders (2019) noted a further point: "Throughout the insect apocalypse saga, some commentators have implied that it is acceptable to use limited or flawed data to grab public attention on a serious issue if doing so means that necessary action will be taken" (p151). She rejected this position and emphasised that ethical science is about accuracy (and complexity).

2.3.3. Parasites

Conservation projects to save endangered species usually ignore the parasites associated with the species, if not try to eradicate them (eg: California condor and louse) (Arnold 2019). "Parasites are the glue that holds a ecosystem together" (Carrie Cizauskas quoted in Arnold 2019).

For example, Kanaiwa et al (2012) reported the example of the horsehair worm which matures in the body of the camel cricket. The worm needs freshwater to reproduce, so drives the host to dive into a stream or pond, where it escapes. Crickets account for much of the food eaten by trout in certain places (Arnold 2019).

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[13] This study included data collected over a 27-year period in Germany, but over half the sixty-three nature reserve sites were surveyed only once (Saunders 2019).

Castaldo et al (2017) calculated that 5-10% of parasites could go extinct by 2070 because of climate change (and loss of hosts).

2.4. MIGRATION

Writing about the government's attempts to target "migrant smugglers", Harwood (2019) argued that such efforts were an attack on "irregular migration". "Rightly or wrongly, irregular migration is portrayed, even if disingenuously, by governments and many electorates as undesirable from a socio-political, security and economic perspective, and as a potential cause of future social unrest and political disruption" (Harwood 2019 p7).

Harwood (2019) compared the policies against migrant smugglers with the "war on drugs" (policies against illicit drug smuggling). Prohibition is not effective in either case. "As with drug trafficking, as long as migrant smuggling profits are high (and pushed higher by restrictions and legal censures) the illegality of smuggling will deter few. As demand for smugglers (ie: the compulsion or aspiration to migrate irregularly in the absence of adequate legal means) grows, the sector will likely flourish irrespective of any new tough criminal laws or harsh sentencing policies for those convicted" (Harwood 2019 p28).

Criminal prosecution of offenders is difficult, particularly because of transnational issues (eg: traffickers based in different countries to where their "product" goes), and force/violence by authorities tends to begat violence (in relation to the drugs trade) (Harwood 2019).

The problem for many is that migration to a better life is highly desirable. A survey of 8000 people in sixteen different areas in 2013 found that "'for every individual who migrates to another country, there are many others that aspire to do the same. Throughout the world, people are becoming increasingly aware of the possibility of international migration' [Carling 2013]. The possibility of regular migration is only realistic for a small proportion of aspiring migrants: most will have to rely on black market actors – smugglers (to move) and other facilitators (to obtain fake documents, for example)" (Harwood 2019 p37). Focusing on the demand for migration is a better answer (Harwood 2019).

Kidnapping and illegal detention ("extortionate detention") are a risk for migrants as they move along the smuggling/migration routes. Most victims are released and continue on their journey, many experience multiple detentions like this, and "the evidence points to smugglers themselves systematically detaining their

clients for ransom along certain routes or colluding with those that do" (Harwood and Forin 2019 p6) [14].

The United Nations Office for Drugs and Crime (UNODC) in 2018 stated that "smuggling of migrants is a deadly crime. Every year, thousands of migrants are killed as a result of smuggling activities. Mass killings, systematic torture, sexual violence, exploitation and kidnapping of smuggled migrants for extortion are recorded along many of the smuggling routes" (quoted in Harwood and Forin 2019). Release may involve financial payment or working for the kidnapper. "Particularly for women and girls, the 'payment' for release may be made through sex" (Harwood and Forin 2019 p8).

The UNODC also noted: "'In some cases, corrupt officials seeking easy profits have carried out such detention in co-operation with smugglers. There is evidence that migrants, asylum seekers and refugees have been locked up in detention centres, suffered various forms of abuse and sometimes torture'. Additionally, in some cases state officials work directly with criminal groups by selling migrants to them, resulting in violent extortion as well as trafficking" (Harwood and Forin 2019 p8).

Based on interviews by the Mixed Migration Centre of 14000 refugees and migrants between 2017 and 2019, 7% reported being kidnapped and double that being detained (Harwood and Forin 2019).

Despite the positives of mobile phone and social media development (eg: providing migrants with information and contacts), "smugglers often incorporate deception into the online promotion of their services, and, when smuggling turns into kidnapping, they use it to extract ransoms, sometimes sending live footage of torture and rape to their captives' relatives to encourage speedy payment" (Harwood and Forin 2019 p17).

2.4.1. Fundamental British Values

Vincent (2019) began: "The constitution of British-ness has been an increasingly visible part of the political discourse throughout this century, in response

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[14] Data collected by the Mixed Migration Centre estimated that 40% of cases are perpetrated by the smugglers themselves, around 30% by security forces/police/military, and 20% by "criminal gangs" (Harwood and Forin 2019). "Overall, smugglers play a dominant role in the kidnapping and detention business, but state officials are also active. For many refugees and migrants there is an overlap, or a lack of perceived distinction, between criminal kidnappers and state officials who carry out extortionate detention. In all cases and all routes impunity is endemic for perpetrators who see refugees and migrants using irregular pathways as easy prey and as a seemingly unending flow of potential victims ripe for financial and/or sexual exploitation" (Harwood and Forin 2019 p32).

to concerns about population movements, integration of minorities, cohesion and terrorism" (p17). However, the idea of "British-ness" or "fundamental British values" (FBVs) has meant different things to different politicians in the 21st century. In November 2014, the Department of Education (DfE) encouraged schools to promote "fundamental British values of democracy, rule of law, individual liberty, mutual respect and tolerance for those of different faiths and beliefs" (quoted in Vincent 2019).

But Vincent (2019) argued that such policy has to be seen in context, including a British history of colonialism and imperialism, state regulations on citizenship, and the positioning of certain minority groups as problematic.

Vincent (2019) performed thirty-eight interviews with teachers and made observations of schools mostly in Greater London on how schools promoted FBVs. She outlined four approaches:

a) "Representing Britain" - eg: union jack-themed decorations (often stereotyped).

b) "Re-packaging" - the list of FBVs are integrated into existing school activities, like democracy covered by school council elections.

c) "Re-locating within school values" - absorption of FBVs into the school's "strong values framework".

d) "Engagement with FBV" - a more critical approach (eg: discussions on the advantages and limitations of democracy).

Vincent (2019) offered some concluding thoughts: "The majority of teachers in my research were alert to and sought to neutralise much of the exclusionary potential of FBV. There was evidence of progressive initiatives in the participating schools, emphasising social justice and equality..., but there are also elements that confine or prevent these initiatives. Teachers cannot erase the wider context of wariness and hostility towards Muslims, nor the performative context in which they work and which, I argue, limits the time given to discussion generally and to subjects which validate debate, such as Citizenship, PSHE [Personal, Social and Health Education] and RE [Religious Education] — all of which, under the current accountability system, are low status" (pp28-29).

She continued: "Thus, without a critical engagement with notions of identity, belonging and citizenship, the risk remains that promoting FBV will in fact promote a 'myopic and exclusivist approach to

citizenship' (Gholami 2017)" (Vincent 2019 p29).

Bartram (2019) considered FBVs in relation to the UK
citizenship process, which includes the "Life in the UK"
test introduced in 2005 as a requirement for
naturalisation [15]. The advocates argue that immigrants
benefit from such tests "as ways to increase immigrants'
knowledge about core social institutions, encourage
destination-country language abilities, foster attachment
to national identity and so on" (Bartram 2019 p671).

The critics see the tests as unwelcome, intrusive,
and exclusionary for immigrants. For example,
Kostakopoulou (2010) argued that "by specifying what
immigrants must do to 'earn' citizenship, the policy
signals the notion that they do not really deserve it in
respect of their own attributes; it also obscures the
contributions they make to economic and social life"
(Bartram 2019 p674).

Bartram (2019) investigated whether undergoing the
citizenship process led to greater political
participation as compared to non-citizen immigrants using
data from the UK Household Panel Survey (known as
"Understanding Society"). In the first year of the survey
(2009-10; Wave 1), a sample of 997 respondents (all born
outside the UK) who did not hold UK citizenship was used.
By 2014-15 (Wave 6), 407 of them had gained UK
citizenship and the remainder had not. Political
participation was measured by questions like, "How
interested would you say you are in politics?" (with the
response options of "not at all", "not very", "fairly"
and "very").

After controlling for variables like education, and
place of birth, individuals who became citizens had a
small drop in political interest between Waves 1 and 6,
while non-citizens remained the same (figure 2.3).

One problem with the citizenship test for Bartram
(2019) is the irrelevance of the questions to political
participation, and to everyday life. It is a test of
"factoids about British history". "A significant
proportion of the test does involve questions about
politics – but these typically refer to facts about
distant institutions (eg: what is the role of the Whips
in Parliament, or what is the name of the Prime
Minister's country house?). Occasionally there are
questions with relevance to individuals' own political
engagement, but even then the focus is on rules of
conventional participation (eg: what is the current
minimum voting age, or what time of year are local
government elections held?). This knowledge is hardly

[15] To gain UK citizenship, beyond passing the test, there are requirements of "good character", and
various residence and status requirements (Bartram 2019).
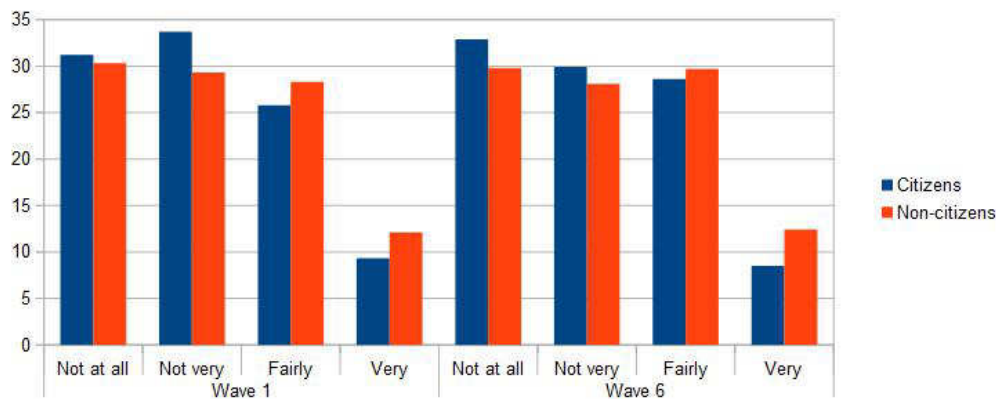
(Data from Bartram 2019 table 1 p678)

Figure 2.3 - Percentage of responses to question about
interest in politics based on UK citizenship.

inspiring. It is quite distant from what Isin (2008)
calls 'acts of citizenship', where citizens attempt to
hold the powerful to account, in the name of justice. The
test does nothing to enlighten potential citizens about
democratic rights (speech, assembly etc) that might
facilitate dissent and/or disruption of the current
order. Instead, the test seems to entail a
'depoliticised', even obedient and submissive version of
politics... Knowledge of this sort is arguably
inconsistent with the notion of fostering
meaningful public engagement; one might speculate that it
sometimes dulls the inclination one might have in that
direction" (Bartram 2019 p683).

2.5. AGEING AND GENTRIFICATION

One aspect of urban change is a process called
"gentrification", defined as "a process where new
residents of a neighbourhood are drawn from a higher
social status than current or previous ones" (Buffel and
Phillipson 2019 p989). Simply, a poorer neighbourhood
becomes fashionable and property prices increase such
that "poorer" social groups are forced to move out and
"richer" incomers arrive.
Lewis (2017) emphasised the limited attention,
though, on the "views of those who remain living in sites
of urban change" (quoted in Buffel and Phillipson 2019).
Smith et al (2018) pointed out: "Although gentrification
could bring new investment and services that improve
health, it may also negatively affect health via
skyrocketing housing costs, loss of informal supports, or
the threat of eviction" (quoted in Buffel and Phillipson

2019).

Older adults are a prime example of those remaining, particularly working-class residents. For these individuals, "stuck in place" (Smith et al 2018) may be the reality, "with the absence of alternatives forcing people to remain despite threats posed by changes to their neighbourhood" (Buffel and Phillipson 2019 p990).

The Manchester inner-city neighbourhood of Chorlton has undergone gentrification in the twenty-first century with housing prices tripling in about fifteen years (Buffel and Phillipson 2019). "Other visible signs of gentrification in Chorlton include an increasing number of wine bars, coffee shops, vegetarian cafes and specialist boutiques, these representing 'new consumption spaces' (Zukin 2009) for incomers pursuing a 'creative cultural' lifestyle" (Buffel and Phillipson 2019 p991).

This area has been previously researched by Savage et al (2005), for example, who noted that "there is no sense of a past, historic, community that has moral rights on the area: rather, the older working-class residents, where they are seen at all, are seen mainly as residues" (quoted in Buffel and Phillipson 2019).

Buffel and Phillipson (2019) reported work with eighteen 58-74 year-olds in the area who were recruited and trained as co-researchers, and then they facilitated focus groups with 58 older residents and individually interviewed thirty of them. "The interviews focused on the conditions for ageing well in the neighbourhood and developing the 'age-friendliness' of the area. Co-researchers used a semi-structured interview guide developed during the training workshops, addressing themes such as experiences of living in the area and whether these had changed over time; views about the physical environment including transportation, public space and housing; and perceptions of community life and neighbourhood relationships" (Buffel and Phillipson 2019 p992).

Two key themes emerged:

i) "Experiences of community change" - One male long-term resident summed up the situation: "There's the young kind of middle-class professional group of people that are artistic and creative... and they like all the trendy bars and restaurants. And then you've got the kind of born and bred Mancs who have lived here all their lives, and then suddenly everything is changing with all these yuppies, and I suppose that creates a kind of conflict between the new population and the old. Chorlton seems to be focused much more on young professionals... and I suppose older people feel a bit left behind and priced out" (p994).

Feelings of exclusion "from the present" were reported by others, and a nostalgia for a "lost

community" ("It's not the old Chorlton anymore"...).

ii) "Responses to gentrification: strategies of control": The formation of new relationships was important as described by a 73 year-old widow with poor health: "The lady across the road – she and her husband, they both work, so I help out and take their dog out for a walk on Mondays and Fridays, and they look out for me, you know: they take me to the hospital; they check on me when I'm poorly; they ask me if I want anything from the shop... and when I make jam, I always give them a jar..." (p996).
Older adults also involved themselves in informal "social clubs" and community-based care groups, as well as social and political action (eg: volunteering at the local foodbank).

The findings, Buffel and Phillipson (2019) observed, "suggest a more nuanced picture than one which presents older people as 'stuck in place' within gentrifying communities. Instead, we find older residents managing both the advantages (eg: improvements to local facilities, support from incoming groups) and disadvantages (eg: population turnover and rise in housing costs). The balance between the positive and negative aspects of gentrification may itself change over the life course, with adverse consequences experienced as a result of the impact of long-term illness, the loss of a partner or diminished financial resources" (p1000) [16].

2.6. APPENDIX 2A - WELL-BEING

"Well-being" has gained attention in recent years as governments seek ways to think about the success of a nation beyond monetary measures, and to "promote good mental and emotional health..., thus extending the context beyond the treatment of mental illness or disorder" (Carlisle et al 2009 p1556).
Well-being is usually conceptualised as "the attainment of pleasure and avoidance of pain" (hedonic approach), or as "the realisation of human potential" (eudaimonic approach) (Carlisle et al 2009).

Well-being as understood here has been criticised as embedded in Western values (or specifically North American), "which places a high value on happiness... strongly characterised by its individualism... [where] the experience of positive emotions is viewed as evidence

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[16] Often, in the research on gentrification, older adults have been stereotyped as "submissive, fragile, childlike and passive" (Woldoff 2011 quoted in Buffel and Phillipson 2019).

of personal and social success, whilst negative emotions can be seen as evidence of failure, requiring treatment... For critics, this 'cultural script' nurtures an unrealistic and potentially damaging psychological view of the world" (Carlisle et al 2009 p1558).

Sointu (2005), for example, saw well-being as aligned to consumerist values, while constructing "authentic selves".

Williams (2000) was also critical, arguing that "emotional health should not be confused with happiness and wellbeing because it is normal, not pathological, to feel dissatisfied, disillusioned or depressed at times... This is partly because prevailing ideologies of happiness and personal fulfilment can be hard to live up to and all humans must face problems and dilemmas at some time in their lives" (Carlisle et al 2009 p1558). This has led to "creeping forms of mental disorder", according to Williams, which includes negative emotional states that are not full diagnosable categories of mental illness. From this situation, for Williams, comes a "therapeutic culture of the self" offering "technologies for the government of the soul". Williams (2000) suggested that "prevailing discourses of happiness and the good life may contribute to breeding unhappiness because of unrealistic expectations" (Carlisle et al 2009 p1558).

To sum up, Carlisle et al (2009) thought of well-being as "a collateral casualty of many social, cultural and economic changes associated with the period roughly recognised as high, late or liquid modernity" (p1556).

Carlisle et al (2009) also linked these ideas to an "environmental critique of modern society": "The increasing obsession, in 'modern' society, with superficialities such as wealth, fame, physical appearance and material possessions is linked not just to the decline of care and concern for others in the world, but to the neglect, even potential destruction, of humankind's shared environment... From this perspective, continued over-consumption by the few may ultimately render the physical world uninhabitable for all" (p1559).

The solution for these authors is a focus on well-being that is not linked to consumerism and its associated narrow values (appendix 2B).

"A components approach to well-being" (Atkinson and Joyce 2011) focuses on "the identification and theorisation of the independent elements that comprise well-being" (Atkinson 2013 p138) (eg: relationships; health; activities of work/leisure and balance). This approach sees well-being as individualised - "a quality that inheres to the individual" (Atkinson 2013 p138).

Atkinson (2013) challenged these assumptions, and argued for well-being as a process rather than just as an

endpoint, and as relational. "Framing well-being as relational and situated makes explicit that well-being can have no form, expression or enhancement without attention to the spatial dynamics of such effects" (Atkinson 2013 p142). Thus, "[A] shift is demanded away from how to enhance the resources for wellbeing centred on individual acquisition and towards attending to the social, material and spatially situated relationships through which individual and collective well-being are effected. As Haidt [2006] proposes, 'Happiness comes from the between'" (Atkinson 2013 p142).

2.7. APPENDIX 2B - CARBON TAX

One strategy to reduce global greenhouse gas emissions is carbon taxation. This involves a surcharge on the carbon in fossil fuels emitted as CO_2.

"The rationale for carbon taxation is simple, compelling, and widely accepted in academia. Taxing carbon raises the cost of fossil fuel, thus reducing fossil fuel consumption and the associated CO_2 emissions. Likewise, it internalises local externalities from polluting behaviour because businesses and consumers are ultimately required to pay the full cost of their consumption, meaning not only the fossil fuel costs per se but also the damage that fuel consumption imposes on nature and society. Last, it discourages the consumption of fossil fuel, where this can be achieved at the lowest marginal cost, and incentivises research and development of substitutes while avoiding technology lock-in associated with myriads of detailed command-and-control regulations" (Beiser-McGrath and Bernauer 2019 p1).

However, citizens are less convinced, particularly as they "have very little appetite for new taxes that would increase their total tax burden" (Beiser-McGrath and Bernauer 2019 p1). This negativity could be overcome by "revenue recycling", which "refers to mechanisms through which income generated from carbon taxation is earmarked and returned back to society" (Beiser-McGrath and Bernauer 2019 p1). This is supported by research in Switzerland (Carattini et al 2017), for example, and hypothetical scenarios in experiments (eg: Carattini et al 2019).

Beiser-McGrath and Bernauer (2019) performed their choice experiments in Germany and the USA. Representative samples of 3620 individuals in Germany and 3640 in the USA from online panels were presented with randomly assigned questions about carbon taxes (eg: varying the cost and how the revenue was recycled) in February 2018.

Not surprisingly, higher taxes were less supported than lower ones. Also "citizens prefer carbon tax policies that do not grant exemptions to either domestic

or foreign firms. Fully taxing these firms significantly increases support for a carbon tax proposal compared to the baseline of no taxation" (Beiser-McGrath and Bernauer 2019 p3). Likewise, support for carbon tax was increased if other countries did the same thing (and same level).

The support for a carbon tax varied with the proposal of revenue recycling (eight options used). Less support if corporation tax reduced, the money was used to reduce government budgets, to retrain workers in fossil fuel industries, or to fund programmes for low-income families. More support for a carbon tax if linked to tax rebates or reductions, or funding infrastructure or renewable projects. Giving details of how the revenue would be recycled was always positive.

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3. HUMAN LANGUAGE AND ANIMAL COMMUNICATION

3.1. INTRODUCTION

Charles Darwin (1981/1871) himself wondered about the origins of human language and its relationship to other animal communication systems. One way to approach this issue is via the multiple components of human language, including "phonology, syntax, semantics, auditory perception and memory, the vocal-motor articulatory system, the conceptual-intentional system and theory of mind" (Fishbein et al 2019a p1).

Fishbein et al (2019a) used four categories to separate articles on this subject published in a special issue of the "Philosophical Transactions of the Royal Society B" based on a conference called "New Perspectives in Animal Models of Language" in 2017.

- Vocal learning
- Phonology, syntax, semantics
- Neurobiology and genetics
- Intentionality and cognition

3.2. VOCAL LEARNING

Janik and Slater (1997) defined vocal learning as "where the vocalisations themselves are modified in form as a result of experience with those of other individuals" (quoted in Tyack 2019).
"In the context of vocal learning, it is important to distinguish between vocal learning by the caller and vocal learning by the listener. Vocal learning by callers encompasses adjustment of the structure of the vocalisations (vocal production learning in the narrow sense) and adjustment of usage in relation to experience (vocal usage learning). Vocal learning by listeners comprises auditory comprehension learning, which refers to the ability to associate a sound with its source and/or what the sound 'stands for', that is, what it predicts" (Fischer and Hammerschmidt 2019 p1).

Tyack (2019) distinguished between "limited" vocal learning (ie: "the ability to fine-tune the acoustic features of species-specific vocalisations, which can be generated by innate motor programmes"; Fishbein et al 2019a), and "complex" vocal learning, which "occurs when an animal hears a sound, creates an acoustic template in memory and then develops a vocalisation that matches the template" (Fishbein et al 2019a p2).

Lattenkamp and Vernes (2018) proposed a framework for studying vocal learning (Vernes and Wilkinson 2019):

- WHAT makes a species a vocal leaner?

- WHEN is vocal learning used (eg: social structures)?

- HOW is vocal learning expressed (ie: underlying genetics and physiology)?

- WHO else is capable of vocal learning (eg: related species)?

- WHY did it evolve?

Watson et al (2015a) reported an example of vocal learning in the food grunts of chimpanzees. Two groups of captive chimpanzees with different grunts were housed together, and their grunts became similar over four years. Fischer et al (2015) suggested that the grunts overlapped acoustically before the two groups were merged. Watson et al (2019b) defended their findings.

Reflecting on other studies with chimpanzees, including in the wild, Fischer and Hammerschmidt (2019) felt that "despite some variation between groups and populations, it appears that the call structure of chimpanzees is largely innate. Even the distantly related eastern and western chimpanzees produce the same general call types. Within the constraints imposed by the neural mechanisms and genetic architecture underpinning vocal patterns, there appears to be some limited potential for plasticity at the individual and group level. One caveat is that many of the studies on chimpanzees are based on small sample sizes, and thus it is difficult to judge the extent of this plasticity with greater confidence" (p2).

An important aspect of vocal learning is vocal feedback as in the maternal call in response to the infant's call, like marmosets. Takahashi et al (2017), for example, experimentally manipulated the amount of maternal feedback (high or low) that marmoset infants heard. The infants were twins, and so divided into the two conditions to control for genetic influences. Infants in the high-feedback condition developed the adult call

earlier than the low-feedback condition. Fischer and Hammerschmidt (2019) questioned some aspects of the methodology of this study (eg: infants respond to the maternal call which means the high-feedback group would have had greater practice at calling).

They summarised: "there is converging evidence that contingent auditory feedback plays a key role in shaping the developmental trajectory of marmosets. At the same time, irrespective of rearing history and amount and temporal contingency of parental feedback, subjects are ultimately able to produce the regular adult call type" (Fischer and Hammerschmidt 2019 p3).

Fischer and Hammerschmidt (2019) suggested two fundamental principles to vocal learning in hon-human primates: "relatively strongly genetically fixed" and "a certain degree of plasticity" (p7) (ie: minor modifications are possible).

Fischer and Hammerschmidt (2019) described the debate about whether or not non-human primates have vocal production learning as futile, and so they focused on the mechanisms behind this ability. They outlined seven mechanisms that underpin vocal production in primates:

i) Null model - innate calls with the potential for some variability based on the arousal of the caller, say. No auditory feedback needed during infancy.

ii) General auditory facilitation - Auditory feedback by parents, say, increases the likelihood of vocal production by infants.

iii) Specific auditory facilitation - Auditory feedback of certain calls lead to the production of those calls.

iv) Learning from success - "Hit and miss" production of vocalisations by infants, say, and those that elicit desired responses are learned.

v) Vocal copying.

vi) Template learning - A sensitive period in development during which an auditory template is acquired. Auditory feedback is thus important.

vii) Innovation/improvisation - "Volitional generation of (literally) unheard sounds" (p8).

Fischer and Hammerschmidt (2019) saw (i) to (iv) as only evident in non-human primates.

This framework seeks to understand the evolution of human language based on the evolution of these mechanisms.

3.3. PHONOLOGY, SYNTAX, SEMANTICS

Many people from researchers to everyday observers have seen a parallel between birdsong and human speech. "Modern research has confirmed that, like humans, some birds (namely, songbirds, parrots and hummingbirds) learn complex vocal patterns early in life, often during a sensitive period, and then produce species-specific vocal repertoires throughout adulthood" (Fishbein et al 2019b p1). That is focusing on the production aspect, but what about the perception of song sequences - are perceivers sensitive to sequential features of song syllables as human are to syllables in their language?

Findings from field studies are "equivocal on how meaningful or salient sequential features in birdsong are for adult birds" (Fishbein et al 2019b p2). For example, swamp swallows respond differently when notes in their trills are rearranged in playback studies (eg: Balaban 1988). On the other hand, indigo buntings are not affected by changes to the sequential regularity of paired notes in their songs (eg: Emlen 1972). "In the overwhelming majority of species, sensitivity to sequential features in song has not been tested in field studies and most studies have not exhaustively explored the sequential rules birds could be using" (Fishbein et al 2019b p2).

There is more evidence about the importance of sequence in call perception. For example, Japanese great tits show vigilance when played "ABC-D" (where ABC is an alarm call and D is a recruitment call), but not to "D-ABC" (Suzuki et al 2016). This suggests a form of "compositional syntax", but not all researchers agree (Fishbein et al 2019b).

Spierings & ten Cate (2016) taught zebra finches an artificial language. The birds when tested were sensitive to some sequential information, but not "anything like the human capacity to process hierarchically structured sequences" (Fishbein et al 2019b p3).

There is also work with zebra finches using the "Go/NoGo" paradigm. Birds are trained to peck a particular key for a reward when they hear a certain sequence of sounds. Then they learn to peck a different key if the sequence is different to the original ("Go") (and not to peck it if the two sequences are the same; "NoGo") (eg: Lawson et al 2018). "Zebra finches were exceedingly good at discriminating reversals of single syllables in a motif but quite poor at discriminating changes in syllable order in the motif" (Fishbein et al 2019b p4). In other words, more attention was paid to structure than sequence. Budgerigars, that were also tested, spotted changes in the syllable order (Fishbein et al 2019b).

Fishbein et al (2019b) concluded that "at least some avian species are not encoding much information in

the sequential patterns of their songs and that none of
the species tested approaches the level of human
capability. On the other hand, the exquisite sensitivity
to the acoustic details of song syllables in zebra
finches and other birds also suggests that birdsong is
much richer in transmitting information about the state
of the singer than we could ever imagine since we are
not be able to hear much of what is conveyed at the level
of acoustic fine structure" (p7).

Human language is distinctly different to non-human
vocalisations, particularly in terms of syntax [17], grammar
[18], and compositionality [19] (Zuberbuhler 2019). The
evolution from animal to human syntax has been explained
in three ways - computational capacity, structural
flexibility, and event perception (Zuberbuhler 2019).
The recent evolutionary perspective (ie: in the last
6-8 million years since Homo and Pan lineages split)
focuses on larger brains in humans (computational
capacity) and syntax as related to that development or a
by-product of it. Alternatively, syntax evolved much
earlier in the primate lineage, and the important change
in humans is "from simple to more complex operations"
(structural flexibility) (Zuberbuhler 2019).
The third approach is the event perception
hypothesis. "In this view, the syntactic structure of
human language is little more than a coding system that
reflects how (humans) perceive events" (Zuberbuhler 2019
p3). Zuberbuhler (2019) favoured this option.
He felt that human syntax evolved as a product of
"two independent evolutionary events, a capacity for
advanced articulatory control [20] and a capacity to
perceive others as governed by mental states. Syntax, in
this scenario, can only emerge in species that have an
urge to communicate perceptions of natural events to
others ('Mitteilungsbedürfnis'), which requires some
understanding of other minds. Natural events are
structured in hierarchical ways, ie: in terms of actors
and patients interacting in intentional ways, but this
needs to be loaded upon a linear signal output, which
requires a much richer signal repertoire than normally
available to non-human primates. The evolution of syntax
and compositionality, in this view, can only emerge in
species that have evolved the computational resources to
perceive, represent and recall natural events in

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[17] Defined as "a set of principles by which meaning-bearing units can be combined into well-formed complexes" (Zuberbuhler 2019 p2).
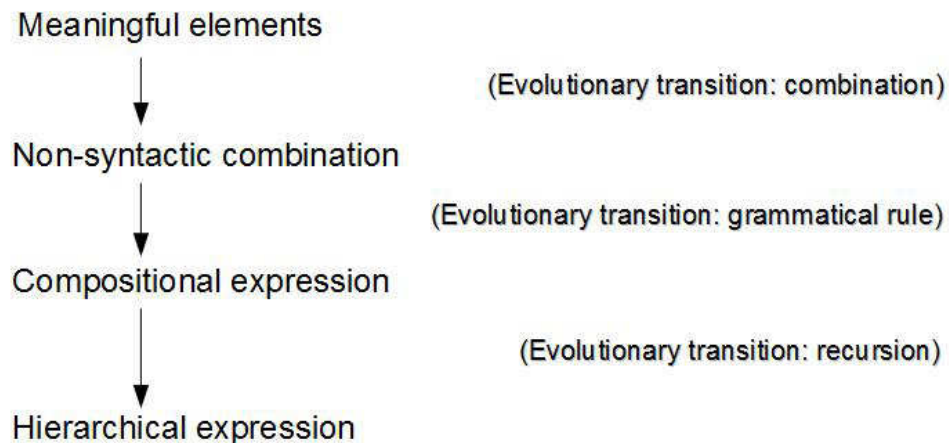[18] This is "a synonym for 'syntax' or an umbrella term encompassing the phonology, morphology, and syntax of a language" (Zuberbuhler 2019 p2).
[19] Zuberbuhler (2019) defined it as "a process by which meaning is determined by the meanings of the constituent parts and the rule that combines them" (p2).
[20] The ability to control the tongue and vocal apparatus to produce complex sounds.

such hierarchical ways and that have a signal system capable of conveying such information" (Zuberbuhler 2019 p7).

Suzuki et al (2019) outlined a framework for understanding the interaction between syntax and semantics - "syntax-semantic interface". There are a series of evolutionary transactions (figure 3.1):

```
Meaningful elements
        |
        |                    (Evolutionary transition: combination)
        v
Non-syntactic combination
        |
        |                    (Evolutionary transition: grammatical rule)
        v
Compositional expression
        |
        |                    (Evolutionary transition: recursion)
        v
Hierarchical expression
```

(After Suzuki et al 2019 figure 1)

Figure 3.1 - Evolutionary transitions of meaningful vocal combinations.

i) Meaningful elements - Different vocalisations for different things (eg: aerial predator vs ground predator) and the receiver responds appropriately (eg: looking up vs around).

ii) Non-syntactic combinations - The combination of vocalisations without rules (eg: young children say "milk mummy" and "mummy milk").

iii) Compositional syntax - The combination of vocalisations, but the meaning is dependent on the correct order.
Ouattara et al (2009) reported evidence of this in Campbell's monkeys, who have discrete calls for threats (eg: "Krak", "Hok", "Wak"). Sometimes "oo" is added as in "Krak-oo" and this seems to signal a lesser threat (Suzuki et al 2019).

iv) Hierarchical expression - The combination of vocalisations in a certain order also produces a new

meaning ("duality of patterning"; Hockett 1959) [21].

There is also an open-ended aspect ("recursion") which allows the meaningful combination of many vocalisations - eg: "the dog bites the man" + "who has a cat" + "which has a black tail" = "the dog bites the man who has a cat which has a black tail" (Suzuki et al 2019).

3.4. NEUROBIOLOGY AND GENETICS

Vocalisations are very important in many species. They can be explored via the "vocal feature space", which has two dimensions - innate - learned [22], and consequences of internal states (affective) - volitionally controlled [23]. This gives four possibilities - innate-affective (eg: alarm calls); innate-volition (eg: instructed calls); learned-affective (eg: birdsong); and learned-volition (eg: human speech) (Nieder and Mooney 2019).

Focusing on the physiology of vocalisations, Nieder and Mooney (2019) described "striking parallels" in different mammals and birds in how vocal sounds are made, including the vocal tract, and brain areas (eg: brainstem [24]).

Nieder and Mooney (2019) stated: "Human speech is a tremendously complex behaviour but has clear antecedents in the vocal behaviours of other vertebrates. The conservation of the vertebrate brainstem and indeed much of the sub-cortical forebrain means that human speech is built on a general platform for vocalisation that solved the fundamental problem of how to integrate vocal motor and respiratory activity. Speech and birdsong both require cooperation and coordination between motor cortical elements specialized for learned vocal control and these more ancestral brainstem vocal-respiratory networks. While much work remains, studies in songbirds are beginning to provide the clearest insights into how such forebrain-brainstem co-ordination is achieved"

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[21] This is "Merge" (appendix 3A).
[22] Innate vocalisations are "closely controlled by hardwired brain structures and their underlying genetic programmes with little or no environmental influence. These innate vocalisations occur spontaneously in all healthy members of a species whenever they are exposed to a certain stimulus, and are not learned through cultural experience or through vocal practice and performance evaluation" (Nieder and Mooney 2019 pp1-2).
[23] With affective vocalisations, for example, "the internal state change in the presence of a predator is sufficient to explain the vocal utterances" (Nieder and Mooney 2019 p2).
[24] "When an animal vocalises, it must generate the right pressure in its lungs, adjust the tension and vibration rate of its vocal cords and configure the upper respiratory tract to produce the sound. All of these actions must be co-ordinated with plans for respiration and swallowing. Research with vertebrates from fishes to mammals has shown that much of the complex co-ordination of the motor nuclei involved in these components occurs in the brainstem" (Tyack 2019 p1).

(p15).

Aamodt et al (2019) focused on birdsong. They stated: "Birdsong and speech are acquired during developmental critical periods when the brain's ability for vocal learning peaks. Both behaviours show similarities in the overall architecture of related brain areas, characterised by cortico-striato-thalamic loops and direct projections from cortical neurons onto brainstem motor neurons that control the vocal organs. These neural parallels extend to the molecular level, with certain song control regions sharing transcriptional profiles with speech-related regions in the human brain. This offers an opportunity to decipher the shared neurogenetic underpinnings of vocal learning" (Aamodt et al 2019 p1). These researchers then considered common genes (eg: AUTS2).

Conspecific voice (CV) perception is "the processing of information carried by the caller's voice" (Bodin and Belin 2019 p1). It includes inferences about the vocaliser's size, age, sex, group membership, and individual identity (Bodin and Belin 2019).
There is evidence that non-human primates show CV perception, and this suggests that the physiological basis for human CV perception is present. "Neuroimaging studies, in particular, suggest the existence of a 'voice patch system', a network of interconnected cortical areas that can provide a common template for the cerebral processing of CV in primates" (Bodin and Belin 2019 p1).

3.5. INTENTIONALITY AND COGNITION

Graham et al (2019) noted two dangers in studying animal behaviour that are particularly relevant to intentionality - (i) "considering non-human species as 'automatons', machines that take input from their surroundings and automatically produce an output" (p1), and (ii) assuming that the surface similarity in communication is actual deeper similarity between humans and non-humans.
"Human language is intimately linked to social cognition — we communicate concepts and intentionally influence other people's mental states" (Fishbein et al 2019a p3).

Defining intentional communication in a way that can be operationalised is not easy. The dominant idea is "when producing an intentional signal, it is explicitly clear that the signaller is communicating something to the recipient (also known as ostension), and the fact that the signal is communicative is mutually understood by both participants" (Graham et al 2019 p2).

Dennett (1983) added graded steps of intentionality in terms of the mental processes behind the communication:

- Zero-order intentionality - No mentality (automatic call based on arousal - eg: seeing predator).

- First-order intentionality - The signaller intends the signal to change the behaviour of the recipient (eg: cause recipient to flee from predator).

- Second-order intentionality - First-order plus mental state attributions (eg: the signaller informs an ignorant audience about the presence of the predator to change their mental state from ignorant to knowledgeable) (Graham et al 2019).

Townsend et al (2017) expanded on first-order intentionality with the following three conditions - "(i) a signaller acts with a goal when communicating to a recipient; (ii) the signaller exhibits volitional control over recipient-directed signal production to obtain their communicative goal; and (iii) that the recipient alters their behaviour in a way that is in line with the signaller's goal" (Graham et al 2019 p2).

Graham et al (2019) outlined two main issues with the research in this area:

i) Lack of consistency in application of intentionality criteria - For example, referring to work with primates, "some studies only require 1/3 or 1/4 criteria to be met to count as an intentional signal, while other studies require that 1/1 or 3/3 criteria are met" (Graham et al 2019 p7).

ii) Validity of behavioural markers - eg: producing a signal in the presence of an audience is taken as a sign of first- or second-order intentionality. But this signal could be a product of arousal as arousal levels are often higher in social groups. "Audience checking" may be a better measure.
"Although audience checking where the signal producer looks at the signal recipient before or during signal production, may have a low-level conditioning explanation for visual signals, there does not seem to be an obvious lower-level explanation for why primates should look to audience members before emitting a vocal signal, as visual attention in the recipients is not necessary for vocal signals to be effective" (Graham et al 2019 p9).

Different studies can produce different findings, which also cause problems for researchers here. For

example, chimpanzees make two alarm calls ("soft huus" and alert hoos"; Graham et al 2019) to snakes. Schel et al (2013) presented lone individuals with a moving python model and they produced "soft huus" (zero-order intentionality) (table 3.1). But Crockford et al (2012) found that "alert hoos" appeared to show second-order intentionality to a static snake model. "One way to reconcile these differences is to accept that there is variability in the degree of intentional control involved in the production of a signal, depending on the precise context (eg: species and movement of predator model)" (Graham et al 2019 p8).

Criteria	Explanation
Social use	The signal is directed at a recipient. This can be assessed at various levels:
	1. Presence/absence audience effect: the signal is only produced in the presence of a recipient.
	2. Composition of audience: the signal is only produced in the presence of certain recipients (e.g., kin, dominants, friends)
	3. Behaviour of audience: signal production is contingent on the behaviour of the recipient
Sensitivity to attentional state of recipient*	Visual signals are only produced in the field of view of recipients. If signaller does not have a recipient's visual attention, tactile or auditory signals should be produced. This can also be considered a level (3) audience effect.
Manipulation of attentional state of recipient*	Before a visual signal is produced, attention-getting behaviours are directed towards a recipient who is not visually attending to the signaller.
Audience checking and gaze alternation	Signaller monitors the audience and visually orients towards the recipient before producing a signal. If a third entity is involved, gaze alternation may occur between recipients and this entity.
Persistence or elaboration	Goal-directed signalling shown by repetition of the same signal (persistence), or production of different signals (elaboration) until the desired goal is met.

*indicates applicable only to visual signals and therefore not relevant for vocal production.
doi:10.1371/journal.pone.0076674.t001

(Source: Schel et al 2013 table 1)

Table 3.1 - Criteria of intentionality used by Schel et al (2013).

Novack and Waxman (2019) observed: "Human language has no parallel elsewhere in the animal kingdom. It is unique not only for its structural complexity but also for its inextricable interface with core cognitive capacities such as object representation, object categorisation and abstract rule learning" (p1).
They continued: "This language-cognition interface makes possible unparalleled communicative precision and enhances conceptual flexibility. For example, in the context of viewing a single scene, we can specify either a particular individual (that monarch hovering by the lowest branch), the object category to which the

individual belongs (butterflies), a property of that
individual (its colour) or the action in which it is
engaged (hovering). This flexibility, precision and
representational power are hallmarks of human language:
together, they permit us to move beyond the 'here and
now', to imagine possible futures and evoke the past, to
generate new symbolic systems, to create poetry and maths
and to convey the contents of our hearts and minds across
generations. This language-cognition link serves as a
conduit for learning and cultural transmission" (Novack
and Waxman 2019 p1).

Novack and Waxman (2019) compared the development of
the language-cognition interface between human infants
and great apes:

a) First year of life - The randomness of early
vocalisations are common in primates, but humans quickly
specify their signals - ie: by six months old,
vocalisations are linked to objects.

b) Second year of life - The appearance and use of
novel words by human infants, along with the combining of
words.

c) Comparison of gestures - "the existing evidence
reveals that although apes in the wild show impressive
usage of communicative gestures, produced intentionally
and with flexibility, these gesture systems differ
dramatically from human communication" (Novack and Waxman
2019 p6):

i. Apes in the wild do not point to communicate.

ii. "There is little to no evidence that apes
gesture declaratively to direct another's attention
simply for the sake of sharing interest in it or
commenting on it. By contrast, human infants frequently
gesture for declarative purposes, sharing their
intentions with their carers" (Novack and Waxman 2019
p5).

iii. Human gestures refer to non-present entities.

iv. "[T]here is little evidence that ape gestural
repertoires are readily learned through imitation or
through cultural transmission. Instead, the ape gestural
repertoire consists primarily of species-typical
behaviours" (Novack and Waxman 2019 p5).

Fitch (2019) argued that understanding about the
evolution of human language should be sort in animal
cognition rather than animal communication. It is that
"animal communication systems appear to be intrinsically

limited to a smallish set of fitness-relevant messages that relate to such factors as food, danger, aggression, appeasement or personal prowess. But a substantial literature in animal cognition reveals that they know much more than this, even if they have no way of saying it. The core argument is that, just as a person's utterances reveal only a sub-set of what they know, animal communication signals express an intrinsically limited sub-set of that species' conceptual storehouse" (Fitch 2019 p2).

Key to this argument is that animals can conceptualise more that they can express. For example, honeybees communicate with a "waggle dance" where to find flowers. But experiments have found that they have excellent colour vision and can recall the colour of rewarding versus unrewarding nectar sources. "Nonetheless, their dance 'language' has no way to communicate colour information" (Fitch 2019 p5).

Fitch (2019) also described differences between "what they say" and "what they know" in dolphins, vervet monkeys, and chimpanzees.

Fitch (2019) ended that "accepting the fundamental fact that animals know much more than they can express implies that the evolution of human language built upon a pre-existing conceptual apparatus much richer than that observable in animal communicative capabilities. It is therefore critical that future scholarly explorations of human language evolution take results from animal cognition research as crucial data for understanding the evolutionary path to human language" (p6).

3.6. MEANING

Human language is combinatorial and compositional. "A system where simpler symbols can be put together into more complex symbols in systematic ways is combinatorial: in natural language, morphemes combine into words, and words into phrases and sentences. A system where combining symbols also results in combining their meanings, again in systematic ways, is compositional: given a phrase or sentence, it is very often possible to assign to it a meaning that is a function of the meanings of the parts (eg: the constituent words) and of the structure of the whole expression" (Martin and Baggio 2019 p1).

Martin and Baggio (2019) continued: "Human thought and language have extraordinary expressive power because meaningful parts can be assembled into more complex semantic structures. This partly underlies our ability to compose meanings into endlessly novel configurations, and sets us apart from other species and current computing devices. Crucially, human behaviour, including language use and linguistic data, indicates that composing parts

into complex structures does not threaten the existence
of constituent parts as independent units in the system:
parts and wholes exist simultaneously yet independently
from one another in the mind and brain. This independence
is evident in human behaviour, but it seems at odds with
what is known about the brain's exquisite sensitivity
to statistical patterns: everyday language use is
productive and expressive precisely because it can go
beyond statistical regularities" (p1).

Martin and Baggio (2019) gave an overview of the
themes of current research on meaning composition:

i) Neurobiology of meaning composition - the search
for brain areas involved in the process(eg: anterior
temporal lobe).

ii) Experimental work on neural activity - eg:
event-related potential and N400 waves.

iii) Computational models of composition - the
attempt to construct models of the process.

iv) Foundations of compositionality - theoretical
models of the cognitive basis to the process.

3.7. APPENDIX 3A - MERGE

"Merge" is "the most basic syntactic computation
that binds two elements together into a syntactic
hierarchy, resulting in a new higher-order element. For
example, a determiner (D) 'the' and a noun (N) 'man' are
combined to create a higher-order element, a determiner
phrase (DP), 'the man'. This DP can combine with a verb
(V) 'run' to make up a next higher-order element, a
sentence (S), 'the man runs'. By applying Merge
recursively, hierarchically complex sentences can be
built. As Merge is assumed to be the most basic operation
of hierarchy building, it functions as the basis of the
human-specific capacity of language" (Friederici 2019
p2).

Merge has been linked in the brain to a sub-part of
Broca's area, the Brodmann area (BA) 44, and
syntactically complex sentences to its connection with
the superior temporal gyrus (STG) (in the temporal lobe)
(Friederici 2019). The human capacity to process
hierarchically structured sequences is grounded in this
connection. "These brain structures constitute a
phylogenetically younger system, possibly unique to
humans" (Friederici 2019 p4).
Note that processing simple rule-based sequences, an
ability found in non-human primates, involves other

"phylogenetically older" brain connections (eg: frontal operculum) (Friederici 2019).

The BA44-STG connection is crucial for language processing, but not for other higher-order cognitive abilities. This is a domain-selective view of unique human abilities. Other brain connections are involved in other cognitive abilities where humans differ from non-human primates (Friederici 2019).

Miscellaneous

A "whistled language" (eg: Spanish Silbo of the Canary Islands) is where words in a language are articulated as whistles by humans. "The sounds of the words just undergo a profound shift; they are generated not by the vibrations of the vocal cords but by a compressed stream of air from the mouth that swirls in turbulent vortices at the edge of the lips" (Meyer 2017 p59). There are around seventy known whistled languages in the world (Meyer 2017).

Whistled language seems to be more effective as long-distance communication. In one test in north-eastern Turkey, spoken word recognition dropped to 70% over seventeen metres distance, but around 90% of whistled words were recognised at twice that distance (Meyer 2017).

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4. JOB QUALITY

4.1. RECENT TRENDS

"Jobs consist of the specific tasks that people do to earn a living" (Howell and Kalleberg 2019 p4). The quality of a job [25] is assessed with criteria like opportunities for productive work, adequate earnings, decent hours, and stability and security. The European Union includes health and safety at work, work-life balance, and gender equality, for example (Howell and Kalleberg 2019).

"Although a number of definitions, measures, and even indexes of job quality exist, no consensus has been established about what constitutes an adequate summary empirical indicator of job quality... Defining whether a job is good for a person depends in part on individuals' motivations for taking one (for example, whether mainly for the money, to make contributions to society or particular groups, or to obtain intrinsic meaning and accomplishment)" (Howell and Kalleberg 2019 p4).

Thus, Howell and Kalleberg (2019), for convenience, operationalised job quality as mainly economic compensation with some non-economic benefits (like working conditions). These authors concentrated on the USA in the last forty years, which they summarised as the stagnation or decline in real income, rising wage inequality, and the growth of low-wage or very low-wage ("poverty-wage") jobs (particularly for younger workers). Also the decline of non-economic benefits. Overall, a "post-1979 decoupling of worker incomes from economic growth" (Howell and Kalleberg 2019 p6).

One trend in job quality in the last forty years is the rise of non-standard work arrangements (appendix 4A), including temporary work, part-time work, contract work, irregular and casual work, "enforced" self-employment and independent contracting. "In general, non-standard forms of work are uncertain and insecure and (especially in the United States) often lack the social and statutory

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[25] Or what the International Labour Organisation (ILO) called "decent work" (Howell and Kalleberg 2019).

protections that have come to be associated with regular, standard employment relations in the early post- World War II period" (Howell and Kalleberg 2019 p17).

Though some non-standard jobs can be "good ones" (eg: well-paid consultants; higher wages than full-time employees), many are "characterised by low pay, low security, poor working conditions, high anxiety, and result in poor mental and physical health" (Howell and Kalleberg 2019 p19).

The traditional view in economics is that wages represent the equilibrium between the supply and demand for labour (in situations of perfect competition). Krueger (2018 quoted in Howell and Kalleberg 2019), for example, rejected this idea, arguing that employers had an unfair advantage (imperfect competition, and thus, monopsony-like effects). "Spurred by technological advances, deregulation, and the shift from the managerial to the financial model of the firm, large firms have restructured by outsourcing specialised and peripheral functions to contractor firms. This has led to increasing competitive pressures in supplier firms, and predictable consequences for wages in the contractor firms" (Howell and Kalleberg 2019 p26).

One consequence of technological change is job polarisation (Autor et al 2006), leaving high-skill (well-paid) and low-skill (low-pay) jobs, with "the declining middle" (Mishel et al 2013). Weil (2017) proposed the fissural workplace hypothesis, which asserted that the "same workers doing exactly the same tasks in the same jobs get lower wages after their tasks have been shifted to outside contractors" (Howell and Kalleberg 2019 p40) (eg: security guards; cleaning services).

Concentrating of US manufacturing and service industries, Dwyer and Wright (2019) found that low-wage jobs outgrew middle-wage jobs in recent years, particularly for female workers and non-White individuals. These researchers analysed data from the Current Population Survey (CPS), which covers a nationally representative sample of households monthly, and the Outgoing Rotation Group Earner Study, which involves workers.

Based on wages (median hourly wage by 2017 rates), jobs in 45 occupations were divided into three categories - low, middle, and high. In the 1980s, all three categories were roughly equal in terms of their share of jobs in the economy. By the 2010s, low-wage jobs had risen (30% to 37% of all jobs) as had high-wage jobs (40% to 51%), but middle-wage jobs had shrunk (31% in the 1980s to 12% in the 2010s).

VanHeuvelen and Copas (2019) investigated where the

affluent and economically insecure households resided in the USA. Wage polarisation could be "between-place" (where different geographical areas have different quality jobs - eg: "brain hubs" like Silicon Valley; Moretti 2012), or "within-place" (with both types of labour market in the same geographical area - eg: high earning households use domestic services like cleaners; Mazzolari and Ragusa 2013).

VanHeuvelen and Copas (2019) analysed data from the US Census, and American Community Survey covering 1950 to 2015. Measures of individual and household income, and household poverty were used for 722 local labour markets ("commuting zones"; CZs) across the whole country.

The data supported both between-place and within-place wage polarisation, particularly since the year 2000.

i) Between-place polarisation - CZs with high concentrations of affluent households and low concentrations of poor households (eg: San Jose, California; Washington DC; San Francisco), and vice versa (eg: Hazard, Kentucky; Poplar Bluff, Missouri; Jena, Louisiana).

ii) Within-place polarisation - Labour markets for low-wage jobs to support affluent households (eg: restaurant workers; domestic services). However, "low wages tend to be higher in affluent areas than in poorer areas" (VanHeuvelen and Copas 2019 p99).

VanHeuvelen and Copas (2019) concentrated on the labour market-level, and thus not on individual workers.

4.2. JOB SEARCH

Exploring the search processes for non-standard jobs, Pedulla and Mueller-Gastell (2019) found that, overall, "job seekers are more likely both to perceive non-standard positions as being below their skill level and to receive job offers for those positions, presenting many workers with a complex trade-off between obtaining a job and working in a position that is poorly matched to their skill level" (p130).
Pedulla and Mueller-Gastell (2019) analysed data from the National Longitudinal Study of Job Search (NLSJS), which followed 2060 US job seekers aged 18-64 years between 8th February 2013 and 30th November 2014 [26]. The sample was contacted nine times during that period.
The findings were presented under a number of

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[26] This sample was a sub-set of 19 509 individuals on the "Knowledge Panel" (a nationally representative sample of US households).

different headings:

i) Socio-demographic differences:

a) Gender - Women were more likely to apply for
part-time jobs than men, but there was no difference in
applying for temporary positions or temporary-to-
permanent jobs [27].

b) Ethnicity - No difference in types of
applications. "This is quite surprising given that
African Americans are significantly over-represented in
temporary jobs in the broader economy" (Pedulla and
Mueller-Gastell 2019 p140).

c) Age - Non-prime-age workers (ie: younger than 25
and older than 54) were more likely to apply for non-
standard jobs.

d) Education -Individuals with higher educational
qualifications more likely to apply for full-time,
standard employment.

ii) Mixed applications - It was found that
"individuals who belong to groups that may experience
less advantage in the labour market — such as women, less
educated workers, and workers who have been unemployed
for longer periods of time — are more likely to apply for
multiple job types, including non-standard positions
alongside their search for full-time, standard jobs"
(Pedulla and Mueller-Gastell 2019 p143).

iii) Job search methods - Acquaintances are
important as a source of vacancies for non-standard work
than formal methods (eg: job advertisements), followed by
friends and family.

iv) Perceived skill level - "A clear pattern
emerges: applications to part-time positions, temp-to-
perm positions, temporary positions, and mixed status
applications (relative to full- time positions) are more
likely to be perceived as below the applicant's skill
level" (Pedulla and Mueller-Gastell 2019 p146).

Altogether, the findings "uncover a complex set of
job search processes, where many workers appear to be
hedging their bets on labour market success by applying
for both full-time, standard and non-standard positions
simultaneously. This strategy appears to have some payoff
because applications for non-standard positions are more

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[27] Initially, the contract is temporary (like a form of probation), but there is the possibility of a
permanent position.

likely to result in job offers than positions for full-time, standard positions. Negative repercussions, however, are also possible, given that these non-standard positions may not fully utilise workers' skills" (Pedulla and Mueller-Gastell 2019 p151).

4.3. WAGE MOBILITY

Low-wage employment is a problem not only in itself (eg: amount of money to live on), but if the individual is unable to move subsequently to higher pay (known as wage mobility).

Many changes have occurred in the US labour market since the 1970s, which limit wage mobility. Schultz (2019) summarised the key events: "Women have entered the labour force in large numbers, deindustrialisation hit hard in the 1980s and quickened the service transition. Union membership declined steadily (table 4.1), and the education expansion continues to lead to a more-educated labour force. Companies restructured and changed hiring practices, resulting in the decline of firm internal labour markets" (p159).

- Wilmers (2019) summed up the situation: "Since the 1970s, real earnings growth for most U.S. workers has sputtered and nearly stalled. At the same time, those at the top of the earnings distribution have enjoyed rapid gains" (p190).

- He placed the blame on the decline of cross-workplace co-ordination practices (eg: multi-employer collective bargaining agreements; informal co-ordination among large companies; "fairness norms" among similar workers).

- Wilmers (2019) supported his arguments with US data from the Employer Expenditure for Employee Compensation (EEEC) surveys of 1968, 1970, 1972, 1974, 1976, and 1977, which were nationally representative earnings datasets. They allowed the comparison of earnings across workplaces. Simply, collective bargaining was associated with a lower pay gap between white collar and blue collar workers.

Table 4.1 - Decline of unionisation and wages.

Studies of US wage mobility tend to cover a decade or less, which Schultz (2019) believed was not long enough. So, he used data from the Panel Study of Income Dynamics (PSID) for 1968 to 2015. This involved an annual or biannual survey of around 5000 households selected in 1968. The low-wage threshold was defined as two-thirds of the median hourly wage for full-time workers.

Around half of all workers entering low-wage full-time employment had moved out of it within 4-7 years for the whole period studied. "Mobility out of low-wage work has declined for entrants into low wages since the late

1990s to the end of the study period in the early 2010s.
Workers entering low-wage employment during the Great
Recession (2007 to 2009) and the years afterward (2010 to
2013) experienced 3.7 and 4 percent lower probabilities
of mobility" (Schultz 2019 p179). This was stronger for
education, health, and business services, for women and
non-White workers, and with the increase in part-time
work.

4.4. WORK SCHEDULES

Work schedules, like volatile hours (varying number
and timing of work hours), limited worker input (and
choice), and short advance notice (of changes), can "fuel
precariousness among US workers by undermining
perceptions of security, both economic and societal"
(Lambert et al 2019 p218).
Farrell and Greig's (2016) analysis of financial
transactions by the bank, JP Morgan Chase, between 2012
and 2105 (ie: monthly variations in total credits to
personal bank accounts), for example, showed the effect
of changing work schedules on household incomes.
"Variation in earnings within the same job, as opposed to
variation accompanying job loss or mobility, accounted
for the overwhelming majority of month-to-month variation
in labour income" (Lambert et al 2019 p220).
However, volatile hours can also include overtime.
"Thus, the extent to which fluctuating work hours
exacerbate or reduce workers' assessments of financial
insecurity may depend on their magnitude and direction,
especially among hourly workers whose earnings are most
closely tied to the number of hours they work" (Lambert
et al 2019 p221).

Lambert et al (2019) used data from the General
Social Survey in the USA in 2002, 2006, 2010, 2014, and
particularly 2016 to understand "the relationships
between fundamental aspects of work schedules and
financial insecurity, job insecurity, and distrust in
institutions" (p223).
The key variables were measured as follows:

• Financial insecurity - An index based on "respondents'
  assessments of satisfaction with their current standard
  of living, their prospects of improving their standard
  of living, and how they think their standard of living
  compares to others in America and to their parents"
  (Lambert et al 2019 p224).

• Job insecurity - True or false responses to "the job
  security is good".

• Institutional distrust - An index assessing trust in

major companies, the government, banks, and the press.

- Work schedules - Regular, irregular or rotating shifts, and input into timing of hours or not, and direction of work-hour volatility.

"Overall, the data suggest that today's labour market is highly stratified in terms of how much input workers have into the timing and number of work hours, how widely weekly work hours fluctuate, and how far in advance workers know when they will need to work" (Lambert et al 2019 p226). The stratification was linked to socio-economic status (eg: lower-status workers have less hours and more fluctuations), age (eg: workers under 26 years old high volatility of hours), and ethnicity. "Findings also suggest that workers who are black, young, and without a college degree are at highest risk of experiencing problematic combinations of scheduling practices" (Lambert et al 2019 p248).

Method of payment was important, in that "workers paid by the hour report greater financial insecurity than those paid a salary, after adjusting for co-variates" (Lambert et al 2019 p248).

Working irregular or on-call shifts, with little input, was associated with distrust in institutions, but among hourly paid workers only.

Lack of advance notice of changes to hours was also a "salient aspect of job quality", and for all workers (salaried and hourly paid) (figures 4.1, 4.2 and 4.3).
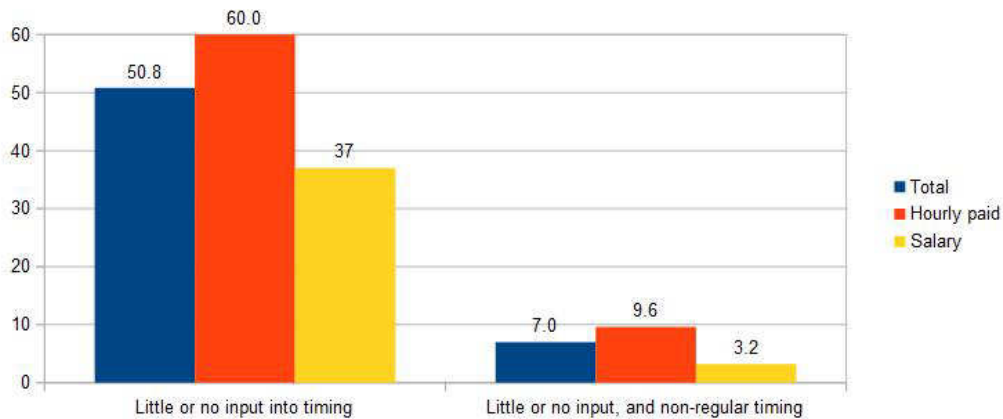
(Differences between salary and hourly-paid are significant at p<0.05)

(Data from table 1 p227 Lambert et al 2019)

Figure 4.1 - Percentage of workers having input to work-hour changes based on salary or hourly paid.

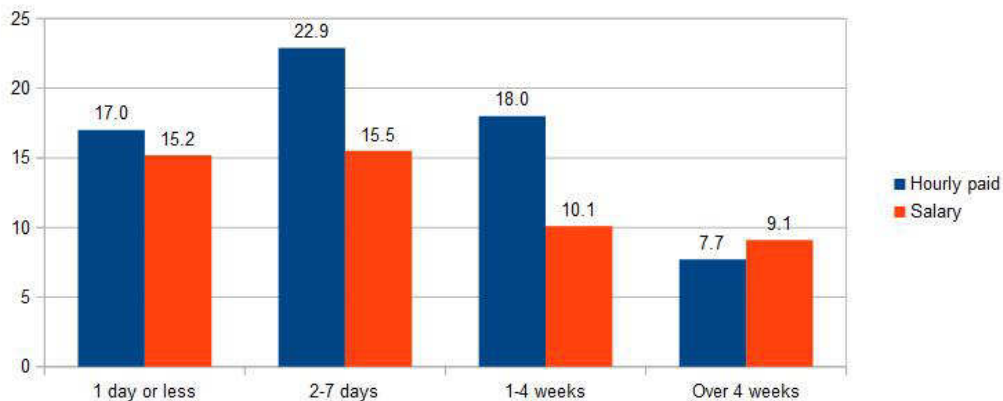"Among hourly workers, less than a week's notice is positively related to financial insecurity, when

Figure 4.2 - Who decides on work-hour changes (%).

accompanied by a lack of input into the timing of hours, and job insecurity, when accompanied by volatile hours... Among salaried workers, a week or less of notice is positively associated with financial insecurity when examined alone and in combination with work-hour volatility and lack of input into both the number and timing of work hours" (Lambert et al 2019 pp249-250).

Figure 4.3 - Amount of advance notice about work schedule change (%).

In summary, volatile work hours, little input into timing and number of hours, and short advance notice of changes undermine job quality, and are associated with institutional distrust.

4.5. EMPLOYMENT QUALITY AND HEALTH

Peckham et al (2019) investigated the link between work and health. Health can be affected by what work the worker does (eg: heavy lifting), and the physical and social environment in which it occurs (work quality - eg: exposure to chemical agents), as well as the contractual relationship between the employer and employee (employment quality; EQ) (Peckham et al 2019).

Occupational health studies tend to have ignored the latter, which is the focus of Peckham et al (2019).

Link and Phelan (1995) proposed the "fundamental cause theory of health", which "posits that money, knowledge, power, prestige, and social connections are personal resources that enable individuals to accumulate health advantages over time; hence the unequal access and distribution of these personal resources are fundamental causes of health inequalities" (Peckham et al 2019 p260). Education is a prime example of personal resources, but so are jobs (Ahonen et al 2018). So, "EQ may affect health by influencing individuals' access to money, knowledge, power, prestige, and social connections, which in turn shape their ability to accumulate health advantages over time" (Peckham et al 2019 p261).

Peckham et al (2019) outlined three pathways from EQ to health:

i) Material deprivation - Whether work provides income and non-material benefits, like health insurance, to "acquire necessities and health-enhancing goods".

ii) Stressors related to employment conditions (eg: job insecurity) - "If the employment contract is short term or hours fluctuate unexpectedly, workers will experience anxiety about keeping the job (job insecurity) and less control over their professional and personal lives, which may hinder career development, create powerlessness, and negatively affect family and other personal relationships. These effects are all associated with poor health" (Peckham et al 2019 p261).

iii) Occupational risk factors - Though risk factors may be the same for permanent, full-time, regularly scheduled work employees (Standard Employment Relationship; SER), and non-traditional employment workers, the former, for example, may receive more training to perform the tasks safely. "The employers are likely to be motivated to keep SER jobs safer because SER employee turnover is expensive. For non-SER workers (for example, short-term, substitute, sub-contractors), employers may not invest many resources in their safety. Because of the power relations represented in employment conditions, some non- SER workers may be reluctant to

refuse hazardous tasks" (Peckham et al 2019 p261).

In terms of data, Peckham et al (2019) used the Quality of Work Life element of the General Social Survey (2002, 2006, 2010 and 2014) to examine the association between EQ and self-reported health (SRH), mental health (frequent mental distress; FMD), and occupational injury (in the last year). There was a total of 5961 respondents. Eight EQ types were distinguished (table 4.2).

Category	Description	Material deprivation	Employment stressors	Work risk factors
SER-like	Similar to SER: permanent, regular schedule	Comparison group	Comparison group	Comparison group
Portfolio	Very high stability, but with long hours	Lower	??	Lower
Inflexible skilled	Highly paid, but limited schedule control	Lower	Higher	Higher
Dead-end	Stable, but low opportunities	Lower	Higher	Higher
Precarious	Non-standard; least stable	Higher?	Higher	Higher
Optimistic precarious	Non-standard, but opportunities to develop	Higher?	Higher	??
Skilled contractor	Self-employed	Lower	??	Both
Job-to-job	Self-employed, but less stable	Higher?	Higher	Higher

(Source: Peckham et al 2019 tables 1 pp264-265 and 6 p272)

Table 4.2 - EQ categories for non-traditional employment used by Peckham et al (2019).

Simply, compared to SER-like jobs, most of the EQ categories were associated with poorer SRH, FMD, and occupational injury. The exceptions were portfolio job holders, and "somewhat surprisingly" optimistic precarious job holders, who, though experiencing poor job quality, reported positive elements like high schedule control.
The two categories of self-employed (skilled contractors and job-to-job) reported a mixture of positive and negative outcomes suggesting "important differences among working people who self-identity as self-employed" (Peckham et al 2019 p274).

4.6. APPENDIX 4A - NON-STANDARD WORK

Non-standard work (also called market-mediated arrangements, non-traditional employment relations, or flexible arrangements) started to increase in the USA in the 1990s. "To date, the consequences of these employment changes are mixed. On the one hand, the increasing insecurity and precarity of jobs raise concerns regarding the quality of work and impacts on workers' lives and families... New organisational strategies of firms, such as outsourcing, have been empirically associated with wage penalties to workers, reduction of benefits and unionisation, and income inequality... On the other hand, the inherent flexibility of alternative employment and the emergence of new arrangements provide employees with tools to deal with increasing family responsibilities, income volatility, as well as complement their earnings" (Liu and Nazareno 2019 p105).

Liu and Nazareno (2019) focused on three dimensions of job quality to compare traditional and non-standard employment at three levels of job skill (high, middle, low):

i) Earnings - Lower in non-standard employment, particularly for middle-skill workers.

ii) Working hours - Less in non-standard jobs, particularly for high-skill workers. Also for low-skill workers, but they compensated with overtime. "The reduced working schedules are at least partly explained by self-selection of workers who may need to combine paid and unpaid work—by restricting the samples to male workers, the differences in working hours disappear for low- and high-skill workers, and middle-skill workers work longer hours in alternative arrangements" (Liu and Nazareno 2019 p120).

iii) Expectations about job continuity - There was "evidence of non-standard employment being associated with lower expectations of job continuity, except for workers in routine occupations, who are increasingly feeling insecure about the future" (Liu and Nazareno 2019 p120).

Liu and Nazareno (2019) used data from the 1995, 2005 and 2017 Contingent Work Supplement (CWS) to CPS, which was designed by the Bureau of Labour Statistics to provide details on non-standard employment [28], and each

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[28] Non-standard employment was officially defined as work "arranged through an employment intermediary such as temporary help firm" or jobs where the "place, time, and quantity of work are potentially unpredictable" (Polivka 1996 quoted in Liu and Nazareno 2019).

covering over 50 000 interviews. Across the time period, around 10% of the sample were non-standard workers.

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