BASIC PSYCHOLOGICAL AND PHYSIOLOGICAL HYDROSTRATEGIES IN HUMANS

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CITATION:

Wagner, J. (2003). Basic Psychological and Physiological Hydrostrategies. Colloque/Symposium C 10.2 Chalcolithic and Early Bronze Age Hydrostrategies, Dragos Gheorghiu (Ed.). British Archaeology Reports International Series 1123: Oxford.

ABSTRACT

Humans are strongly tied to water and our bodies show a number of hydrostrategic attributes—both psychological and physiological—for interacting and dealing with water. We value living near water, derive pleasure and even health benefits from viewing water scenes, and seek out water areas for recreation. Compared to other terrestrial mammals, humans are exceptionally thirsty and have physiological mechanisms useful for interacting with water such as subcutaneous adiposity and the diving reflex. Intriguingly, our health is critically dependent on dietary sources of essential fatty acids, which are predominantly found in water environments.

ACKNOWLEDGEMENTS

I thank Dr. Dragos Gheorghiu, Adjunct Research Associate at the University of Missouri-Columbia, and Professor Ralph M. Rowlett of the University of Missouri-Columbia for their interest in including my article in this collection of papers on human hydrostrategies.

This chapter considers human hydrostrategies in terms of our psychologies and physiologies. It is undeniable that humans have a special connection to water. Eleven of the world's 15 largest cities are located on seacoasts or estuaries (Cohen and Small, 1998) and a majority of the world's population live close to major rivers and coasts (Small and Cohen, 1999). We also seek out recreation sites that are situated close to lakes, rivers or oceans and enjoy associated activities such as swimming, skiing, diving, snorkeling, boating, and fishing. Folklore, myths, and rituals are deeply rooted in and replete with references to water (Roede 1991). As inveterate users of water—whether drinking, cooking, or washing—our connection to water is nearly visceral.

Perhaps then it is not surprising that humans have psychological preferences for interacting with water. U.S. real estate markets consistently show that housing prices increase as the distance to water decreases (Benson, Hansen, Schwartz, and Smersh 1999; Brown and Pollakowski 1977). Houses with scenic views of water are also worth more (Benson, Hansen, Schwartz, and Smersh 1998). Watching videos of water scenes has been found to inspire feelings of tranquility (Herzog and Bosley 1992), been linked to lowered stress levels (Ulrich, Simons, Losito, Fiorito, Miles, et al. 1991), and associated with improved convalescence (Ulrich 1984). Studies of landscape preferences reliably converge on water being the most desired feature (Yang and Brown 1992), with a bias towards preferring large bodies of water that are calm and come with a mountain backdrop (Herzog 1985).

On a more fundamental level however, water is not only preferred by humans, it is essential. Compared to other terrestrial mammals, humans are by far the most dependent on water. It has been suggested that this strong reliance on water may be related to a number of unique physiological characteristics found in humans but not other primates (Morgan 1990). Consider our exceptional thirst. Whereas a typical terrestrial mammal can withstand dehydration of up to 20%, humans typically succumb around 10% (Schmidt-Nielsen 1979). Moreover, when it comes to thermoregulation we are profligate sweaters, capable of secreting 15 liters per day in hot environments (Newman 1970). This amount must be replaced by drinking but even so, when humans take on excess water, instead of conserving, we rapidly excrete water through our kidneys (Schmidt-Nielsen 1979). Clearly, humans have come to rely on abundant and permanent sources of water.

Humans are also considerably fatter than other primates, containing roughly ten times the number of fat cells as would be expected for a mammal of similar size (Pond 1987). Our fat is also distributed differently than it is in other terrestrial mammals and primates. Instead of being largely confined to internal body cavities, our fat has migrated out to become attached to our skin, forming a continuous fat layer. This fat distribution pattern is also found in aquatic mammals such as dolphins, dugongs, whales, and seals. Alistair Hardy, a marine biologist, first pointed out this similarity when he noted that the skin of flensed sea mammals bore a striking resemblance to the skin layer in humans (Hardy 1960). A subcutaneous fat layer is generally held to be an effective insulator against heat loss in water and also aids flotation.

A fat layer would be useful for diving and humans are very adept for a primate at doing this. The famed Ama divers of Korea and Japan are able to exceed depths of 25 meters and hold their breath for up to two minutes while foraging the ocean bottom for shellfish and edible seaweed. Although male pearl divers in the South Pacific reach depths of 40 meters, women are generally more effective divers because they have higher body fat than men (Hong and Rahn 1967).

A useful mechanism for diving is the "diving response", which is a general mammalian defense against asphyxia. It involves a decrease in heart rate along with a redistribution of blood through so that oxygen is diverted to the brain and heart (Andersen 1966) and other necessary muscle groups (Butler and Woakes 1987). The diving response is most developed in diving mammals and birds and can be triggered by apnea but is more strongly triggered by submersion of the face or head. Cold water causes a more pronounced response although the critical factor is the difference between the ambient air and water temperatures (Schagatay and Holm 1996). With training humans can greatly improve the response and trained humans have been found to have diving responses in the range of semi-aquatic mammals like the beaver and the otter (Schagatay 1996). Developing an improved diving response through practice is useful for exploiting underwater resources.

A final hydrostrategy in humans concerns our diet and is doubly worth mentioning here because of the ramifications for our current health. Humans have a dietary requirement for essential fatty acids (EFA) and obtaining these nutrients is critical for developing optimal mental and visual functioning. Further, there are two types of EFA: omega-3 and omega-6 and obtaining these in equal amounts is considered optimal for health. However, much higher levels of omega-6 fatty acids are now common in

Western diets mainly through the increased use of vegetable oils. Modern diets can also be very low in omega-3 intake overall, and low levels have been linked to a litany of adverse health outcomes including heart disease, stroke, Type II diabetes, arthritis, depression, breast and prostate cancer, hypertension, and several autoimmune disorders (Simopoulos 1999). Omega-3 supplementation during and after pregnancy has also been found to increase gestation periods, birth weight, and cognitive development in some groups (McGregor, Allen, Harris, Reece, Wheeler, et al. 2001).

Omega-3 fatty acids are most plentiful in marine-based food chains. Shellfish and fish in general are typically good sources of omega-3 fatty acids with coldwater species such as mackerel and herring providing relatively more. Lesser amounts (and in a somewhat less useful form) can be had from seeds, nuts, and leafy plants. Terrestrial plants and animals tend to have low levels of omega-3 fatty acids except for animal brains, which are a very rich source. A hydrostrategy for exploiting marine-based resources may have had beneficial health effects on those living near water.

Taken together, hydrostrategies in humans appear to run deep, influencing both our mental and physiological selves. Compared to most other terrestrial mammals, humans' physiology and psychology literally impel us to seek adaptively close hydrostrategies.

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