

One terribly timely example of this broad influence relates to the widespread fear of terrorist attacks and the professed "War on Terror." Following the attacks on the World Trade Center and Pentagon on September 11, 2001, the psychological reverberations of that horrific event echoed across the United States and throughout the world. Symptoms included increased anxiety, anger, nervousness, increased alcohol use, feelings of a loss of control over external events, and helplessness (Centers for Disease Control, 2002). Indeed, one of the goals of terrorists is to make people feel vulnerable and helpless. One clinical psychologist summarized the effects of the attack like this:

The threat of terrorism creates the textbook psychological setup for anxiety and depression. Psychologists call this "anticipatory anxiety"—waiting for the proverbial shoe to drop or, in this case, the terrorist bomb to go off. Add the element of "learned helplessness"—the perception that there is nothing or very little you can do to stop the terrorism—and depression, vulnerability, and a profound sense of loss of control will develop. These are precisely the conditions to which we have all been exposed since the September 11 attacks. They define the "New Normalcy" and the "September 11 Syndrome." (Braiker, 2002)

Interestingly, a more recent study suggested that indirectly experiencing a traumatic event, may, after some time passes, lead to some psychological benefits (Swickert et al., 2006). Although the authors do not deny or seek to diminish the profoundly painful psychological effects of witnessing the September 11 attacks, they point to a paradoxical result in some individuals that they refer to as *posttraumatic growth*. They point out past research which postulated that "posttraumatic growth occurs when fundamental assumptions about the self, others, and the future are challenged. In response to this challenge, traumatized individuals may try to find meaning from their experience. Thus, individuals often discover that they have benefited from the traumatic event" (p. 566). You may ask, what possible benefits could come from such an experience? These authors reported that other research has found a wide variety of positive characteristics that strengthened in the aftermath of the 9/11 tragedy, including gratitude, hope, kindness, leadership, love, spirituality, and teamwork. They reported that individuals who indirectly witnessed the attacks reported similar benefits soon after the event, but these effects appeared to diminish over time.

## CONCLUSION

We return now to the issue of experimental ethics. Most of us have difficulty reading about animals, especially dogs, being subjected to painful shocks in a psychology laboratory. Over the years, strict standards have been developed to ensure that laboratory animals are treated humanely (see the discussion of these standards in this book's Preface). However, many, both within and outside the scientific professions, believe these standards to be inadequate. Some advocate the complete elimination of animal research in psychology, medicine, and all the sciences. Whatever your personal stand on this issue, the question you should be asking is this: Do the findings from the research extend our

knowledge, reduce human suffering, and improve the quality of life sufficiently to justify the methods used to carry out the study?

Ask yourself that question about this study by Seligman and Maier, which found the beginnings of a theory to explain why some people become helpless, hopeless, and depressed. Seligman went on to develop a widely accepted model of the origins of and treatments for depression. Over the years his theory has been refined and detailed so that it applies more accurately to types of depression that occur under well-defined conditions, from the death of a loved one to massive natural and human-caused disasters.

Through Seligman's research, for example, we now understand that individuals are most likely to become depressed if they attribute their lack of control to causes that are (a) permanent rather than temporary, (b) related to factors within their own personality (instead of situational factors), and (c) pervasive across many areas of their life (see Abramson, Seligman, & Teasdale, 1978). Through this understanding, therapists and counselors have become better able to diagnose, intervene in, and treat serious depression.

Does this body of knowledge justify the methods used in this early research on learned helplessness? Each of you must decide that thorny issue for yourself.

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## Reading 32: CROWDING INTO THE BEHAVIORAL SINK

Calhoun, J. B. (1962). Population density and social pathology. *Scientific American, 206*(3), 139-148.

The effect of overcrowding on human behavior has interested psychologists for decades. You have probably noticed how your emotions and behaviors change when you are in a situation that you perceive as overly crowded. You may withdraw into yourself and try to become invisible, you may look for an escape, or you may find yourself becoming irritable and aggressive.

The title of the article in this chapter uses the phrase *population density* rather than *crowding*. Although these may seem very similar, psychologists draw a clear distinction between them. *Density* refers to the number of individuals in a given amount of space. If 20 people occupy a 12-by-12-foot room, the room would probably be seen as densely populated. *Crowding*, however, refers to your subjective *experience* that results from various degrees of density. If you are trying to concentrate on a difficult task in that small room with 20 people, you may feel extremely crowded. Conversely, if you are at a party with 20 friends in that same room, you might not feel crowded at all.

One way behavioral scientists study the effects of density and crowding is to observe places where crowding already exists, such as Manhattan, Mexico City, some housing projects, prisons, and so on. The problem with this method is that all these places contain many factors other than population density that may influence behavior. For example, if we find high crime rates in a crowded inner-city neighborhood, we cannot know for sure that crowding is the cause of the crime. Maybe the cause is the fact that people there are poor, or that there is a higher rate of drug abuse, or perhaps all these factors and others combine with crowded conditions to produce the high crime rates.

Another way to study crowding is to place human participants into high-density conditions for relatively short periods of time and study their reactions (it would not be ethical to leave them there for very long). Although this method offers more control and allows us to isolate crowding as a cause of behavior, it is not very realistic in terms of real-life crowded environments because they usually exist over extended periods of time. Nevertheless, both of these research methods have yielded some interesting findings about crowding that will be discussed later in this reading.

Because it would be ethically impossible (because of the stress and other potential damaging effects) to place humans in crowded conditions over long periods of time simply to do research on them, researchers have employed a third approach to address the effects of density: do research using animal subjects (see the Preface for a discussion of animal research). One of the earliest and most pivotal series of studies of this type was conducted by John B. Calhoun (1917–1995) in the early 1960s. Calhoun allowed groups of white rats to increase in population (on their own!) to twice the number that would be normal in a small space, and then he observed their “social” behavior for 16 months.

### THEORETICAL PROPOSITIONS

Calhoun especially wanted to explore the effects of high-density population on social behavior. It may seem strange to you to think of rats as social animals, but they interact in many social ways in their natural environment.

To appreciate what led Calhoun to the study discussed in this chapter, it is necessary to back up several years to an earlier project he conducted. Calhoun had confined a population of rats to a quarter acre of enclosed, protected, outdoor space. The rats were given plenty of food; they had ideal, protected nesting areas; predators were absent; and all disease was kept to a

minimum. In other words, this was a rat’s paradise. The point of Calhoun’s early study was simply to study the population growth rate of the rats in a setting free from the usual natural controls on overpopulation (e.g., predators, disease, etc.). After 27 months, the population consisted of only 150 adult rats. This was very surprising because with the low mortality rate of adult rats in this ideal setting, and considering the usual rate of reproduction, Calhoun should have seen about 5,000 adult rats accumulate in this period of time! Calhoun learned that the reason for this limited rat population was an extremely high infant-mortality rate. Apparently, reproductive and maternal behavior had been severely altered by the stress of social interaction among the 150 rats, and very few young rats survived to reach adulthood. Even though 150 rats in a quarter acre does not seem to be particularly dense, it was obviously crowded enough to produce extreme behavioral changes.

These findings prompted Calhoun to design a more controlled and observable situation inside the lab to study more closely what sorts of changes occur in rats when they are faced with high population density. In other words, he had observed *what* happened, and now he wanted to find out *why*.

### METHOD

In a series of three studies, adult rats were placed in a 10-by-14-foot laboratory room that was divided into four sections or pens (see Figure 32-1). The rats

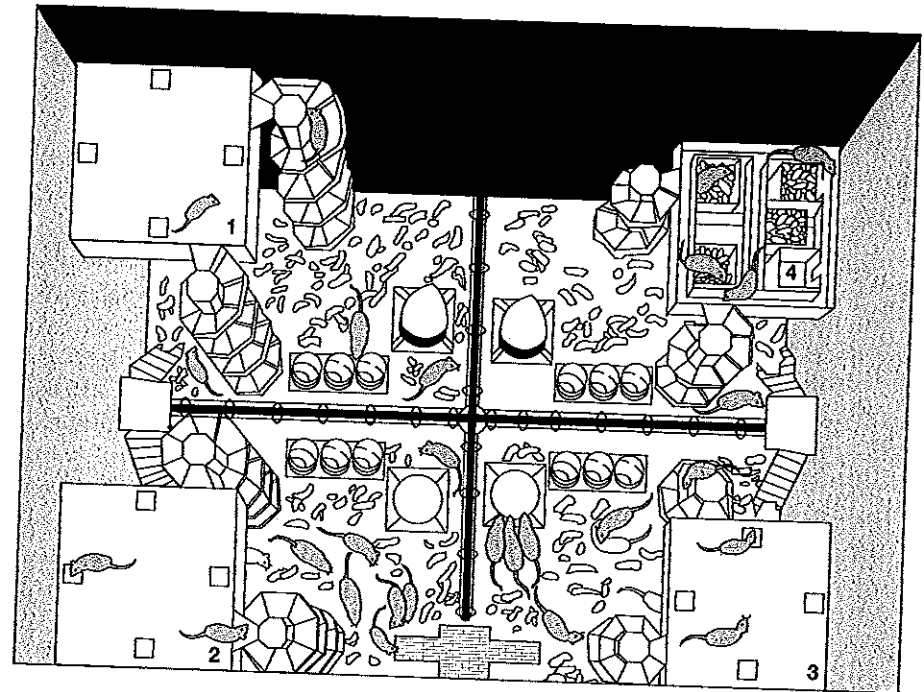


FIGURE 32-1 Diagram of laboratory room as arranged in Calhoun’s study of crowding.

had ramps that allowed them to cross from pen 1 to pen 2, from pen 2 to pen 3, and from pen 3 to pen 4, but it was not possible for the rats to cross directly between pen 1 and pen 4. Therefore, 1 and 4 were "end-pens." If a rat wanted to go from 1 to 4, it would have to go through 2 and 3. The partitions dividing the pens were electrified, so the rats quickly learned that they could not climb over them.

These pens consisted of feeders and waterers and enclosures for nests. The rats were supplied with plenty of food, water, and materials for building nests. A viewing window in the ceiling of the room allowed the research team to observe and record the rats' behavior.

From his years of studying rats, Calhoun was aware that this particular breed is normally found in colonies of 12 adults. Therefore, the observation room was of a size to accommodate 12 rats per pen, or a total of 48. After the groups were placed in the observation room, they were allowed to multiply until their normal density was nearly doubled, to 80. Once the population level of 80 was reached, young rats that survived past weaning were removed so that the number of rats remained constant.

With this arrangement in place, all that was left was to observe these crowded animals for an extended time and record their behavior. These observations went on for 16 months.

## RESULTS

This level of population density was not extreme for the rats; in fact, it was quite moderate. If the rats wanted to spread out, each pen would hold 20 or so with room left over, but that did not happen. When the male rats reached maturity, they began to fight with each other for social status, as they do naturally. These fights took place in all the pens, but the outcome was not the same for all of them. If you think about the arrangement of the room, the two end-pens had only one way in and one way out. When a male rat won a battle for dominance in one of these pens, he could hold his position and his territory (the whole pen) simply by guarding the single entrance and attacking any other male that ventured over the ramp. As it turned out, only one male rat ended up in charge of each of the end-pens. However, he was not in there alone. The female rats distributed themselves more or less equally over all four pens. Therefore, the "masters" of pens 1 and 4 each had a harem of 8 to 12 females that they could keep all to themselves. And they didn't take any chances. To prevent infiltration, the males took to sleeping directly at the foot of the ramp and were always on guard.

On occasion, a few other male rats entered the end-pens, but they were extremely submissive. They spent most of their time asleep in the nesting burrows with the females and only came out to feed. They did not attempt to mate with the females. The females in these pens functioned well as mothers. They built comfortable nests and nurtured and protected their offspring. In other words, life for the rats in these end-pens was relatively normal, and reproductive behavior was successful. About half the infant rats in those pens survived to adulthood.

The rest of the 60 or so rats crowded into the middle two pens. Because these two pens each had central feeding and watering devices, they had many opportunities to come in contact with each other. The kinds of behaviors observed among the rats in pens 2 and 3 demonstrate a phenomenon that Calhoun termed the *behavioral sink*—"the outcome of any behavioral process that collects animals together in unusually great numbers. The unhealthy connotations of the term are not accidental: A behavioral sink does act to aggravate all forms of pathology that can be found within a group" (p. 144). Let's examine some of the extreme and pathological behaviors he observed:

1. *Aggression*. In the wild, normal male rats will fight other male rats for dominant positions in the social hierarchy. These fights were observed among the more aggressive rats in this study as well. The difference was that in the end-pens, unlike in their natural environments, top-ranking males were required to fight frequently to maintain their positions, and often the fights involved several rats in a general brawl. Nevertheless, the strongest males were observed to be the most normal within the center pens. However, even those animals would sometimes exhibit "signs of pathology; going berserk; attacking females, juveniles, and less active males; and showing a particular predilection—which rats do not normally display—for biting other rats on the tail" (p. 146).
2. *Submissiveness*. Contrary to this extreme aggression, other groups of male rats ignored and avoided battles for dominance. One of these groups consisted of the most healthy-looking rats in the pens. They were fat, and their fur was full without the usual bare spots from fighting. However, these rats were complete social misfits. They moved through the pens as if asleep or in some sort of hypnotic trance, ignoring all others, and were, in turn, ignored by the rest. They were completely uninterested in sexual activity and made no advances, even toward females in heat.

Another group of rats engaged in extreme activity and were always on the prowl for receptive females. Calhoun termed them *probers*. Often, they were attacked by the more dominant males, but they were never interested in fighting for status. They were hypersexual, and many of them even became cannibalistic!

3. *Sexual deviance*. These probers also refused to participate in the natural rituals of mating. Normally, a male rat will pursue a female in heat until she escapes into her burrow. Then the male will wait patiently and even perform a courtship dance directly outside her *door*. Eventually, the female emerges from the burrow and the mating takes place. In Calhoun's study, this ritual was adhered to by most of the sexually active males, except the probers, which completely refused to wait and followed the female right into her burrow. Sometimes the nests inside the burrow contained young that had failed to survive, and it was here that late in the study the probers turned cannibalistic.

Certain groups of male rats were termed *pansexuals* because they attempted to mate with any and all other rats indiscriminately. They sexually approached other males, juveniles, and females that were not in heat. This was a submissive group that was often attacked by the more dominant male rats but did not fight for dominance.

4. *Reproductive abnormalities.* Rats have a natural instinct for nest building. In this study, small strips of paper were provided in unlimited quantities as nest material. The females are normally extremely active in the process of building nests as the time for giving birth approaches. They gather the material and pile it up so that it forms a cushion. Then they arrange the nest so that it has a small indentation in the middle to hold the young. However, the females in the behavioral sink gradually lost their ability (or inclination) to build adequate nests. At first they failed to form the indentation in the middle. Then, as time passed, they collected fewer and fewer strips of paper so that eventually the infants were born directly on the sawdust that covered the pen's floor.

The mother rats also lost their maternal ability to transport their young from one place to another if they felt the presence of danger. They would move some of the litter and forget the rest, or simply drop them onto the floor as they were moving them. Usually these infants were abandoned and died where they were dropped. They were then eaten by the adults. The infant mortality rate in the middle pens was extremely high, ranging from 80% to 96%.

In addition to these maternal deficits, the female rats in the middle pens, when in heat, were chased by large groups of males until they were finally unable to escape. These females experienced high rates of complications in pregnancy and delivery, and they became extremely unhealthy.

## DISCUSSION

You might expect that a logical extension of these findings would be to apply them to humans in high-density environments. However, for reasons to be discussed next, Calhoun did not draw any such conclusions. In fact, he discussed his findings very little—probably assuming, and logically so, that his results spoke volumes for themselves. He did comment on one clear result: that the natural social and survival behaviors of the rats were severely altered by the stresses associated with living in a high-population-density environment. In addition, he noted that through additional research, with improved methods and refined interpretation of the findings, his studies and others like them may contribute to our understanding of similar issues facing human beings.

## SIGNIFICANCE OF FINDINGS

As with many of the studies in this book, one of the most important aspects of Calhoun's studies was that they sparked a great deal of related research on the effects on humans of high-density living. It would be impossible to examine

this large body of research in detail here, but perhaps a few examples should be mentioned. One environment where the equivalent of a behavioral sink might exist for humans is in extremely overcrowded prisons. A study funded by the National Institute of Justice examined prisons where inmates averaged only 50 square feet each (or an area about 7-by-7 feet), compared with less crowded prisons. It was found that significantly higher rates of mortality, homicide, suicide, illness, and disciplinary problems occurred in the crowded prisons (McCain, Cox, & Paulus, 1980). Again, however, remember that other factors besides crowding could be influencing these behaviors (for examples, see Reading 37 on Zimbardo's prison study).

Another interesting finding has been that crowding produces negative effects on problem-solving abilities. One study placed people in small, extremely crowded rooms (only 3 square feet per person) or in larger, less crowded rooms. The participants were asked to complete rather complex tasks, such as placing various shapes into various categories while listening to a story on which they were to be tested later. Those in the crowded conditions performed significantly worse than those who were not crowded (Evans, 1979).

What do you suppose happens to you physiologically in crowded circumstances? Research has determined that your blood pressure and heart rate increase. Along with those effects, you tend to feel that other people are more hostile and that time seems to pass more slowly as density increases (Evans, 1979).

## CRITICISMS

Calhoun's results with animals have been supported by later animal research (see Marsden, 1972). However, as has been mentioned before in this book, we must always be careful in applying animal research to humans. Just as substances that may be shown to cause illness in rats may not have the same effect on human physical health, environmental factors influencing rats' social behaviors may not be directly applicable to people. At best, animals can only represent certain aspects of humans. Sometimes animal research can be very useful and revealing and lead the way for more definitive research with people. At other times, it can be a dead end.

In 1975, researchers undertook a study in New York City that attempted to replicate with people some of Calhoun's findings (Freedman, Heshka, & Levy, 1975). The researchers collected data from areas of varying population density on death rates, fertility rates (birth rates), aggressive behavior (court records), psychopathology (admissions to mental hospitals), and so on. When all the data were analyzed, no significant relationships were found between population density and any form of social pathology.

Nevertheless, Calhoun's work in the early 1960s focused a great deal of attention on the psychological and behavioral effects of crowding. This line of research, as it relates to humans, continues today.

## RECENT APPLICATIONS

John Calhoun died on September 7, 1995, and left behind a legacy of insightful and historically meaningful research. The kinds of social problems discussed he discussed in his 1962 article are increasingly relevant to the human condition. Consequently, when scientists undertake research to better understand and intervene in such problems as aggression, infertility, mental illness, or various forms of social conflict, it is not unusual for them to make reference to Calhoun's research on crowding and behavioral pathology.

An interesting study citing Calhoun's work examined changes in animal behavior that accompany domestication (Price, 1999). Price contended that species of animals that are domesticated—that is, kept as pets—have undergone genetic and developmental changes over many generations that have altered their behaviors in ways that allow them to share a common living environment with humans. Basically, what Price suggested is that as wild animals have become domesticated over centuries, they have had to adapt to human settings that are very different from their original habitats. This usually includes living in peaceful harmony (most of the time, at least) with others of their own species, other animal species, and humans, usually in relatively crowded conditions. This is accomplished, the author contends, through the evolution of increased response thresholds, meaning it takes a lot more provocation for a domesticated animal to become territorial and aggressive. In other words, dogs, cats, and humans are all able to live together in a relatively small space without running away or tearing each other to pieces, as would occur among undomesticated animals in the wild.

In a different direction, an article by Torrey and Yolken (1998) incorporated Calhoun's study in examining the association between growing up in crowded conditions and the development of schizophrenia and bipolar disorder (manic-depression). Many studies have found that people who are raised in high-density urban environments are at increased risk for these psychological disorders later in life. Numerous factors are present in crowded, urban settings that may account for such increased risks. However, the authors of this study hypothesized that it is the increased density of living conditions not in the neighborhood but rather in the individual homes (more people occupying less space) that may explain the higher rates of mental illness later in life. Why? This study contended that exposure to a larger number of infectious agents may account for this association.

A related study found a possible key difference in human reactions to population density compared to animals. In animal studies, pathology appears to increase in a linear way as a direct result of increased density: as one increases the other increases. However, a study by Regoeczi (2002) found for humans that the effect of household population density on increased social withdrawal and aggression actually *decreased* as the number of people in a single household increased. However, this effect was only observed until the number of people exceeded the total number of rooms; very much beyond that, the antisocial effects begin to appear with increasing density. In other

words when living conditions are such that, say, five people occupy a three-room apartment or seven people are squeezed into a four-room house, the tendency for people to withdraw or display more aggression increases. Two possible causes may be at work here. Either density is causing the pathology, or people who are more withdrawn or more aggressive end up in less crowded living situations, by choice or by ostracism, respectively.

## CONCLUSION

These and many other studies demonstrate how social scientists are continuing to explore and refine the effects of density and crowding. Although the causes of social pathology are many and complex, the impact of population density, first brought to our attention by Calhoun over 45 years ago, is only one—but a very crucial—piece of the puzzle.

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