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Street Use and Social Diet in Urban Newcastle

Daniel Nettle · Rebecca Coyne · Agathe Colléony

Abstract Within affluent societies, people who grow up in deprived areas begin reproduction much earlier than their affluent peers, and they display a number of other behaviors adapted to an environment in which life will be short. The psychological mechanisms regulating life-history strategies may be sensitive to the age profile of the people encountered during everyday activities. We hypothesized that this age profile might differ between environments of different socioeconomic composition. We tested this hypothesis with a simple observational study comparing the estimated age distribution of people using the streets in an affluent and a socioeconomically deprived neighborhood which were closely matched in other ways. We were also able to use the UK census to compare the age profile of observed street users with the actual age profile of the community. We found that people over 60 years of age were strikingly less often observed on the street in the deprived than in the affluent neighborhood, whereas young adults were observed more often. These differences were not reflections of the different age profiles of people who lived there, but rather of differences in which residents use the streets. The way people use the streets varies with age in different ways in the affluent and the deprived neighborhoods. We argue that chronic exposure to a world where there are many visible young adults and few visible old ones may activate psychological mechanisms that produce fast life-history strategies.

Keywords Human behavioral ecology · Life history · Mortality rates · Urban deprivation · Social diet · Socioeconomic gradients

Within affluent developed societies, people of lower socioeconomic position engage in a suite of behaviors which make sense if their lives are going to be relatively short. They start to reproduce at a younger age than their affluent peers (Geronimus et al.

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1999; Nettle 2010a; Wilson and Daly 1997) and, from childhood onward, express the desirability of doing so (Nettle et al. 2010; Nettle and Cockerill 2010). In the UK, this is found despite the fact that their final family sizes are scarcely any larger than those of higher socioeconomic position; they do not reproduce much more, just much sooner (Nettle 2010a). Early reproduction is adaptive where the mortality rate—in particular, the adult mortality rate—is high (Promislow and Harvey 1990; Schaffer 1974). People of lower socioeconomic position have also been found to discount the future more rapidly, or, equivalently, have more present-oriented time perspective, than people of higher socioeconomic position in the same populations (Adams 2009; Adams and White 2009), and they also make less effort in health-promoting behaviors whose impact will only be felt in the distant future (Nettle 2010b). Thus, it seems that, under conditions of socioeconomic deprivation, psychological mechanisms for adjusting personal allocation of time and energy tend to become calibrated to a shorter personal time horizon.

To some extent, these psychological mechanisms are responding correctly to the objective state of the world. Across all developed countries there are social gradients in mortality, with lower socioeconomic position being related to higher mortality risk (Bajekal 2005; Burrows et al. 2012; Singh and Siahpush 2006). Thus, from an ultimate perspective, it makes adaptive sense for people in a lower socioeconomic position to adjust their life histories to the expectation of a shorter life (Geronimus 1996; Nettle 2010a). However, this leaves unanswered the question of what the proximate mechanisms are: how do people know that their life expectancies are likely to be short? Humans are a highly generalist species, with great variability in their life histories (Low et al. 2008; Walker et al. 2006), who have inhabited many different ecologies with widely diverging mortality regimes. Thus, we should expect natural selection to have endowed us with psychological mechanisms which can take input from the surrounding population, as we grow up, and calibrate life-history parameters in a locally adaptive way. But how would these mechanisms work?

A number of researchers have argued that psychological mechanisms for life-history adjustment should be sensitive to direct indications of mortality (Chisholm 1993) and have investigated, for example, the effects of making people read or think about death on their life-history attitudes (Griskevicius et al. 2011; Wisman and Goldenberg 2005). This makes sense. However, direct experience of death, particularly death affecting people in the age categories relevant to life-history decisions, is an infrequent experience. Thus, basing one's estimate of mortality rates on the number of times such direct experience has occurred in a given interval will be subject to a high degree of stochastic error. Similarly, the amount people talk about death may not be straightforwardly related to age-specific mortality rates, so it is not clear that these cues to the mortality regime will be the most reliable ones available, or the only ones to which people should be sensitive. Another, more direct source of information about local life expectancy comes not from seeing or hearing about people dying, but from seeing who is alive. That is, individuals are, for much of each and every day, surrounded by a community of others. In vision science, the everyday distribution of visual stimuli to which people are exposed is called the visual diet; by analogy we suggest that the daily distribution of types of people to whom one is exposed can be called the *social diet*. The age-class distribution in the social diet is easily available data which carries a substantial amount of information

about the local mortality regime and is not sensitive to the stochasticity of observing rare events, such as death itself, or the possible biases inherent in how much people talk about death. In fact, in a stationary population in which everyone was visible to everyone else much of the time, keeping track of the ages of people in the social diet would enable one to construct the entire life-table of the population with considerable accuracy. For example, in such a population, the observed ratio of adults of post-reproductive age to adults of prereproductive age provides a good estimate of the rate of mortality through the reproductive years, which is the parameter most relevant to the timing of the onset of reproduction.

Thus, we suggest that a plausible hypothesis of one of the proximate reasons people in a lower socioeconomic position calibrate their life histories toward the "fast" trajectory is as follows: (*a*) People growing up under conditions of lower socioeconomic position chronically experience a social diet with relatively few older people in it, and (*b*) Psychological mechanisms for calibrating life-history strategies are sensitive to this difference in social diet. This paper focuses on part a of this claim. We do not test part b here, though we return to it in the discussion. However, if there is no evidence that part a is true, then clearly, the whole hypothesis fails. Thus, it is important to try to test part a carefully before moving on to part b, and that was the aim of this study.

Investigating proximate cues in this way is important for understanding socioeconomic variation in life-history decisions within affluent populations. This is because, although the direction of the difference in life-history parameters between the rich and the poor is understandable from an ultimate perspective, the magnitude of those differences is puzzlingly large. To give an example, if we take country-level data on age at first birth across all countries in the world, we find a relationship whereby age at first birth is around 0.18 years earlier for every year's reduction in female life expectancy (data from Nettle 2011a). If we now apply this to the comparison between the poorest and the richest neighborhoods in England, we ought to predict that age at first birth will be around 0.6 years earlier in the poorest than in the richest ones, since the difference in female life expectancy between these neighborhoods is around 3.2 years. However, the observed difference in age at first birth is a striking 7 years, more than the difference between the national averages of Denmark and Pakistan, and ten times greater than the mortality differential alone would lead us to expect. Thus, we have to conclude that either something other than the difference in mortality rates is affecting people's life-history decisions, or the difference in *cues* of mortality that people are receiving is disproportionate to the difference in *actual* mortality (or both). A more complex analysis also controlling for income still leads to the same conclusion (Nettle 2011a); the within-country variation in the UK is much larger than the global pattern, or any ultimate model based on mortality alone, would lead us to predict. Thus, an interesting question is whether the divergence in social diet of people from rich and poor neighborhoods is greater than the divergence in the actual age structure of the population. This would provide a potential explanation of why life-history decisions diverge to a greater extent than the actual difference in mortality rates would suggest they ought to.

Our study took place across two neighborhoods in the city of Newcastle upon Tyne, England, which have been the site of our ongoing fieldwork. Newcastle upon Tyne, like many UK cities, features rather marked socioeconomic inequality that is strongly spatially patterned. Our two study neighborhoods, henceforth A and B, were chosen

because they are very similar in terms of layout, basic architecture, population size, population density, sex ratio, ethnic composition, and distance from city center (see Nettle 2012; Nettle et al. 2011). However, they are highly contrasting in socioeconomic terms. Neighborhood A is in the richest quartile of all English census neighborhoods, whilst neighborhood B is in the poorest 1%. Thus, these neighborhoods provide a useful mixture of similarity (in almost every respect other than socioeconomic composition) and divergence (on the socioeconomic spectrum). This means that, although they are only a single pair, the differences between them are potentially suggestive in terms of the ways in which low-socioeconomic-position environments in general differ from those of high socioeconomic position. Previous research has confirmed that Newcastle upon Tyne exemplifies the English national pattern of faster life histories and shorter time perspective as one moves from the more affluent to the more deprived neighborhoods (Adams and White 2009; Nettle and Cockerill 2010).

Our aim here was simply to assess the age profile of people whom a focal individual encounters on the streets of each neighborhood. The urban streets near people's homes are an influential environment. They are one of the few places in which almost everyone spends some time every single day, and in urban Newcastle, where most children walk to and from school, what happens in and on them has potential to be psychologically formative. Our methodology was very simple: DN recruited two researchers, RC and AC, two students in their twenties who were not briefed on the specific hypothesis, or indeed the broader research question of the study. They separately conducted repeated transect walks through the two neighborhoods and recorded the estimated ages of every man, woman, and child they passed. Of course, this only yields subjective estimates of age, not actual ages. However, aside from convenience, we feel that there are good reasons for focusing on subjectively assessed age rather than objective age. What matters in terms of the impact of social diet on psychological mechanisms is the age *as the focal individual perceives it*. Over evolutionary time, the hypothesis assumes that subjectively estimated ages bear a reasonably strong relationship to actual ages (otherwise social diet would not be a reliable cue, and selection could not fashion mechanisms that exploit it). Accordingly, there is evidence that people are generally highly accurate at estimating ages from faces (George and Hole 1995). However, for our current purposes, it would be sufficient to show that focal individuals in the deprived neighborhood do not encounter many people whom they *judge* to be elderly. Note that one of the major possible sources of bias, the fact that people's health is generally poorer in neighborhood B than neighborhood A, so they might tend to appear older than they really are, works against the prediction we are testing, which is that there will be fewer judged-to-be-older people in neighborhood B than A.

In our study, we wished to ask the following questions. First, is the age profile of people in the social diet in neighborhood B significantly different from that in neighborhood A? Second, what conclusion might a person reach about adult mortality rates in the two neighborhoods if the social diet of the streets were the only information available? Third, how does the observed age profile of people in the streets in each neighborhood relate to the actual age distribution of people living there? UK census data with a high degree of spatial resolution is freely available, so we know this distribution exactly, at least for the most recent available census, which was 2001. This allows us to establish whether the difference in the perceived age

profiles that one forms as a result of walking around the neighborhoods is greater than the difference in the actual age profiles of the two communities.

Methods

Two separate sets of data were collected, one by RC and one by AC. RC's data were collected in July and August 2010, and AC's in April 2011. Both data collection periods were during the school holidays, and data were collected on weekdays between 10am and 4pm. In each visit, the researcher walked at normal speed through the main streets of the neighborhood, using a digital voice recorder to estimate the age and sex of every person passed. Babes-in-arms were assigned an age of 1 and their sex was treated as missing if not obvious. Each researcher made six visits to each neighborhood on different days, varying the time of day, and alternating between the two neighborhoods. Approximate time of day was balanced across the neighborhoods. RC spent around 15 min in each data-collection session, and AC about 30 min, producing a total of 885 observations in sample RC and 1,648 observations in sample AC.

Data were subsequently transcribed into a database for analysis. The 2001 census data for each neighborhood were extracted from the UK government's neighborhood statistics database (http://www.neighborhood.statistics.gov.uk/dissemination/). Each neighborhood corresponds to two census output areas, and the data from these were combined. To generate a simple framework for analysis, we created a four-category classification of 1–19 years, 20–39 years, 40–59 years, and 60+ years. The relative frequencies of these categories did not differ between samples RC and AC overall ($\chi^2=6.95$, df=3, $p>0.05$), and the two samples were therefore combined for analysis. Analyzing them separately leads to the same conclusions as presented below.

Results

The numbers and proportions of people in each age category in our observational data, and recorded as resident by the census, are shown in Table 1 for the two neighborhoods.

Table 1 The frequencies (percentages) of individuals in each age category for neighborhoods A and B, for our observed data, and the people living there at the 2001 census

Category	Our data		2001 census	
	A	B	A	B
1–19	280 (18.5%)	267 (26.2%)	751 (24.2%)	921 (28.6%)
20–39	446 (29.4%)	354 (34.7%)	967 (31.2%)	903 (28.0%)
40–59	469 (31.0%)	267 (26.2%)	824 (26.6%)	725 (22.5%)
60+	318 (21.0%)	132 (12.9%)	555 (17.9%)	675 (20.1%)

Is the Age Profile of People in the Social Diet in Neighborhood B Significantly Different from that in Neighborhood A? The distributions of people across the four age categories are significantly different in the two neighborhoods (χ^2=49.12, df=3, p<0.01). As Fig. 1 shows, this difference results from the two younger age groups being relatively over-represented in neighborhood B, and the two older age categories being relatively under-represented in neighborhood B. This under-representation is particularly marked for the 60+ category, which constitutes 21% of observations in neighborhood A, and only 13% in neighborhood B.

What Conclusion Might a Person Reach About Adult Mortality Rates in the Two Neighborhoods if the Social Diet of the Streets were the Only Information Available? As mentioned in the introduction, the mortality rate affecting adults of reproductive age is the parameter most relevant to life-history decisions. One cue that should in principle provide information about this parameter is the ratio of observed adults over 60 to adults in prime reproductive life (20–39). In a stationary population with no age-based migration, and where everyone alive is equally likely to be observed, this ratio would provide a direct estimate of the probability that a person who reaches adulthood remains alive well beyond 60. For neighborhood A, this ratio is 0.71, implying (under the assumptions given) a 71% chance of a person who reaches young adulthood being still alive well beyond 60. For neighborhood B, the ratio is 0.37, implying only a 37% chance. Breaking this down by sex gives ratios of 0.79 and 0.66 for men and women, respectively, in neighborhood A, and 0.29 and 0.45 for men and women, respectively, in neighborhood B.

How Does the Observed Age Profile of People in the Streets in Each Neighborhood Relate to the Actual Age Distribution of People Living There? The observed distribution of people across age categories differs from the age-category distribution of residents for both neighborhoods (neighborhood A: χ^2=28.4, df=3, p<0.01; neighborhood B: χ^2=43.89, df=3, p<0.01). However, these discrepancies arise in different ways (Fig. 2). In neighborhood A, the two younger age categories are under-represented on the streets relative to their true prevalence, whereas those aged 40–59 and 60+ are over-represented on the streets. By contrast, in neighborhood B, adults aged 20–39 are over-represented relative to their true prevalence, whereas those over 60 are strongly under-represented. Thus, a person inferring the population structure of

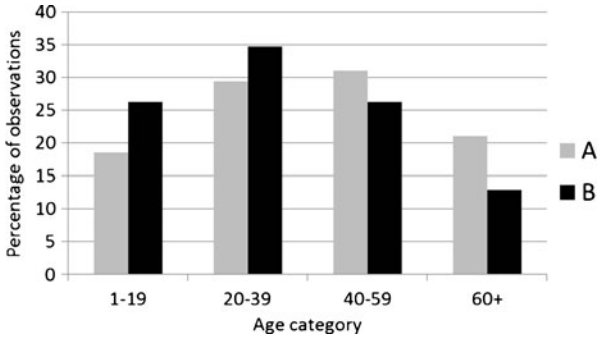

Fig. 1 The percentage of observed individuals estimated to be in each age category, for the two neighborhoods A and B

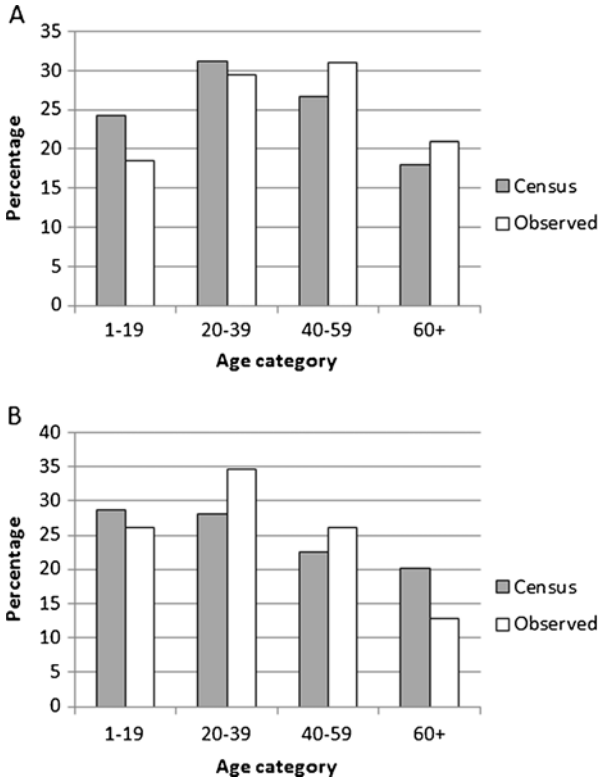

Fig. 2 Comparison of the age distribution observed with the age distribution of residents at the census, for neighborhoods A (*top*) and B (*bottom*)

neighborhood A from the people observed on the street would conclude that there were more old people and fewer young people than there really are. A person inferring the population structure of neighborhood B from the people on the street would conclude that there are more adults under 40, but many fewer under 60, than there really are. The "true" values of the ratio of those over 60 to those aged 20–39 in the two neighborhoods are 0.57 (A) and 0.75 (B). That is, the actual neighborhood difference in the structure of the population is in the opposite direction than the difference observed on the street.

Discussion

We estimated the ages of people using the streets of two urban neighborhoods of contrasting socioeconomic composition and observed large differences in the age profile of street users. In the relatively affluent neighborhood, there were relatively more people over age 40, and especially over age 60, compared with the deprived neighborhood. Moreover, we were able to show that this is not reducible to differences in the composition of the neighborhood population. The proportion of residents who were over 60 was actually *higher* for the deprived than for the affluent

neighborhood. The difference must then arise from the fact that older residents are less likely to be out using the streets in the deprived than in the affluent area.

In neither neighborhood was the age distribution of street users a good guide to the age structure of the resident population. However, the distortion was in contrary directions. Looking at who is using the street in the affluent neighborhood leads the observer to believe that there are more older people in the community than there actually are. This may simply reflect the fact that older people have more free time during the day when they may be shopping or moving about the area, and older people in this neighborhood are generally in good health. By contrast, looking at who is using the streets in the deprived neighborhood leads to the conclusion that there are many more adults under 40 in the community than there really are, and many fewer adults over 60. Why should this be? The deprived neighborhood has relatively high unemployment and underemployment, and residents are more likely to have jobs with non-traditional hours of work. Thus, there may be a relative surplus of working-aged people around the neighborhood during the day. On the other hand, many people in the deprived neighborhood suffer chronic ill health (see Nettle 2011b), and this will impact older people more than younger people. Moreover, the neighborhood suffers a much higher crime rate than neighborhood A, and the discrepancy is particularly marked for violent crime (Nettle et al. 2011). People report liking their neighborhood less than in neighborhood A, and feeling that it is less safe (unpublished survey data). Thus, older people in neighborhood B may experience multiple impediments to moving around the neighborhood, stemming from their own health status as well as their fears about being outside.

These findings, as well as shedding light on how people use the streets in these two parts of the city, have potential implications for understanding how individuals growing up in deprived areas come to calibrate their life histories toward a "fast" trajectory. As argued in the introduction, it is plausible that natural selection would have made individuals sensitive to the age structure that they experience in the social diet of everyday encounters. Under living conditions where all community members are visible to each other much of the time, which would have been true for much of human history, this social diet would have provided extremely accurate cues to local mortality rates. The ratio of observed young adults to postreproductive adults would be, assuming roughly stationary populations where migration is not age-based, a highly reliable cue of the rate of adult mortality, which is the variable most relevant to selecting the optimal age at which to begin reproduction. In our observational data, this ratio was 0.71 for the affluent neighborhood (there were 71 age 60 and older for every 100 20- to 39-year-olds), but only 0.37 for the deprived neighborhood (there were 37 age 60 and older for every 100 20- to 39-year-olds). Thus, any mechanism designed to deliver locally appropriate life-history decisions on the basis of the age profile of the surrounding community would be tuned toward a fast strategy, not just by the small amount required by the actual neighborhood difference in adult mortality, but by a very large amount, as suggested by social experience. This is consistent with arguments by Geronimus (1996; Geronimus et al. 1999) and by Nettle (2011a) that the magnitude of life-history differences between rich and poor in countries such as the USA and UK is not just because of their differences in life expectancy, but also how quickly the health of the poor deteriorates with age compared with that of the rich. Our contribution here is to suggest an available proximate cue—the age profile

of people in the streets—which would be altered by this increased morbidity, and which might have an impact on young people.

Several important limitations of the study affect the generalizability of this conclusion. First, we only observed the component of the social diet which arises from walking about on the streets. People also have many experiences in their homes, on trips away, in the workplace, at school, and so on, as well as virtual experiences through television and other media. However, we would argue that the street is a particularly important social influence in modern urban societies. It is an environment that almost every able-bodied person in the community experiences almost every day, and is the environment which perhaps provides the most direct source of available information about people who are like oneself but who are not in one's family. Thus, its potential cumulative impact is very great. Moreover, the social diet experienced in non-street encounters may be correlated with that experienced in street encounters: people who live in deprived areas may also have homes wherein the older family members have poor health, and workplaces where the labor force is biased toward the young. Thus, other sources of social influence may reinforce rather than override the influence of local street life. Nonetheless, it is important to acknowledge that experiences on the streets are only one component of the overall social diet.

Second, the ages of street users were only estimated, not actual. As noted in the introduction, this is not necessarily a serious limitation, as people are very accurate at estimating ages from faces (George and Hole 1995), and moreover, it is the perceptions of our two researchers that are relevant to the hypothesis. Moreover, the most obvious source of bias, which is that people in the deprived neighborhood will look old before their time compared with the people in the affluent one, would militate directly against the findings we have reported here. Third, our source of information on the actual age profile of the community was from the 2001 UK census, so our comparisons with the census are based on the inference that the age structure of the two populations has remained roughly the same over 10 years or so. Unfortunately, more recent census information is not currently available.

Third, our analysis has focused on only one aspect of social diet, namely the overall age distribution. Clearly, social diet is a rich and multifaceted set of experiences, which includes how people are behaving as well as who they are. We are not attempting to imply that the only information people extract from their everyday experience in these neighborhoods regards the age structure of the population; there are likely to be many others, arising for example from the physical dilapidation of structures, the relatively frequent littering and violent disorder (Nettle et al. 2011), the greater prevalence of street drinking and smoking (Nettle 2011b), and the different pattern of social associations people form (Nettle 2012). We are not downplaying the importance of all these other cues or the future prospects they suggest. We are merely arguing that the age structure of the population is a cue that theory suggests ought to be important, is easily available, and differs in interestingly patterned ways between our two study neighborhoods.

Finally, and most importantly, these are only two neighborhoods in one city. Thus, we are far from having shown that a social diet skewed toward many young and few old people is a ubiquitous part of the experience of young people from deprived backgrounds. However, the neighborhoods were carefully chosen so that the only obvious parameter on which they differ in a dramatic way is socioeconomic

composition. Nonetheless, it will be important to test this hypothesis in many other parts of many other cities. The data presented here, and particularly the magnitude of the neighborhood differences, suggest that this would be a worthwhile exercise. Datasets from other field sites may already be in existence which would allow researchers to do this.

In the introduction, we suggested as a plausible hypothesis that one of the proximate reasons people of lower socioeconomic position calibrate their life histories toward the "fast" trajectory is that (*a*) People growing up under conditions of lower socioeconomic position chronically experience a social diet with relatively few older people in it, and (*b*) Psychological mechanisms for calibrating life-history strategies are sensitive to this difference in social diet. In this paper, we have shown that *a* appears to be true, at least in our field site. This does not of course mean that *b* follows. Just because individuals who are exposed to a social diet of many young and few old people reproduce young does not mean that their social diet *causes* early reproduction, or is even one among many causal factors. Thus, the next challenge to address is to establish whether people are in fact sensitive to variation in the age profile they encounter in their social diet. This is extremely challenging. It might be possible to manipulate social diet in the short-term, in some kind of staged or virtual encounter. This might or might not produce an immediate effect on participants' attitudes or behavior. However, the hypothesis really concerns the *chronic* effect of social diet: what does it do to you if, day after day throughout childhood, you don't see many old people despite seeing many young ones. Thus, even if does not prove possible to produce an acute effect experimentally, a chronic effect may still exist in the long term, or perhaps during important sensitive periods. Thus, to address part b of the hypothesis may require innovative approaches such as natural experiments, to find people who grew up in communities with unusual demographic compositions.

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