



*Bread*

a story of  
gods and  
gluten



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DEPARTMENT OF  
AGRICULTURAL ECONOMICS



## *A civilization founded on grass*

This thing we call civilization began with a peculiar type of grass, a grass that could produce seeds within a few months and whose seeds were storable for long periods of time. Storability is important, because it allowed hunter-gatherers to collect large amounts of seeds and store them for times when food was scarce. As they were stored in one location, that place had the beginnings of a home, and hunter-gatherers made their first step towards civilization (for better or for worse). Our ancestors eventually learned that you could plant the seeds and grow them in the same place year after year, allowing them to cease their roaming and stay in the same place—and in much larger groups.

Living amongst strangers in densely populated areas required a different form of social organization than that in small nomadic clans. It produced something we call civilization. Being a 'citizen' meant you belonged to a specific area and were bound to strangers of that area by rules. It wasn't necessarily more peaceful than the hunter-gatherers, it was just different. Permanency led to the notion of private property. Agreements between strangers led to the written language. Clan chiefs were replaced by kings, and religion became organized. Inter-tribal conflict was replaced by warfare between nations. While most people still spent the majority of their time producing food, others developed specializations that did not exist in the hunter-gatherer lifestyle. Some were priests, some served the king, some became artisans, and some became soldiers.

Civilization arose independently in different areas and from different grasses. There were the maize people of the Americas, the rice people of Asia, and the wheat people of Europe and the Near East. Originally these grasses were quite different from their modern descendants. Maize, for example, originated from teosinte, a wild grass that produces ears about the length of your thumb. But

we domesticated teosinte and it became maize. Domestication happens when the deliberate choice of which plant seeds to harvest and replant leads to alterations on the plants' genetics. Just as we began with the wolf and produced dogs as varied as the Chihuahua and the Great Dane, we began with wild grasses and created all different types of maize, rice, and wheat.

The transition from hunter-gatherers to civilized farmers was so slow that the people lost track of (or never realized) how it happened, so they replaced their lost history with myths. The wheat people, the maize people, and

the rice people all conjured stories about how these plants were given to them by gods. The god Manco Capac gave the Incas maize, the goddess Guan Yin gave her people rice, and the goddess Ashnan gave the Sumerians wheat. Every child learns the story of how summer changes to winter as Demeter's daughter returns to the underworld, but few have heard the one where Demeter gave grain to the Greek city of Eleusis in return for their loyalty.

Most origin-stories view agriculture as a gift from the gods, but the Hebrews had a different take, where having to acquire food from farming was a punishment from God for eating

the forbidden fruit. The story would become even stranger for Christians, where this God's son (who is also God himself) daily turns himself into wheat bread to be consumed by his devotees during Communion.

How exactly did domestication of these grasses occur, though?

Consider the non-shattering seed. Wild plants generally release their seeds once they are viable, but every now and then a natural genetic mutation causes the plant to hold onto those seeds. These seeds would naturally be easier for humans to harvest—it's easier to rip seeds of a standing grass plant than to bend over and pick the seeds up off the ground. By then planting more of these seeds than seeds from shattering-seed plants the genetic



*Demeter, on her throne, receiving an offering of wheat from the queen of Eleusis. Notice Demeter is receiving the 'triune', meaning three sheaves, of wheat. As in Christianity, three was a holy number in ancient Greek religion.*

makeup of these grasses were altered until they all produced non-shattering seeds. This is just one example of the many genetic changes caused by humans, producing the domesticated maize, wheat, and rice.

Wheat has a number of wild ancestors, the two main ones being wild einkorn and wild emmer. When the seeds of these wild grasses are viable the plant stems shatter, whereas modern wheat stems holds the seeds erect, making it easy for both human hands and combines to harvest it. The wild seeds have tight husks which are hard to separate from the seed, whereas husks from their modern counterparts easily break from the seed, making threshing easier. Natural genetic mutations and human selection ultimately led to *T. aestivum*, the modern bread wheat, whose distinguishing feature is larger amounts of gluten. Gluten refers to a family of proteins who crisscross and bind with each other to form a net-like structure that, when the wheat is made into dough, gives it elasticity

and the ability to rise by trapping the carbon dioxide gas released by yeast. All ancient wheats had some amount of gluten, but not as much as those present in modern wheat. The first wheat products were consumed as pastes and porridges, but as humans discovered wheats with greater amounts of gluten they learned to make leavened bread (*i.e.*, bread that rises when baked).

The Homo Sapien lived as hunter-gatherers for around 300,000 years, but developed agriculture only around 8,500 BC. The word 'agriculture' is derived from Latin, where *agr* means 'field' and *cultura* means 'care for'. Today the word 'culture' describes the customs and the norms of a particular society. It is fitting *cultura* is the mother of both 'agriculture' and 'culture', for the culture of a people, their agriculture, and their diets are intertwined. Wheat is more than a bundle of calories and nutrients. 'You are what you eat' and our attitudes towards wheat describes who we are as a people. The history of wheat bread is necessarily a social history.

## Wheat and culture

In the days of the Roman Republic (509 - 29 BC) wheat signified the citizen-soldier. Early we remarked how wheat's storability helped give rise to civilization. Civilizations inevitably go to war and wheat's storability made it the ideal soldier's food. In peacetime, the Roman would consume mostly vegetables and a little meat. They especially loved cabbages (strange, right?). When war was declared this diet would be reversed. Citizens called to war would provide their own equipment like armor and swords, but also the food they would need on campaign, and they would plan to consume around 2 lbs of wheat each day.

Before the Roman Republic became the Roman Empire it was mostly just the wealthier citizens who fought in wars, the idea being that citizens with property have more to lose should Rome fall, and would thus fight harder than a peasant with nothing to lose but his life. Wheat was thus raised almost exclusively for war, and war was waged by citizens, and so wheat sym-

bolized citizenship as well. Bread here was thus not just a convenient food but a symbol of distinction, an expression of identity, a bundle of carbs and protein that connected the Roman citizen to his ancestors who built Rome, like Romulus and Aeneas. Bread connected Roman citizens to a man who was [said to be] raised from the dead and became a god (Romulus) in the same way that bread connects modern Christians to a man who did the same thing (Jesus).

As Rome evolved from a democratic republic to an autocratic empire the symbolism of bread changed with it. Its army now relied more on mercenaries from distant, conquered regions. The small farmer-citizen was replaced by *latifundia* (very large farms) owned by a few wealthy senators and run by slaves. Citizens who would formerly be farmers now went to Rome looking for work, and emperors were keen to ensure they were complacent and not riotous, so the emperor provided them with cheap—sometimes free—bread. This led the satirist Juvenal to lament that Roman citizens who once cherished their political rights now only cared about 'bread and circuses'.





Whereas wheat once symbolized the citizen's political rights and responsibility it now represented an abdication of political power—a bribe from the emperor. By now the empire had expanded to the entire circumference of the Mediterranean, and beyond (even to Britain). To acquire the wheat needed for Rome the emperor imported it from the outer regions of the empire—modern day England, Spain, Turkey, North Africa, and especially Egypt. Bakers who were once independent businessmen were now civil servants of the emperor.

### *A god becomes bread*

Rome took so much wheat from its provinces that they suffered from poverty and hunger. Often the province of Judea would have to forego a fourth of its grain to Rome. Great discontent grew in the Middle East especially. There a hunger of two kinds proliferated. First there was a physical hunger and a yearning for more bread. Second there was a metaphysical hunger, for values had deteriorated and religion was now conducted more as a bureaucratic practice than out of personal piety towards god(s). Politics had infiltrated religion to the point that religion seemed to lose its essence. Out of this hunger came a peculiar man, or perhaps not a man at all, for today over 2 billion people believe he was—and is—God.

The man, of course, was Jesus, and tales of his life are filled with grain / bread as a symbol. The gospels were written (or, if you are a believer, Jesus' life was lived) to show Jesus as a man who wished to satisfy both types of hunger. The major problem in his time was physical hunger, and so it is fitting that he was born in the town of Bethlehem which means 'house of bread'. Most of his parables involved agriculture. One of his miracles involved creating bread and fish from nothing to feed to large crowds. In many ways it does seem that he was trying to replace the Roman Emperor. The emperor during Jesus' youth, Augustus, was said to be the son of God, as his adopted father (Julius Caesar) was said to have become a god after his death and sometimes referred to as 'God' in the singular. The emperor doled bread, and so did Jesus. Moreover, most historians think that Jesus was crucified because he claimed to be the king of the Jews, and that was an usurpation the emperor could not allow.

Of course, Jesus was claiming to be a very different prince, and a very different god, than an emperor; for Jesus provided physical bread but also the Bread of Life. Centuries before Jesus there existed the concept of a 'bread of life' which gifted immortality to those who ate it. It was an idea among the Greeks and the Babylonians alike—a concept that most everyone in the region would be familiar with. It was the bread of life that concerned Jesus most, so when the devil tempted him to turn rocks into bread, the story says that Jesus refused, replying, "One does not live by bread alone, but by every word that comes forth from the mouth of God." When Jesus later taught his disciples the Lord's Prayer, one of the lines

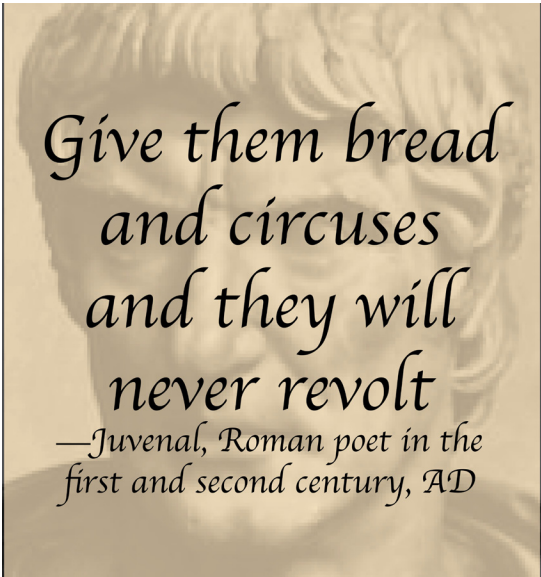
is 'give us this day our daily bread', and this refers to both the physical need of food and the spiritual needs of the person—both the bread of physical nourishment and the bread of life. This is why Catholics today celebrate the Eucharist daily, a ceremony involving the eating of bread blessed by a priest.

Bread was such a powerful symbol for Jesus because, however much scholars debate who the real Jesus was, most are agreed that he was an apocalyptic prophet, which means he believed that to eliminate the suffering going on at the time, God would soon intervene and aid

the Jews in establishing a new, just kingdom. He also thought that he would play an active role in this intervention. So while he was not competing with the emperor as the provider of bread (at least for the time being), he was playing a long game, convinced that before the next generation they would shrug off Roman rule and no longer hunger for bread.

### *Bread for the pagans*

The idea of bread being a physical need for the poor but also a symbol of eternal life persisted long after Rome fell and Christianity dominated Europe. The western half of the Roman Empire fell as Germanic tribes invaded; the eastern half persisted until 1453 (though we refer to the eastern half as the Byzantine Empire they referred to themselves as Romans). Humans still hungered for bread, though this time it was not because of the emperor's taxes but the incessant warfare among the tribes. A new type of society emerged in Europe, one where most everyone was placed into one of three groups: those who prayed, those



*Give them bread  
and circuses  
and they will  
never revolt*

*—Juvenal, Roman poet in the  
first and second century, AD*



who fought, and those who worked.

Those who prayed consisted of priests, monks, nuns, and the like. The nobility fought, for only they had enough money to purchase horses, armor, and weapons. The vast majority were workers, and most of these were farmers. With the constant threat of violence most of the farmers opted to become serfs, where they lived under the protection of a noble. The nobles of course did not protect them for free, but in return for food and labor.

We are now in the period 500 – 1500 AD. After the wheat harvest the serfs would take the grain to the noble for storage, and when the serf needed bread, the noble would grind it into flour for them. It was actually a requirement that the serfs use the noble's miller, and there were harsh penalties for serfs caught milling grain at home. Moreover, serfs were often not allowed to take their flour home to make bread. The bread had to be baked in the nobleman's kitchen—for a fee, of course.

In England during this time a form of Germanic language referred to as 'Old English' was spoken, and the vocabulary used to refer to the nobleman's household reflected their control of bread. A nobleman was referred to as *hlaford*, which means 'the man who gives out the bread'. *Hlaford* was contracted to the modern day word 'lord'. Peasants would refer to the nobleman who protected them as 'my lord', and like us

today, they referred to Jesus as 'lord'. Likewise, the nobleman's wife who was responsible for baking the bread was referred to as *blaefdigge*, meaning 'kneader of the dough', which later became 'lady'.

Throughout the Middle Ages Christianity spread into northern Germany, Scandinavia, and Russia. With it came bread. Some of the Germanic tribes had formerly performed little agriculture, relying mostly on livestock, hunting, gathering, and gardening. The concept of plowing the soil was foreign to many of them and frankly frightening, as the earth was sacred, something of a god. At the same time they were taught to farm they were taught about Jesus and the Eucharist.

They naturally associated everything about the making of bread with the god of bread, Jesus. After all, wheat made bread, mills turned bread into flour, flour becomes bread, and bread is both the son of God and God. A diseased child could be cured, they believed, by a splinter from a wheel mill. The mill wheels would make sounds that some thought was God speaking, and hymns were composed based on what they thought the mill was saying.

It took them some time to let go of their pagan beliefs and adopt Christianity in full. It is difficult to go from many gods to one God, especially when the priests tell you that one God is also three gods (the trinity) plus a multitude of angels. When the mill



*Saint Boniface chopping down a sacred pagan tree in modern-day Hesse, Germany. Sometime around 723 AD.*

*The word 'lord' is derived from Old English 'the man who gives out the bread'*

## *Wheat in Colonial America*

*Wheat had a difficult time adapting to Colonial America, largely due to its susceptibility to the wheat blast fungus, so early European settlers relied mostly on rye, barley, and oats for bread. So scarce was wheat bread it was usually only eaten on the Sabbath, and in New Netherland bakers were prohibited from selling wheat bread to Native Americans.*



would made a loud sound they at first thought it must be Thor (the Norse god of thunder), but the Church said 'no', the sound was made by Saint Verena—the saint of the miller's trade. Pagan holidays were replaced with Christian holidays, which is why the spring festival for the Germanic fertility god Eostre became Easter (hence the Easter eggs), when Jesus is said to have risen from the dead. For every minor pagan god the church gave people a Christian saint.

It is hard to overstate what a transformation of culture this was, and bread played a central role. When we say 'bread' we don't mean wheat bread exclusively though. What type of bread did Jesus consume? The wealthy used wheat flour for most of their bread, but the poor ate mostly barley or rye bread, depending on the region. Barley in the Mideast and rye in the Iberian Peninsula (modern day Spain and Portugal). So if Jesus performed miracles with bread it was likely barley bread, and the bread used at the last supper was likely barley bread as well. This caused a number of controversies about what type of bread should be used in the Eucharist. Saint Aquinas said Mass should be celebrated with wheat bread because Jesus compared himself to wheat in a parable, and because wheat was a finer grain befitting a god. Around 1,000 AD it became a church rule that only unleavened bread should be used to make the Eucharist bread, as it was unleavened bread consumed by the Jews as they fled Egypt, the Jewish holiday celebrated today as Passover. This means the bread should not contain yeast or other leavening agents like baking powder.

All of this tells us something important about the breads used in the Christian Eucharist: whatever the breads were made from, they contained gluten. While wheat contains more, barley and rye do have gluten. It is gluten that allows bread to rise, so specifying the bread should be unleavened implies the flour contained gluten. It is not so much wheat itself that has been such a powerful force in western culture, but gluten. In fact, Catholic Canon Law requires Eucharist bread to be made from pure wheat exclusively, and while they allow low gluten

"hosts" (the wafers of bread) for those with Celiac disease they explicitly prohibit gluten-free hosts.

People believed the wafers—small cracker-like unleavened bread used in the Eucharist after it was blessed by priests—had magical powers. It was the body of Jesus, a 'host' of a god, and peasants would steal the hosts and feed them to their livestock hoping it would improve their health. Other times the wafers would be placed at the bottom of a beehive to enhance the honey's sweetness. Sometimes the wafers even seemed to bleed, turning red as if God himself were injured. A terrible omen, people would desperately sought to identify and punish whoever was offending God.

These were not rumors or hallucinations of a few deranged monks; enough people witnessed the wafers turning red to verify it truly happened. Unfortunately, Jews were often thought to be the culprit, resulting in massacres of many Jews. It was not until 1848 that we learned the true cause of the 'bleeding'. When Christian Gottfried Ehrenberg examined bleeding wafers under the more powerful microscopes that had been recently developed he could see it was caused by tiny living organisms: a bacterium named *prodigiosus Cohn*, which Ehrenberg also managed to raise as cultures to prove it was indeed a microscopic life form. Bread had entered the modern age, and its role in human culture would change as well.

## Bread in the modern age

It was about this time that the germ theory of disease was developed. Now that people knew food sickness was caused by microscopic organisms that were easily spread by human hands, a movement for 'pure food' emerged. The word 'sanitary' was first used around 1923 and was increasingly used to depict foods that did not contain these germs. A war against unsanitary foods began, and on the front line were mothers. They preached a 'gospel of germs' and would make surprise visits to bakeries, insisting on inspecting their practices. These were not government inspections; such laws did not yet exist. They were concerned citizens doing what government

**BUSINESS SUCCESS**

The baking industry of the Ward family really began in New York City about 50 years ago when Henry Ward came to New York from Belfast, Ireland. Henry Ward was a baker. He opened a small bakery in Dryden Street and for a few years conducted a successful business in what was then a quiet residential center of old New York.

Attracted, however, by the opportunities of the west, Henry Ward moved a few years before the outbreak of the Civil War to Allegheny City, where he opened his second American Bakery.

It was here that Mr. H. R. Ward the organizer and founder of the Ward Baking Company, began to work in the bakery industry toward it to be greater than himself.

In 1870 Mr. H. R. Ward moved on his own account, starting a bakery in the city of Pittsburgh, just across the river from Allegheny. In 1875 he connected with his former partner, George H. Ward, under the firm name of H. R. Ward & Company.

In 1880 the expansion of the bakery propelled the introduction of mass capital, and the Ward Baking Company was incorporated. This Company took what was at that time the largest building lot in the city of Allegheny.

The Ward Baking Company was exceptionally alert in keeping abreast of the times in the great improvements that have descended in the process of making bread. The purity and deliciousness of their product and the sanitary appliances of their plant led to make their business one of phenomenal growth. For example, the first bakery built by the first and second Ward Baking Companies in the Pittsburgh field, having won for themselves a place in the very best of catering back to New York, where their name was first known.

You remember these have recently been considered in New York City. These great Sanitary Temples of Bread and Cleanliness which the Pittsburgh bakery in New York of an American family which has "made good."

**Snow-white Temples of Cleanliness**

**THE BRIGHTEST, WHITEST, CLEANEST PLACES IN ALL NEW YORK**  
The Ward Bakeshops—Largest and Best Equipped Bakeshops in all the World. Where Ward's Tip-Top Bread is Made

**Do-It-Right Bakeshops—Open to Public Inspection**  
Here are two great plants, one of six, one of four floors. Both are equipped with every modern appliance for the production of absolute cleanliness in the bread-making process. The machinery for making bread is on each floor—each one run by its own electric motor.

**Wonder Bakeshops**  
These two bakeshops are without a question the greatest in the whole world. They have floor space of more than 400,000 square feet; a capacity for producing more than 100,000 loaves of bread a day. They contain 15 ovens to bake and cool. They cost \$1,000,000. Each of the Ward Bakeshops is on a city lot. They occupy their floor in brick load quantities, having a capacity for storing 200 car loads.

**Delivery of Bread**  
Bread will be delivered all over Greater New York by means of more than 200 motor trucks, equipped with special delivery apparatus. These motor trucks will give you a fresh loaf of Ward's Tip-Top Bread at the very door of your home.

**A Physician Examines Every Employee**  
at the Ward Bakeshops. Only people in perfect health work there. Shower baths, medicine, isolation, recreation rooms—every modern device to promote health and comfort, is provided.

**100% Pure**  
**WARD'S TIP-TOP BREAD**  
**100% Pure**  
At Your Grocer's 5¢ & 10¢ Loaves

general through topography details the bread seems almost to smile back.

**You May See All This**  
Here's an invitation—at the same time a reminder; you may call at one of these bakeshops any afternoon—except Saturday or Sunday—and examine our every process of the making of Ward's Tip-Top Bread. A guide will conduct visitors and explain the operation of the machinery to you. That is the invitation. The reminder is—  
**Ward's Bakeshops—Inspected Inside a Bread Bakery Before!**

And just—how's this? You are more interested in bread than in any other food. You eat every loaf that any other loaf—you eat it at every meal. You are really interested in bread, aren't you?  
Read the advertisement of Ward's Tip-Top Bread that follows this one—telling all about the making of bread.  
Visit one of the Ward Bakeshops. You will find that you can expand by the interesting things you see.



health inspectors due today. Bakeries deemed sanitary were placed on a ‘white list’ and made publicly available so that the public would know where they should buy bread. Most of the small urban bakeries did not make this list, as the bread was baked in poorly ventilated cellars by workers who had obvious health problems like tuberculosis or bronchitis.

This was also an era of great racial discrimination. Jim Crow laws were passed in the South, large influxes of Irish, Italian, and other non-Anglo-Saxon immigrants entered the US, and the recent discovery of natural selection gave rise to the eugenics movement. The bakery workforce consisted largely of these immigrants, and white America deemed these immigrants to be ‘unclean’, and so the bread itself was considered unclean. The desire for bread to be made without being touched by a human hand came at the same time a factory system for baking bread was technologically feasible—a system where bread was indeed untouched by human hands.

When people today say ‘I want to know where my food comes from’ they generally want to know the people who made the food, and to know it was made by local, small-scale producers—not factories. Around the beginning of the 1900s it was the opposite; they wanted to know it was produced in a factory with lots of machines, a factory one could visit and witness the industrial fans providing ventilation and workers with gloves and hair nets. It was New York that led the movement towards industrial bread, and they encouraged people to visit the factories where they boasted, “You can see every detail in the making of Ward’s Tip-Top Bread. The human hand never touches bread at these, the greatest bakeries in the world—daylight bakeries, snow-white temples of cleanliness.” You may not have

heard of Tip-Top bread, because today it goes by the name of Wonder Bread.

Then came sliced bread, something no one thought was possible until one baker on the verge of bankruptcy attempted it as a Hail Mary to stay in business. Consumers loved it and it wasn’t long before bread had to be pre-sliced before consumers would buy it. Sliced bread didn’t just replace sales of unsliced bread, it increased the demand for bread overall because it was more convenient to use. And ever since July 6, 1928—the day the first loaf of sliced bread was produced—anything great was given the honor of being ‘the greatest thing since sliced bread’.

In only a few decades the Pure Food Movement transformed the bread sector. In 1890 women

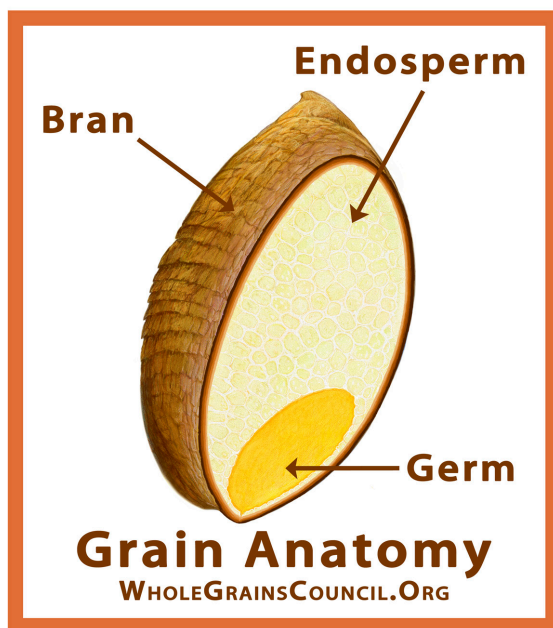
made 90% of the bread in their own homes; forty years later 90% of the bread was made by men working in factories.

The first half of the twentieth century was an era in America where people held great respect for professionals and the industrial process, and by the end of the 1930s people looked for three things in bread. First, it had to be sliced. Second, it

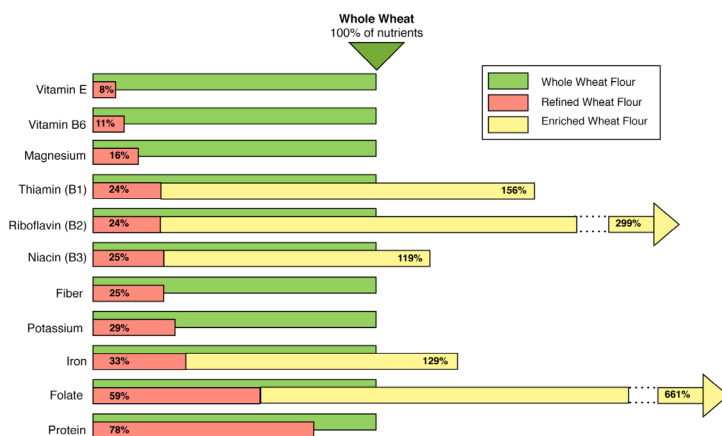
must be pure white and of a homogenous texture (*i.e.*, no air bubbles). Third, it had to be very soft. People judged the purity of the bread by its whiteness and its freshness by its softness. In taste-tests people didn’t actually like soft bread as much as other breads, but when it came to what they purchased, they purchased soft.

This was a type of bread unheard of during the time of Jesus because it was pure white bread. The wheat seed contains three components: bran, germ, and endosperm. The bran is the outer shell of the seed, the germ provides a variety of specific nutrients for the

young plant, and the endosperm stores the energy the



*White flour is made from the endosperm alone, while whole wheat flour contains the endosperm, bran, and the germ.*



Obtained from [wholegrainscouncil.org](http://wholegrainscouncil.org)



plant needs to grow. Before the nineteenth century even the best mills could not remove all the bran and germ, but now mills can, allowing bread to be made from the endosperm exclusively. This has some advantages. White flour can store longer than whole wheat flour and is better tasting to some people. The problem, though, is that much of the nutrient content of the wheat seed resides in the germ and bran, so white flour is undoubtedly less nutritious.

This problem became evident at the US prepared for World War II. As the US began to draft citizens, the military discovered the US population was dangerously malnourished and unfit to wage war. Depending on the region, 30 – 70% of conscripts were deemed too unhealthy to fight, and the main problem seemed to be vitamin and mineral deficiencies. Most of the vitamins and minerals in wheat are in the bran and germ, the two parts removed from wheat when making white flour. The obvious solution was for Americans to return to eating whole wheat flour. This was the United Kingdom's solution, and it worked, but Americans were unwilling to part from white bread, so the only feasible solution was to add vitamins and minerals to white bread.

Thus the invention of 'enriched' bread. With a combination of wartime laws requiring enrichment of flour, and propaganda heralding its ability to make America strong, consuming enriched bread be-

came not only wise from a personal health perspective but patriotic. Eventually Americans would accept nothing else. Moreover, enriching bread added only a modicum of expense. America entered the war with a dangerously unhealthy population and left the war victorious and robust. It was the scientists and industrial bakers who helped make America the most powerful nation on Earth. To them we owe our gratitude.

### Counterculture

Trust in experts and institutions started to erode in the 1960s, where young, affluent, white kids tried in vain to reconcile the contradictions of their daily life. They

watched the news from the safety of their living rooms, but what they saw was death. Leaders like JFK, JFK's brother, Martin Luther King Jr., and college students at Kent State University were assassinated. In schools where the greatest danger was not having a date for the prom white students learned of black people being lynched for simply trying to vote. In those same schools they were taught to 'duck and cover' under their desks in case of a nuclear attack, knowing it would provide little protection.

This was the decade Rachel Carson published *Silent Spring*, where she convinced many Americans that the pesticides produced by corporations were injuring nature and possibly endangering human health. Then came Vietnam, where young men were asked to die for their country in a land they had never heard of and in a war they did not understand.

It is not surprising that some young people reacted to these contradictions by rejecting the status quo and refusing the social norms their parents. Their parents' way of life was rejected in total, from their views towards

other races, their views towards sexuality, their music, their politics—and their food. This was the generation that established the first all-vegetarian restaurants in the US and the first farmers markets. They started the movement for organic agriculture, they created the natural foods

**"A lot of wheat has at least ten applications of chemicals from start to finish. Starting with a spray they put on the seeds to make them sprout. They have hormone sprays to make their stalks strong. Hormone sprays to make them come into seed all at the same time. And then they have fumigants in the warehouse. So all of these chemicals are applied to wheat, and that's just the beginning before they start processing."**

**—Sally Fallon, founding president of the Weston A. Price Foundation. Quoted in *What's With Wheat* documentary, 2016. 24:20-25:10.**

movement, and they established the concept of the farm-to-table food system. As author and former hippie Yvonne Daley writes, "They were saying no thanks to deodorant, hair perms, makeup, and all things that smarted of chemical alteration, except of course the more mind-expanding chemicals that came in little blue tabs or were soaked into a blotter. But that was food for the mind. When it came to the rest of the body, they wanted raw, whole, and natural ..."

These were the first Americans to reject white bread in favor of whole wheat bread. Daley explains, "As children born into a time of growth and plenty, we were defined by food, not just the abundance of it but its convenience,

its symbolism of all things modern: TV dinners and canned vegetables, sugar-coated cereals, soft drinks and Kool-Aid, casseroles and box cake, white bread ... When we discovered real food, crunchy brown rice and *whole wheat bread* ... it was a revelation,” (italics added). When the counterculture was formed it differentiated itself from conventional culture by many other ways besides embracing whole wheat flour. It adopted a different view of other foods, a different politics, a different attitude towards sex and drugs, a different form of music. But whole wheat flour was part of it.

The counterculture movement may have been small in terms of the US population but it would soon have a large impact on American culture. Few hippies still live on communes, but some of their core values are alive in the average household. Like the hippies, most of Americans

reject racism, they are more relaxed about sex, and a casual stroll down the grocery store aisle shows a keen enthusiasm for foods considered ‘natural’.

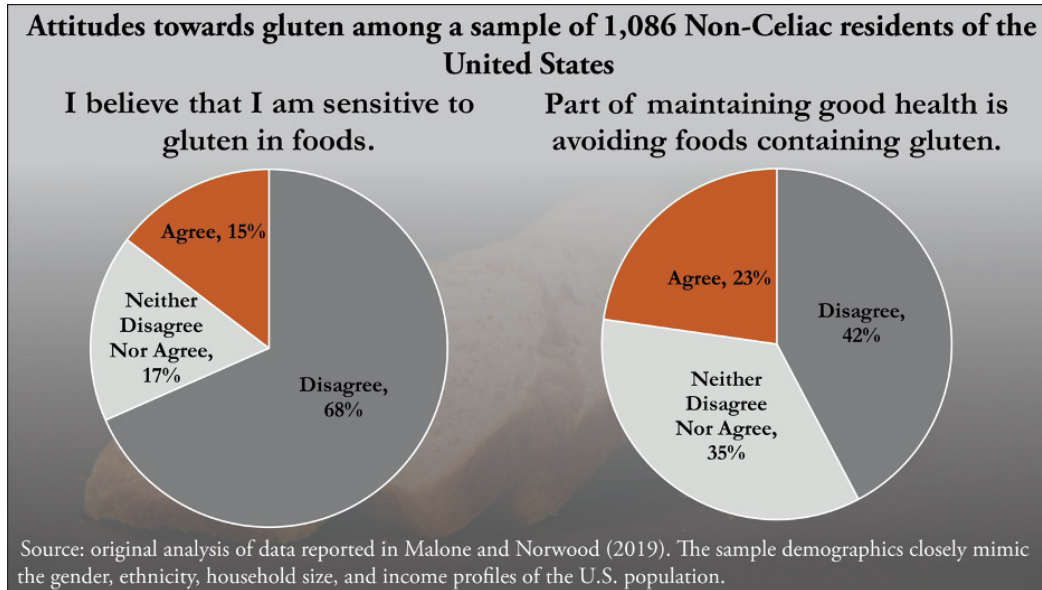
Consider the quote above from a recent documentary arguing that wheat has changed so much in the last century that it is no longer healthy to eat. Sally Fallon is arguing that wheat has undergone so much breeding to achieve higher yields that it no longer even resembles a natural plant. Instead it requires chemical after chemical just to survive. Unnatural, indeed: if it is true, which it mostly isn’t. However absurd the quote may sound to those who raise wheat, I investigated this claim and found there is some truth—but not a lot of truth—to it. There may be a few places where, in abnormal years, wheat really is treated this frequently with synthetic chemicals. In Oklahoma wheat will only be sprayed about 3 to six times, though—less than ten, but enough to scare people who believe these chemicals are dangerous.

This delicious grass seed that gave birth to civilization and served as one of the primary sources of nutrients for much of humanity is now seen by some as unnatural and

unhealthy. Isn’t this strange? Yes, but is it stranger than believing that a god is speaking through the sounds of a grain mill? This is how human culture works.

Humans are placed in a dangerous and confusing world and are asked to develop ways to cooperate with each other for survival. Decisions must be made, thousands of decisions a day, each of which must be made with incomplete information. They develop rules of living, rules that are followed when they seem to work and are replaced with other rules when they don’t. These ‘rules’ I’m referring to constitute a people’s culture. It describes how a people worship, and how they eat. Perhaps the most

insightful observer of human culture is William James, who remarked, “The gods we stand by are the gods we need and can use, the gods whose demands on us are reinforcements of our demands on ourselves and one another.”



Can we not say the same for the foods we stand by?

The hippies grew up, moved away from the commune, and returned to ‘normal’ society, bringing a fondness for whole wheat bread with them. They became professionally successful, and some of their values were spread throughout the middle and upper classes, such that their food choices are now the foods associated with the affluent classes of society. Think organic, natural, and local foods, all of which tend to be more expensive. This change not only elevated the status of whole wheat bread but debased that of white bread, such that white bread is now associated with the poorer and ‘trashy’ segments of society.

When the owner of the Los Angeles Clippers was reported to have made racist remarks against black people, Snoop Dogg responded by saying, “A message to the %@\$&! that owns the Clippers, you bitch-ass redneck *white bread* chickenshit %@\$&! you, your mama and everything connected to you, you racist piece of shit,” (italics added). Why is being a ‘white bread’ eater an insult? Because, according to our culture, that is what trashy



people eat. It isn't true, of course, but most all insults are wrapped in overlapping layers of truth and myth.

### *Gluten in the cross-hairs*

In the years after the counterculture movement America had won the battle against malnutrition but was losing the battle against obesity, Type II diabetes, and a number of other health problems. Unlike the malnutrition problem, experts had

no easy solution, and this helped to reinforce distrust in authority. Consider obesity: what is causing it? If we could identify the cause a solution would be easier to prescribe. This is a wicked problem though; so many things in the life of Americans have changed at

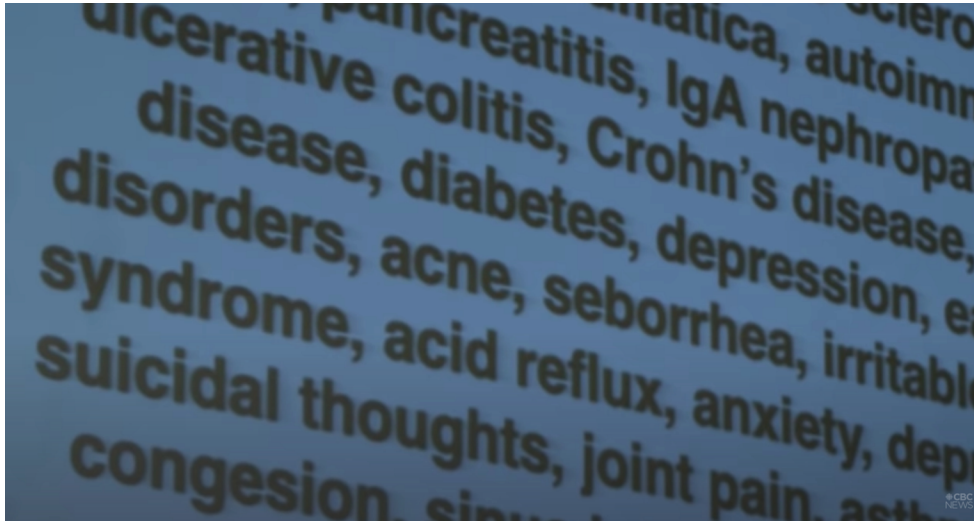
the same time obesity has trended upwards it is difficult to say which are the true causes. Science, experts, and industry: as of yet they have come up with hypotheses but none that are proven. There are plenty of 'experts' telling us how to stay slim, and plenty of corporations willing to sell us weight-loss products, but obesity rates have not fallen. For now, we are on our own.

In our search for healthier foods we first turned against carbs, and then turned against gluten. This is a strange turn of events, given that we need around half of our calories in carbs, and given our reliance on grains containing gluten for millennia. Both the low-carb diet and the non-gluten diet movements began with a blend of science and hype. In 1972 the book Dr. Atkins' New Diet Revolution argued that weight loss is best achieved and sustained by greatly reducing intake of carbs. The diet allowed

all the protein and fat one liked, under the assumption that the body would utilize the protein and fat it needed and would discard all the rest, but would not do the same for carbs. For sure, some studies did find people lost weight successfully (at least in the short term) on a low-

carb diet. Perhaps the reader knows some people who champion the low-carb diet (the author certainly does). Yet this weight loss is not always permanent, and too little carbs can lead to disastrous health consequences. After the Atkins diet came a number of other low-carb diets, like the South Beach diet which did not reduce carbs to the extent as the Atkins Diet.

The anti-gluten movement is particularly strange. The



Part of slide deck from a presentation by Wheat Belly author William Davis, claiming wheat to be a cause of various ailments from lupus to suicidal thoughts. Taken from *The War on Wheat - The Fifth Estate*, CBC News, 2015.

growing popularity of gluten-free foods is hard to explain solely on scientific findings. True, there was initially some evidence suggesting the existence of gluten-sensitivity among the non-Celiac disease population, where consuming gluten was suspected of causing irritable bowel

syndrome among some people. However, later evidence suggests gluten is not to blame and there is still no consensus on whether gluten-sensitivity is a medical condition. If it exists, it is a condition in which little is understood, and affects only a small portion of the population. Certainly, the medical profession does not consider foods containing gluten to be less healthy than their gluten-free counterparts.

The book *Wheat Belly* didn't help, where the author and cardiologist William Davis blames gluten for a range of health problems from obesity to schizophrenia. This

*"That's why the last thing any commander should need to worry about is the grades he is getting from some plush-bottomed Pentagon bureaucrat for political correctness or social experiments — or providing gluten-free MREs"*

—Republican Ted Cruz in a 2016 speech.

book has zero credibility in the medical profession, but in the age of social media conspiracy theories easily proliferate. Whereas there was once at least some reason to believe that gluten might cause a specific health problem, now there exists a belief that gluten is simply 'bad' in

manifold ways. Today about 15% people think they may be sensitive to gluten (see previous page), and one in five think health can be improved by keeping gluten off their plates. The ubiquity of 'gluten-free' food labels, even on foods that never contain gluten, can be seen in any gro-

cery store, attesting to industry reports that the market for gluten-free foods has risen and will continue to rise.

For a condition that is supposed to be medical in nature, gluten-sensitivity has a rather strange social aspect to it, at least from popular media. It is common for politicians, movies, and television to depict gluten-sensitivity as a food choice among Americans on the political-left, yet recent research suggests it is Trump supporters who are most likely to avoid gluten. Survey evidence even suggests that some people consider a gluten-free diet to be a successful weight-loss strategy, even though there is nothing about a gluten-free diet that suggests it would aid in weight loss.

What is going on here? It only takes a moment of reflection to acknowledge that much of our beliefs about health and food do not stem from carefully vetted research and advice from medical institutions, although they obviously play an important role. Conceptual models of food choices constructed from interviews document social factors as playing an important role, and empirical studies support this claim.

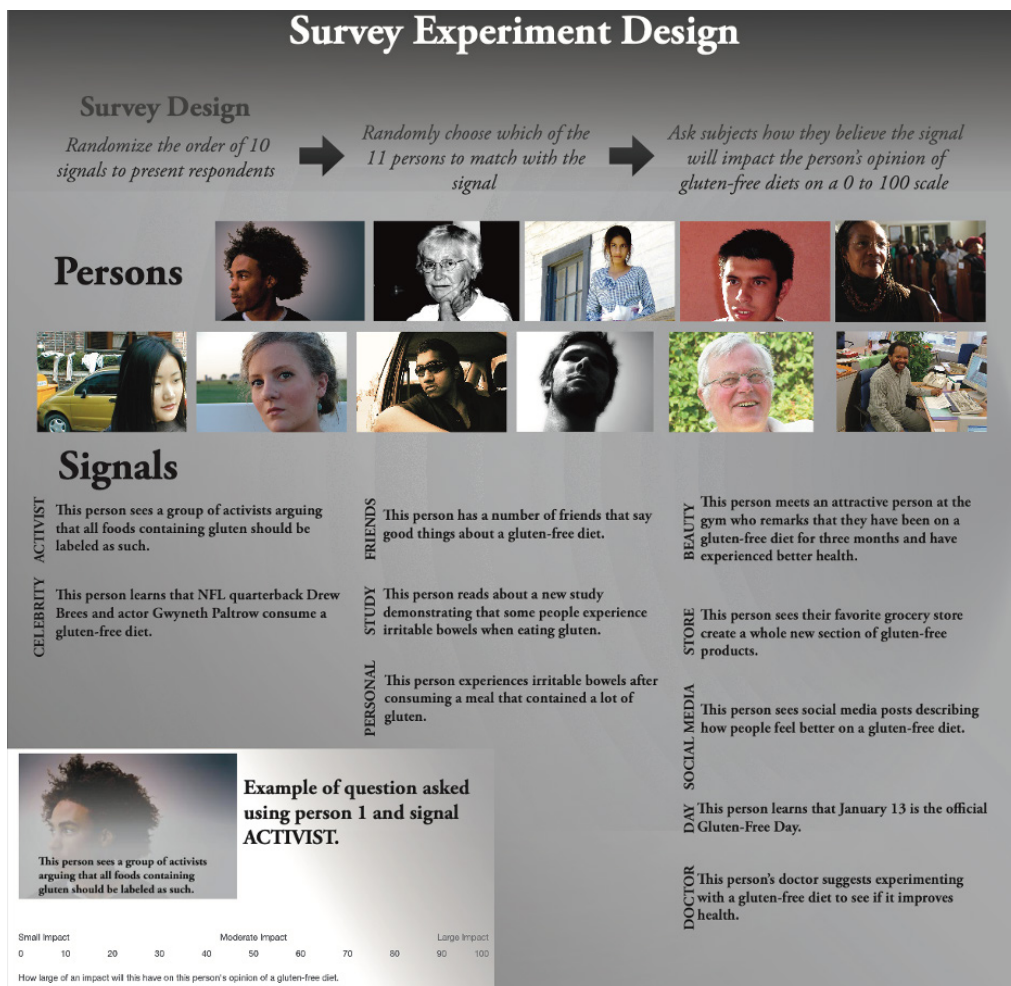
With some reflection it is perhaps obvious that people cannot base their diets solely on medical facts. The science of food and health is incomplete and cannot be customized to each person's environment and genetics. Nor can they rely exclusively on their own eating experiences, due to their inability and disinterest in conducting their own carefully controlled eating experiences. As studies of food choices show, persons must absorb information from their environment, and some of this information

will undoubtedly be social in nature.

If someone decides to experiment with a gluten-free diet, what gave them this idea? Was it the recommendation from a doctor? A news article? Praise of the diet from a friend? Social media? Seeing more and more gluten-free products at the grocery store?

To help identify what social factors most influence attitudes towards gluten I conducted a survey of over 1,000 Americans in 2019. In this survey I wanted to know the impact different information signals would have in terms of changing attitudes towards the gluten-free diet. The information signals I wished to study included things like social media posts praising

glutenfree diets, and learning that a specific celebrity is on a gluten-free diet. Because some people will be reluctant to admit they allow social media and celebrities influence their food choices, I couldn't ask them this directly. Instead, I asked them the extent to which they think a hypothetical 'other' person would be influenced by such a signal. The idea is that while people will not want to admit that social media influences their food choices, even if it does, they have no problem saying it influences the eating decisions of other people. As such, asking them what an "other" would do gives us more information about what the person themselves would do. People have a tendency to exhibit social desirability bias in surveys, whereby they misrepresent their true behaviors to create a more favorable impression. While people are prone to make themselves look good to others, they are less eager to make others look good, and so asking about an "other" person is a way of getting around this bias.





Who is this “other”, though? I was fearful the survey respondents would envision an affluent white female, as that is the type of person most commonly associated with gluten-free diets. To avoid this, I collected a group of photos depicting a wide variety of demographics and would randomly present one of these pictures as the “other” person.

These photos are shown to the left, as well as the ten information signals considered. Each person taking the survey was presented with ten questions, one for each signal, where each question randomly matched an information signal with one of the pictures. The questions asked how large of an impact the signal would have on the person’s opinion of a gluten free diet. The projected impact is then provided on a 0 to 100 scale where a larger value indicates a greater impact.

The figure shows an example of one of the demographic / information signal combinations, where a young African American is paired with the ‘activist’ signal, the narrative about the signal saying, “This person sees a group of activists arguing that all foods containing gluten should be labeled as such.” In the next question an elderly white woman may be paired with the ‘study’ signal that says, “This person reads about a new study demonstrating that some people experience irritable bowels when eating gluten.” The next question may then pair a middle-aged asian with the ‘friends’ signal, with the one after that pairing an older African American woman with the ‘social media’ signal.

Each survey respondent is ultimately asked about all ten signals, where the order in which the signals appear on the survey is randomized, as is the picture associated with that signal. This ensures the projected impact of any one signal is not dependent upon the order in which it appears on the survey (to prevent an ordering-bias) and is not dependent upon one type of demographic.

Note that the signals cover both social and non-social

signals. Opinions about gluten can be impacted by a news story, a personal eating experience, or doctor recommendation—three non-social signals considered objective in nature. Most are social signals though, including learning a celebrity lives gluten-free, activists wanting foods containing gluten to be labeled as such, friends saying good things about the diet, an attractive person saying good things about it, a social media post, learning there is such thing as Gluten-Free Day, and noticing a grocery store

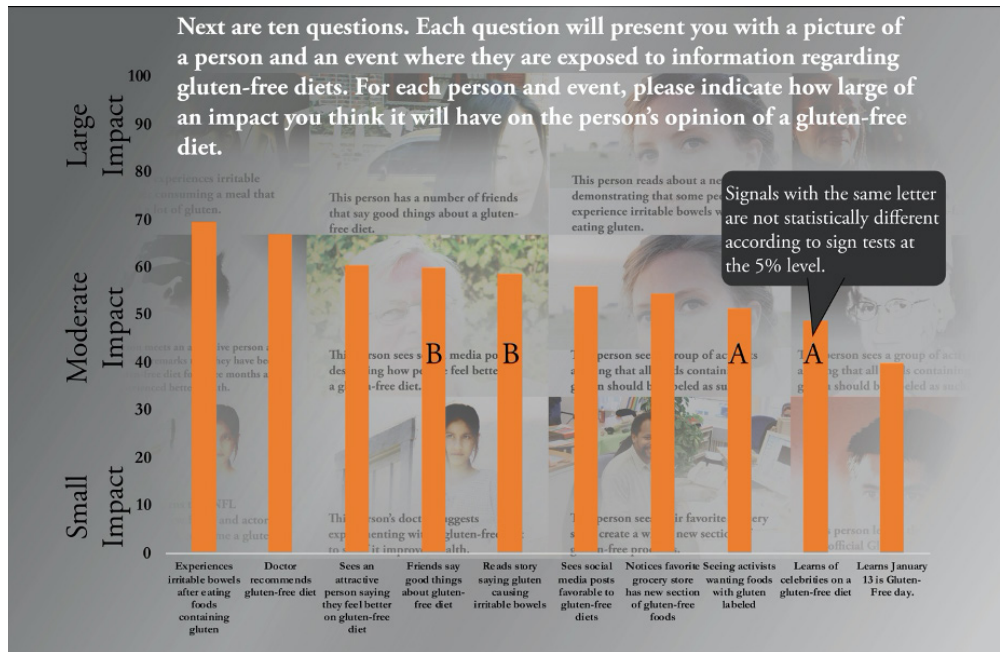
has a special section devoted solely to gluten-free foods.

### Survey results

The survey was administered to 1,327 US respondents. The impact of each signal is measured in two ways. One is to calculate the average impact for each signal across all respon-

dents. While this provides an easily interpretable measure, it has one problem. Although the scale shown on the previous page has words helping the subject to interpret it (e.g., a score of 50 is associated with moderate impact), it is still difficult to compare a score from one person to the score of another. It is not clear if what one person considers a ‘large’ impact is similar to what another person considers a ‘large’ impact.

As such, nonparametric sign tests are used to determine if one signal is consistently assigned a larger impact than another signal across individuals. The sign test works by calculating the percent of times one signal receives a higher score than another signal for each person. If this percentage is ‘statistically’ greater than 50% across all respondents then we can say the signal can be said to have a larger projected impact. For example, suppose signal A has a larger impact score than signal B for 52% of respondents. While this is larger than 50%, the larger response could have been the result of the random fluctuation of survey responses (in the same way one may repeatedly flip a coin finding ‘heads’ 52% of the time) so in this case the signals are said to not be statistically different. However, if signal A has a larger score than signal B for



63% of respondents, a statistical formula shows that this is not the result of random fluctuations, and thus signal A is said to have a statistically greater impact on opinions of gluten-free diets than signal B.

The results are shown in the graph to the left. Not surprisingly, experiencing an irritable bowel after consuming gluten and a doctor recommending a gluten-free diet has the largest projected impact. Not far behind is the impact of seeing an attractive person say they feel better on a gluten-free diet. Friends praising the diet or reading a news story has a similar impact. Social media posts and seeing a grocery store develop an exclusive gluten-free section is thought to have a moderate impact. Activists, celebrities, and learning there is such thing as a Gluten-Free Day have the smallest impact, though it is still rated on average as a moderate impact.

What this tells us that people absorb eating advice from wide variety of signals. In fact, it seems almost every signal matters in some regard. Particularly interesting is that the opinion of an attractive person matters almost as much as a doctor! It is doubtful they would have said this if we asked about type I diabetes instead of gluten, but note these responses are not necessarily irrational.

If a person is attractive it is reasonable to attribute some of this to them taking good care of themselves. If they are slim with a good complexion, surely they are eating healthy, right? It makes sense to take advice from friends as well. After all, we tend to choose friends who are like us, and if a certain diet works well for them it might work for us. We make jokes about all the false information on social media, but it is also true that all major news media are also on social media.

Consider the grocery store signal, where people say a grocery store designating a new gluten-free section will have an impact on people's opinion of gluten-free diets. At first this

may seem like people are just innocent victims of a marketing campaign—think again. If a grocery store devotes an entire section to gluten-free foods there is probably a high demand for such foods, and if the demand is there, perhaps people are buying gluten-free foods because it makes them feel better. The same can be said for January

13 being the official Gluten-Free day. On the one hand why would the designation of a day impact our beliefs? On the other hand, the fact that day exists suggests some people are believers in its healthiness, and why would they believe unless it really makes them healthier?

*"A Pragmatic Theory of Truth holds (roughly) that a proposition is true if it is useful to believe ... Beliefs that lead to the best 'payoff', that are the best justification of our actions, that promote success, are truths, according to the pragmatists."*

—Internet Encyclopedia of Philosophy

*They say 'Gluten is bad for you': Is it true?*

I hate to split hairs, but it depends on your definition of 'true'. In philosophy there are a number of definitions for 'truth', two of which are considered here. There is the correspondence theory of

truth that [roughly] says a statement is true if it 'corresponds' with objective facts. Scientific studies have not concluded that gluten is bad for health in general (as long as you don't have Celiac disease) so we can't say it is true that gluten is bad for you using this definition. Even if you find a single scientific study concluding gluten is unhealthy for non-Celiac people, you must weigh this one study against other studies that conclude the opposite.

Of course, you might say that it is objectively true that every time you eat gluten you feel bad, in which case the correspondence theory might confirm the statement as true. You just have to make sure you have performed enough eating experiments in the right way to conclude that it is indeed gluten, and not some other factor, causing irritable bowels.

The statement 'gluten is bad for you' may be true according to the pragmatic theory of truth, though. This theory states that a proposition is deemed to be 'true' so long as it is useful, regardless of whether there are objective facts associated with it. Certainly, many non-Celiac people have deemed gluten unhealthy without any real

objective evidence that it is. A closer look at why they may do this helps us better understand food choices and gives us a deeper perspective of human nature.

Suppose a person used to eat a diet high in simple

carbs and low in fiber. When they embark on a gluten-free diet they will find that the types of foods available to them are quite different. Unable to consume conventional grains like wheat, they must eat bread made from grains like amaranth, buckwheat, millet, quinoa, and teff. Flour from these grains tend to be made from the whole seed,



akin to whole wheat flour, and will thus be more healthy than white flour. As the person is now eating healthier, they feel better, and though they could have achieved the same improvement by consuming whole wheat bread instead of white bread, they are unaware of this fact.

What they realize is that they feel better when they switched to a gluten-free diet. Though it is true their health improved, they mistakenly conclude it is because they eliminated gluten. But that's okay, what is important is that they feel better, and so the statement 'gluten is bad for you' is useful and is thus spoken by them as a truth statement.

Consider a slightly different story. As before, the person is eating a generally unhealthy diet and adopts the gluten-free lifestyle as part of a self-improvement routine. Eliminating all gluten requires paying special attention to what you eat, and as they are more careful about what they put into their body they also make generally healthier food choices. In addition to getting rid of gluten they eat fast food less, consume more vegetables and less deep fried foods, eat more meat and less sugar, and as a result become healthier. Part of their self-improvement strategy might also involve more exercise. This enhanced lifestyle improves their life considerably, and though gluten could have easily been a part of this healthier diet, it wasn't, and once again the person's belief that gluten is bad for you did indeed lead to an improvement in health. From this person's perspective, they are convinced that gluten is an unhealthy food.

Notice we have periodically used the term 'gluten-free lifestyle', which is an odd way of describing a food preference, but the term conveys something important. Beliefs about gluten are often formed concomitant with a set of other beliefs that help define our identity. Humans are a social animal, and part of being a member in a social

clique involves wearing similar clothes, listening to the same music, enjoying similar foods, and espousing like beliefs. In some cliques going gluten-free allows one to share foods and beliefs at the same time, for some groups reject gluten as a product of industrial crop breeding that disturbs human health. Regardless of whether it is 'true', believing it to be so helps reinforce social ties in the same way that joining a Jewish synagogue, an Islamic mosque, or a Christian church does. Just as one's religion is determined mostly by the geography in which one is raised and one's community of friends and family, views on gluten can be formed more by social networks than gluten's actual impact on health. Here, the usefulness of the belief that 'gluten is bad' does not stem from the food itself, or even physiolog-

ical health outcomes, but a happier life from having a more meaningful network of friends.

### *Bread: a slice of civilization*

A versatile character in the play of life, bread was a main character in the opening act of civilization and every act thereafter. For some acts it was on stage, but in the background, being a perennial presence at the dinner table but rarely the source of drama. Other times it is a main character. In ancient Rome it became a symbol of war, sharing the stage with spilt human blood, and as ancient times evolved into antiquity it became the blood of a god whose desire was to save, not slay, persons. As this new god made converts through sermons and the sword, it traveled from the Mediterranean up into northern Europe, and eventually the whole world.

Like any good play character, it evolved with the story, changing in form and in relation to other characters. In its whiter, less nutritious form it first belonged to the upper classes, then in other acts, the lower classes. In its

*Tennis champion Novak Djokovic once collapsed from exhaustion during a game. A "new age nutritionist" watched him do so on television and suggested it was a buildup of toxins in his body. He gave Djokovic a slice of wheat bread to hold and it seemed to make him physically weaker. The nutritionist suggested this was because of the gluten in the bread.*

*(Djokovic only held the bread, mind you.)*

*So Djokovic gave up gluten, immediately felt better, and went on to play the best tennis of his life.*

*Today Djokovic even believes that polluted water can be purified by writing positive messages on the water bottle.*

*Yes, all this is crazy, but the belief has helped him become one of the greatest tennis players of all time. What would you believe if it gave you such a power?*

darker, more nutritious whole-wheat form it was first the bread of peasants, then hippies, then the affluent.

Most compelling stories have a conflict where a character suffers injustice. Bread's current reputation as unnatural and unhealthy is undeserved and unsupported by science. However, the thing about human culture is that it doesn't need scientific support for justification. One day bread containing gluten may be redeemed and adored by all as a nutritious and delicious food able to assume myriad forms from the shell of a Beef Wellington to the core of a wedding cake and the crust of a pizza.

That act resides in the future, though. No matter, bread is playing a long game. As long as the human race exists wheat bread will continue to provide its physiological needs of energy and nutrition as well as its psychological needs in terms of human culture.

## References

Anding, Robert A. 2013. "Lecture 6: Not all carbohydrates are created equal." Nutrition Made Clear. The Great Courses.

Arzani, Ahmad. 2019. "Chapter 7—Emmer (*Triticum turgidum* ssp. *dicoccum*) Flour and Bread." Flour and Breads and their Fortification in Health and Disease Prevention (Second Edition). Editors: Victor R. Preedy and Ronald Ross Watson. Academic Press: NY, NY.

Berger, Kevin. 2022. "Novak Djokovic and the Healing Water Crystals." Nautilus. Issue 42: 58-69.

Biesiekierski, JR and JI Iven. 2015. "Non-coeliac gluten sensitivity: piecing the puzzle together" United European Gastroenterology Journal. 3(2):160-165.

Carroll, Abigail. 2013. Three Squares: The Invention of the American Meal. Basic Books.

Diamond, Jared. 1997. Guns, Germs, and Steel. Norton: NY, NY.

Drohan, Christopher M. and F. Bailey Norwood. 2020. "From Tunnel-Vision to Panoramic Fog—An Essay on How Philosophy Can Help us Better Understand Consumers' Pursuit of Ethical Food." Applied Economic Perspectives and Policy.

Dupont, Florence. 1996. "Chapter 10: The Grammar of Roman Dining." Food. Editors: Jean-Louis Flandrin and

Massimo Montanari. Columbia University Press: NY, NY.

Durant, Will. 1939. The Life of Greece. The Story of Civilization: Part II. Simon and Schuster: NY, NY.

Durant, Will. 1944. Caesar and Christ. The Story of Civilization: Part III. Simon and Schuster: NY, NY.

Ehrman, Bart D. 2020. Heaven and Hell: A History of the Afterlife. Simon and Schuster: NY, NY.

Ehrman, Bart D. January 16, 2021. "Still Other Humans Who Became Gods: In Jesus! Time!" The Bart Ehrman Blog.

Everitt, Anthony. 2013. The Rise of Rome. Random House: NY, NY.

Fasano, Alessio, Anna Sapone, Victor Zevallos, and Detlef Schuppan. 2015. "Nonceliac Gluten Sensitivity." Gastroenterology. 148(6):1195-1204.

Feldman, Moshe and Mordechai E. Kislev. 2007. "Domestication of emmer wheat and evolution of free-threshing tetraploid wheat." Israel Journal of Plant Sciences. 55(3-4):207-221.

Fuller, Dorian Q. 2007. "Contrasting Patterns in Crop Domestication and Domestication Rates: Recent Archaeobotanical Insights from the Old World." Annals of Botany. 100(5):903-924.

Geisslitz, Sabrina, Herbert Wieser, Katharina Anne Scherf, and Peter Koehler. 2018. "Gluten protein composition and aggregation properties as predictors for bread volume of common wheat, spelt, durum wheat, emmer and einkorn." Journal of Cereal Science. 83:204-212.

Geisslitz, Sabrina, C. Friedrich H. Longin, Katharina A. Scherf, and Peter Koehler. 2019. Comparative Study on Gluten Protein Composition of Ancient (Einkorn, Emmer and Spelt) and Modern Wheat Species (Durum and Common Wheat). 8(9):409; <https://doi.org/10.3390/foods8090409>.

Gustafson, Perry, Olga Raskina, XueFeng Ma, and Evia-tar Nevo. "Chapter 1: Wheat Evolution, Domestication, and Improvement." Wheat Science and Trade. Editor: Brett F. Carver. Wiley-Blackwell: NY, NY.



- Hadjivassiliou, Marios, David S Sanders, Richard A Grunewald, Nicola Woodroffe, Sabrina Boscolo, and Daniel Aeschlimann. 2010. "Gluten sensitivity: from gut to brain." *Personal view. The Lancet Neurology*. 9(3):318-330.
- Jacob, H. E. 1944. *Six Thousand Years of Bread*. Seventieth Anniversary Edition, 2014. Skyhorse Publishing: NY, NY.
- James, William. 1902. *The Varieties of Religious Experience*.
- Jasny, Naum. 1950. "The Daily Bread of the Ancient Greeks and Romans." *Osiris*. 9:227-253.
- Kaplan, David M. 2020. *Food Philosophy*. Columbia University Press: NY, NY.
- Kucek, L. K., L. D. Veenstra, P. Amnuaycheewa, and M. E. Sorrells. 2015. "A Grounded Guide to Gluten: How Modern Genotypes and Processing Impact Wheat Sensitivity." *Comprehensive Reviews In Food Science And Food Safety*. 14: 285-302.
- Kumar, P. R. K. Yadava. B. Gollen. S. Kumar. R. K. Verma, and S. Yadav. 2011. "Nutritional Contents and Medicinal Properties of Wheat: A Review." *Life Sciences and Medicine Research*. LSMR-22.
- McCorriston, Joy. 2000. II.A.10: Wheat. *The Cambridge World History of Food*. Editors: Kenneth F. Kiple and Kriemhild Conee Ornelas. Executive editor: Stephen V. Beck.
- Malone, Trey and F. Bailey Norwood. 2019. "Gluten aversion is not limited to the political left." *Agriculture and Human Values*. DOI: 10.1007/s10460-019-09958-7
- Murphy, Kevin M., Philip G. Reeves, and Stephen S. Jones. 2008. "Relationship between yield and mineral nutrient concentrations in historical and modern spring wheat cultivars." *Euphytica*. 163:381-390.
- Nevo, E., A. B. Korol, A. Belles, and T. Fahima. 2002. *Evolution of Wild Emmer and Wheat Developments*. Springer: NY, NY.
- Nevo, Eviatar. 2014. "Evolution of wild emmer wheat and crop improvement." *Journal of Systematics and Evolution*. 52(6).
- (USDHHS) United States Department of Health and Human Services and the United States Department of Agriculture. 2015. *Dietary Guidelines for Americans 2015-2020*. Eight Edition.
- (PFHN) Plant Foods Hum Nutr. The wheat grain. 55, 15-20 (2000). <https://doi.org/10.1023/A:1017237631105>
- Sokolowski, Robert. 2000. *Introduction to Phenomenology*. Cambridge University Press: UK.
- Stallknecht, G. F., K. M. Gilbertson, and J. E. Ranney. 1996. *Alternative Wheat Cereals as Food Grains: Einkorn, Emmer, Spelt, Kamut, and Triticale*. In: J. Janick (ed.), *Progress in new crops*. ASHS Press, Alexandria, VA.
- Standage, Tom. 2009. *An Edible History of Humanity*. Walker Company: NY, NY.
- (USDA) United States Department of Agriculture. 2015. *2015-2020 Dietary Guidelines for Americans*. 8th Edition.
- (WGC) Whole Grains Council. 2020. What is a whole grain? A Refined grain? Accessed June 3, 2020 at <https://wholegrainscouncil.org/sites/default/files/atoms/files/WGC-WhatIsWholeGrain.pdf>.
- Wieser, Herbert. 2000. "Comparative investigations of gluten proteins from different wheat species I. Qualitative and quantitative composition of gluten protein types." *European Food Research and Technology*. 211:262-268.