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### Evolutionary mismatch: Getting to the root of modern problems

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# THink

The HEAD Foundation Digest

- | Higher Education Reform in Cambodia since 1990s 3
- | The Diplomacy of China 3.0 21
- | The Early Childhood Practice Gap: A Matter of Context 26
- | Where Are the Youth in Agriculture? 35



## Bridging the Gaps



**3**  
**Higher Education Reform in Cambodia since 1990s:**  
 How or What for?

LEANG UN, LARS BOOMSMA AND SAY SOK

INSIDE THIS ISSUE:

**8**

**Be Limitless:**

The Future of Science Education in the Philippines Through International Collaborations

CARMINA DALIDA AND GLADYS MALTO



**11**

**Evolutionary Mismatch:**

Getting to the Root of Modern Problems

DR NORMAN LI



**15**

**Disability-Centred Arts as a Powerful Tool for Inclusiveness**

KIRIN HENG



**17**

**Experiential Learning in the Digital Age:**

Why it Matters

DR ADHA SHALEH



**19**

**Tackling Barriers:**

Enhancing International Students' Employability in Australia

DR THANH PHAM

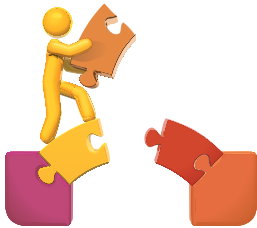


**26**

**The Early Childhood Practice Gap:**

A Matter of Context

SHAIREEN MARCHANT



**29**

**Is Some Degree of Inequality Desirable in a Well-Functioning Economy?**

THAM YIN YEE



**32**

**Learning to Transform**

JIX SZE



**35**

**Where Are the Youth in Agriculture?**

MANDA FOO



**39**

**Food Matters**

PROFESSOR PAUL TENG



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# Evolutionary Mismatch: Getting to the Root of Modern Problems

DR NORMAN LI

Humans have experienced an enormous amount of technological progress in recent years. Owing to this progress, we are globally connected and can instantly communicate with family, friends, co-workers and multitudes of strangers. We are increasingly sheltered from harsh natural elements, dangerous animals and deadly wars, and have an incredible array of medicine to treat whatever ill us. Our entertainment options now include thousands of satellite television channels and millions of video games and videos. Our food options are just as numerous. Transportation is so fast and easy that we can visit places and do business with people all around the world. Goods and services are becoming astoundingly numerous and accessible as they are increasingly provided by multinational corporations that enjoy economies of scale on epic proportions. Resources can be extracted at a faster rate, and machines can do a lot of what we used to have to do using our own physical and mental energy. Imports, exports and outsourcing make it easy to run successful companies and ensure consumers have the best that the world offers. We can now accomplish a lot more than we used to, and keep pushing the limits of what we can do.

Yet, all this progress is directly related to why we also have so many of the problems that we have today. Individuals in modern societies spend less time with family and close friends, and are often lonely and depressed. Individuals are chronically stressed, suffer from anxiety disorders, attention deficit and hyperactivity disorder from an early age, are dissatisfied with their jobs, their lives and their body image, and develop eating disorders and are quick to dissolve their marriages. Increasingly more people are obese, have diabetes, struggle with high blood pressure, and develop various cancers. Many people, including children, require medication to function normally and are addicted to alcohol, nicotine and other chemical substances, as well as social media, pornography and video games. At the country-wide or societal level, we are faced with the threat of nuclear war, pollution, global warming, water shortages, sustainability of natural resources, the environment and an increasingly ageing population that is not supported by the younger generations.

## The Origins of Modern Problems

To understand the origin of these problems and the key role that technology plays, we must understand evolution. Evolution by natural (and sexual) selection is the process through which all living organisms are subject to and have developed. Our physiology as well as our psychology — the ways we think, feel and behave — owe themselves to millions of years of evolution. That is, our physiology and psychology are governed or largely influenced by genes, and the genes that somehow led our ancestors to survive and reproduce better are the ones that got selectively passed down over millions of years. Indeed, we have the physiology and psychology that we have today precisely because they were useful for survival and reproduction in the ancestral past.

Our psychology can be thought of as consisting of numerous highly specialised mechanisms or information processors that take very specific environmental cues as input and produce output in the form of thoughts, feelings and behaviours that are adaptive (leading to greater survival or reproduction). The problem, however, is that technological progress has occurred so rapidly in recent years that we are now living in conditions that our physiological and psychological mechanisms were not evolved to handle, much like cheetahs that roamed and lived for aeons in the Serengeti but one day awoke inside the confines of a zoo cage. In other words, the environment has become *mismatched* with our evolved physiology and psychology.

## Mismatched Food

To illustrate, here is an example: Humans, like all other organisms, have always needed to obtain and ingest calories in order to live and function. However, not all things in the natural environment are edible and provide good caloric sources. In the natural world, things that have the most calories (and nutrients) include fruit, berries and honey. Those of our ancestors with genes that inclined them to find sugar tasty were more likely to eat these things (versus say, tree barks, grass, dirt and poisonous plants) and survive better than those who lacked

those genes and thus, did not find these calorie-dense foods tasty. As such, people with these genes were more likely to live and pass down these genes and tastes to the next generation, who themselves were more likely to live and pass down their genes, and so forth.

In the modern world, however, technology has eliminated the need to search for ripe fruit or the occasional patch of honey, by enabling us to mass-process sugar into potent forms (e.g., high-fructose corn syrup). We now have things like soda, candy bars, cake, etc., that are cheap, available and loaded with unnaturally high levels of sugar, and that are strongly favoured by our ancient calorie-obtaining mechanisms. So much so that our insulin and glucagon mechanisms, which evolved to regulate energy obtained from the sugars that people consume in natural environments, get overloaded and give out, leading to diabetes — a condition not found in traditional hunter-gatherer societies.

### Mismatch-Induced Low Fertility

Another modern issue is one that I have been researching recently with my collaborators: why is fertility so low in Singapore, Thailand, all of East Asia, and parts of Europe such that local populations are shrinking? How could this be when evolution is all about successful reproduction? As with all modern phenomena, it is instructive to view this issue with a mismatch lens. There is a biological framework called life history theory that explains how all organisms have evolved to expend their time and energy based on various environmental conditions. When conditions are more favourable for reproduction (e.g., low population density, abundant resources), organisms will expend more energy on reproductive activities (e.g., finding mates, mating). When conditions are unfavourable for supporting reproduction (e.g., high population density and competition, limited resources), many organisms will shift their energy expenditure away from mating and more towards investing in one's growth and resources so that when conditions improve, they will be in a better position to reproduce.

In the modern world, however, conditions such as social competition are only getting more intense and do not appear to be abating. Thus, people's ancient reproductive timing mechanisms keep getting them to further slow down and delay reproduction, even though in the modern world, most people who delay reproduction are capable of having children. That is, reproductive timing mechanisms are calibrated to conditions that were reliably associated with reproductive success in the ancestral past, not the technologically enhanced modern world. So, a person who lives amongst a population of millions of strangers, works indoors in surroundings devoid of natural

elements, competing globally around the clock for compensation that cannot be seen, would be correctly assessing that current reproduction is a bad bet if that person were in the ancestral environment, but not in the modern one. We have this mismatch because environments have changed too fast for psychological mechanisms, including those governing reproductive timing, to evolve and adapt.

### Mismatch is Extensive

If we apply these principles more broadly, we can see that evolutionary mismatch is ubiquitous and underlies much of the unique difficulties of the modern world. Consider the workplace. Throughout human evolutionary history, men hunted and women gathered plants during a few hours of the day. Now, however, men and women do similar work, often side by side, in indoor offices, using computers and other machines. Although human stress systems were designed mostly to respond to fleeting, immediately pressing threats like a tiger or snake, they are now chronically engaged through multitasking around the clock, and having projects that take months or years to finish. We spend very little time outdoors and have increasingly less time to relax and spend in the actual presence of family and friends. As such, the mismatched workplace contributes to Vitamin D and serotonin deficiencies, high blood pressure, job burnout and conflict.

At a worldwide level, sustainability is an issue — resources are being drained at an alarmingly fast rate that, according to many sources, is exceeding the rates at which they can be replenished. However, it is not easy to enact sustainability practices because humans did not have a need to conserve and be mindful of such issues until relatively recently. Throughout human evolutionary history, people consumed as much as they could of the available local resources and moved to a new location if they had exhausted all the resources. Populations were fairly small and technology rather minimal, so this way of living was largely sustainable. Thus, humans did not have the need to evolve a conservation mindset or to think about the greater good of the world or future generations.

This is not to say that sustainability and other modern problems are unaddressable or that humans are incapable of thinking unselfishly or over a longer time horizon, but that such thinking does not come naturally for most people and thus, such problems are not so easy to fix. At any rate, the best solutions for addressing a problem are made possible when we understand its root cause. Too often in the modern day, we treat the symptoms of a problem caused by technology by throwing more technology at it. This has the effect of causing further problems while simply relieving symptoms for the short term.



Depression, for instance, is a natural response to the permanent loss of something valuable, including a loved one, resources, or an important goal. Depression's pain likely evolved to induce individuals to slow down, mentally let go of whatever it is that they have lost, and sometimes to understand their circumstances better.

In natural settings, depression typically clears up within weeks or months, and rarely ever lasts more than a year. In the modern world, however, anything that resembles depression is often treated with antidepressant medication. While such medication has undeniably helped many people (some of whom were likely afflicted with the kind of severe depression that is brought about and sustained by mismatched conditions), it is also the case that for many individuals, long-term usage of antidepressants can cause the brain to decrease its natural ability to produce neurotransmitters in order to offset the large exogenous amounts coming from the medications (neurotransmitter levels are regulated by homeostasis-maintaining mechanisms). This process induces individuals to become increasingly resistant to anti-depressant treatment while also becoming psychologically worse off than when they started the treatment. As such, it has been suggested by some evolutionary psychologists that antidepressants be used more as a last resort rather than a first-line treatment.

### Concluding Remarks

In summary, we are living in a technologically savvy modern world where rapid progress has brought about many advances, but also many changes to our environment, at a historically unprecedented rate. The ever-changing environment is mismatched with our physiology and psychology, which evolved to function in contexts that existed throughout ancestral times. Thus, as we continue to push for rapid progress and social change, there will necessarily be side effects, negative repercussions and unintended consequences as our systems are pushed beyond what they were designed to handle.

Although I have made the point that mismatch is implicated in most, if not all modern problems, it is important to clarify that not all problems are modern and thus, due to mismatch. For millions of years, humans have struggled along many dimensions just to survive, and have only recently started enjoying the kind of leisure and luxuries that we now have access to. Yet, at the same time, psychological mechanisms had evolved to deal with natural, ancestral environments and do not have infinite flexibility to deal with all the novelty that is being introduced into the world and our lives. Understanding and addressing mismatch is particularly important for the future functioning and well-being of Singapore, which is on the leading edge of the digital age, and the

rest of the Southeast Asian region, where technology and lifestyles are quickly progressing and modernising. ■

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### Recommended Reading

Li, N. P., van Vugt, M., & Colarelli, S. M. (2018). The evolutionary mismatch hypothesis: Implications for psychological science. *Current Directions in Psychological Science*, 27, 38–44.

