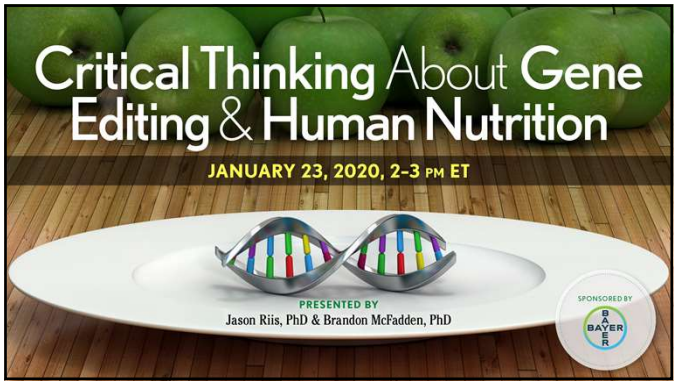


Learning Objectives

1. **Identify** gene editing **questions and controversies** that nutrition communicators may need to address
2. Discuss the **key aspects of critical thinking failure** that are likely to emerge in discussions of gene editing and human nutrition
3. **Discuss specific** communication tactics to **improve the public's understanding** of the challenges and opportunities of gene editing in agriculture

Introduction

Global Challenges Need Solutions

- Global disease
- Climate change
- Global conflict
- Global food supply

4

Agricultural Technology May Be Part of the Solution

- **Gene editing:** bioengineering method used to make changes to genetic code by inserting, replacing, or removing DNA with hopes of introducing beneficial traits
- **GMO:** bioengineering method used to introduce new DNA with hopes of passing beneficial traits between organisms

5

There Are Technology Optimists…

"The pace of progress in biology creates a foundation that naturally gets picked up by the biotech and pharmaceutical industry to solve the rich-world diseases. This is attractive science. It's science that people want to work on."
Bill Gates

"I think the biggest innovations of the 21st century will be at the intersection of biology and technology. A new era is beginning."
Steve Jobs

6

…and Technology Pessimists

Everyone is thinking. Everyone is eating.

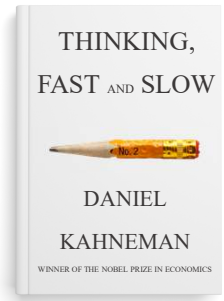
Can we help them do both, better?

How Do People Think?

How Do We Think About Technology Risk?

Thinking Fast:

"In the picture that emerges from recent research, the intuitive System 1 is more influential than your experience tells you, and it is the secret author of many of the choices and judgements you make." *Daniel Kahneman*



Daniel Kahneman, Thinking, Fast and Slow. Page 13.

10

How Do We Think About Technology Risk?

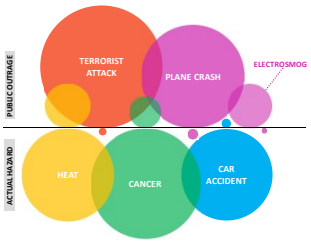
Affect Heuristic:

Perceptions of risk are driven by feelings, not by objective considerations.

How Do We Think About Technology Risk?

Affect Heuristic:

Perceptions of risk are driven by feelings, not by observations.



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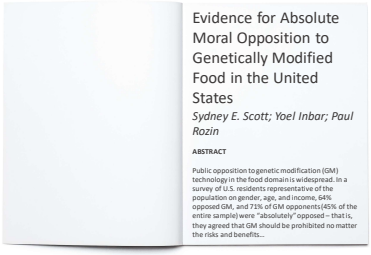
How Do We Think About Technology Risk?

Absolutism:

Most opponents agree with the following:

This should be prohibited no matter how great the benefits and minor the risks from allowing it.


Evidence for Absolute Moral Opposition to Genetically Modified Food in the United States

Sydney E. Scott; Yoel Inbar; Paul Rozin

ABSTRACT

Public opposition to genetic modification (GM) technology in the food domain is widespread. In a survey of U.S. residents representative of the population on gender, age, and income, 64% opposed GM, and 71% of GM opponents (45% of the entire sample) were "absolutely" opposed – that is, they agreed that GM should be prohibited no matter the risks and benefits...

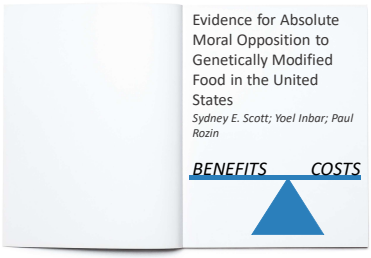
Perspectives on Psychological Science 2016, Vol. 11(3) 315–324. 2016

13

How Do We Think About Technology Risk?

Absolutism and Disgust:

Disgust-based opposition does not weigh benefits and costs. Disgust trumps all.



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How *Should* We Think About Technology Risk?

"We can recognize that it's sad if a little girl dies from a reaction to a vaccine, but if removing the vaccine from the market will cause 100 kids to die, then we have to keep the vaccine. **I think emotions play a necessary role in motivating us to do certain things, but decisions should be made through rational means."**

"4 Questions for Paul Bloom." (2019, December 16). https://www.apa.org/monitor/2017/05/conversation-bloom

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How Can We Help People Think About Technology Risk?

Better reasoning in two steps:

Deactivate Disgust

Emotions can be deal breakers. They end the dialogue. Let's temper them so we can keep talking.

Clarify the Trade-offs

Trade-offs are necessary. Let's understand them so we can choose wisely. Because we must choose.

16

What is the Most Important Cause of Critical Thinking Failure?

✔	The media (including social media and celebrities) get in the way of people's ability to think critically.	59%
✔	Education systems do not adequately teach critical thinking.	26%
	The public has only minimal background knowledge of nutrition and nutrition science.	12%
✔	Human nature has limitations in critical thinking ability.	3%

Thinking Critically About Nutrition. Jason Riis, PhD; Brandon R. McFadden, PhD.; and Karen Collins, MS, RDN, CDN, FAND. *Today's Dietitian*. August, 2019. Vol. 21, No. 8, pg. 36.

17

What is the Most Important Way to Prevent Critical Thinking Failure?

✔	Show people better information.	67%
✔	Show people better reasoning.	21%
✔	Show people better self-reflection.	12%

Thinking Critically About Nutrition. Jason Riis, PhD; Brandon R. McFadden, PhD.; and Karen Collins, MS, RDN, CDN, FAND. *Today's Dietitian*. August, 2019. Vol. 21, No. 8, pg. 36.

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Tactics for Helping Non-critical Thinkers

Better Information		Better Reasoning		Better Self-reflection
Help people prioritize accuracy of information so that they get the full picture.	+	Deactivate disgust to activate a trade-off mindset.	+	Normalize uncertainty so that they can recognize their own knowledge gaps.

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Activist Tactics as Anti-critical Thinking

What the Anti-Activists Do

NEW REPORT: Gene Editing in Agriculture Poses New Risks to Health, Environment

September 12, 2018

New report documents growing body of science demonstrating need for safety assessment, oversight

Washington, DC — On the heels on the European Court of Justice's ruling requiring organisms developed using new genetic engineering techniques to undergo GMO risk assessments, and several new studies revealing "genetic havoc" as a result of gene editing, **Friends of the Earth** and **Logos Environmental** released a new report today…

Activate Disgust

Muddy the Trade-offs

Friends of the Earth. (2019, December 17). Retrieved from https://foe.org/news/new-report-gene-editing-agriculture-poses-new-risks-health-environment

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What the Anti-Activists Do

Example of activating disgust:

- Several new studies revealing "**genetic havoc**" as a result of gene editing

Activate Disgust

Friends of the Earth. (2019, December 17). Retrieved from https://foe.org/news/new-report-gene-editing-agriculture-poses-new-risks-health-environment

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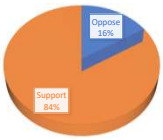
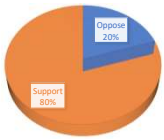
Signaling of the GMO name

Do you support or oppose mandatory labeling for food containing GM ingredients?



Do you support or oppose a labeling for food containing DNA?



McFadden, B.R. and Lusk, J.L., 2016. What consumers don't know about genetically modified food, and how that affects beliefs. The FASEB Journal, 30(9), pp.3091-3096.

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What the Anti-Activists Do

Examples of activating disgust:

- Several new studies revealing "**genetic havoc**" as a result of gene editing
- If **gene-edited GMOs** are to be used in U.S. agriculture, they need to be carefully scrutinized for any unexpected effects

Activate Disgust

Friends of the Earth. (2019, December 17). Retrieved from https://foe.org/news/new-report-gene-editing-agriculture-poses-new-risks-health-environment

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How Can We Help People Think About Technology Risk?

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Deactivate Disgust

Offering a Competing Moral Concern

Deactivate Disgust: Case #1

Offering a Competing Moral Concern

Example (see citation):

A non-profit has made "Golden Rice," which is high in Vitamin A. It could prevent thousands of cases of blindness (which is a moral concern).

Inbar et al. "In the United Stated and Europe, GE food opposition is Moral and Respond Specifically to Moral Countering"

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Offering a Competing Moral Concern

The Idea:

If a person's objection to gene editing really is a *moral* objection, then perha the objection can be reduced by highlighting other, competing, moral concerns.

(i.e., moral concerns that favor gene editing)

Inbar et al. "In the United Stated and Europe, GE food opposition is Moral and Respond Specifically to Moral Countering"

29

Offering a Competing Moral Concern

Study Result:

After being exposed to a competing moral concern, 32% of moral absolutists changed their minds.

Inbar et al. "In the United Stated and Europe, GE food opposition is Moral and Respond Specifically to Moral Countering"

30

Offering a Competing Moral Concern

Which "competing moral concerns" could favor gene editing?

- Sustainability / your family's future world
- Global progress / American progress



Inbar et al. "In the United Stated and Europe, GE food opposition is Moral and Respond Specifically to Moral Countering"

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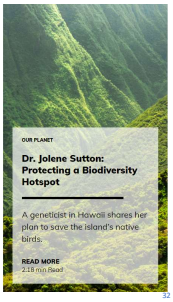
Offering a Competing Moral Concern

What is industry practice now?



Innovature. (2019, December 16). Retrieved from https://innovature.com

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Emphasizing the Naturalness of Gene Editing

Deactivate Disgust: Case #2

Emphasizing the Naturalness of Gene Editing

Example (see citation):

Teosinte, the original plant that eventually became our corn, was bred by the ancient Mexicans to make it larger, have larger kernels, and to keep the kernels on the stalk. [This] was accomplished by an introduction of about 6 genes via selective breeding.

Teosinte

Corn

Inbar et al. "In the United Stated and Europe, GE food opposition is Moral and Respond Specifically to Moral Countering"

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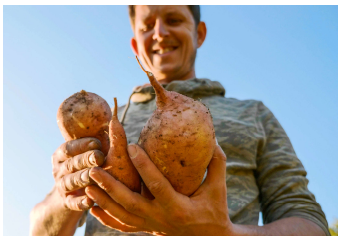
Emphasizing the Naturalness of Gene Editing

The Idea:

Many feel disgusted by gene editing because they feel it is unnatural. Perhaps we can show them that it is in fact just as natural as some other processes.



Natural GMO? Sweet Potato Genetically Modified 8,000 Years Ago

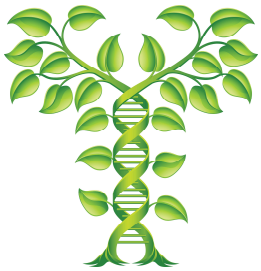
Inbar et al. "In the United Stated and Europe, GE food opposition is Moral and Respond Specifically to Moral Countering"

35

Emphasizing the Naturalness of Gene Editing

Study result:

After reading an essay explaining natural gene editing, opposition decreased by 15% among moral absolutists.



Inbar et al. "In the United Stated and Europe, GE food opposition is Moral and Respond Specifically to Moral Countering"

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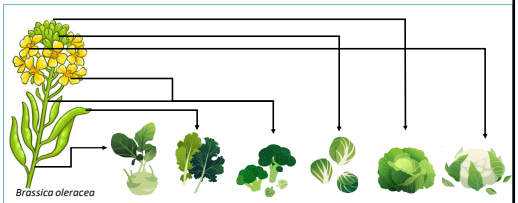
Emphasizing the Naturalness of Gene Editing

Which "naturalness" emphasis could favor gene editing:

- What pre-ag corn looked like
- How new is broccoli
- Nature is havoc



Brassica oleracea

Strain	Kohlrabi	Kale	Broccoli	Brussels sprouts	Cabbage	Cauliflower
Modified Trait	Stem	Leaves	Flower buds and stem	Lateral leaf buds	Terminal leaf bud	Flower buds

Inbar et al. "In the United Stated and Europe, GE food opposition is Moral and Respond Specifically to Moral Countering"

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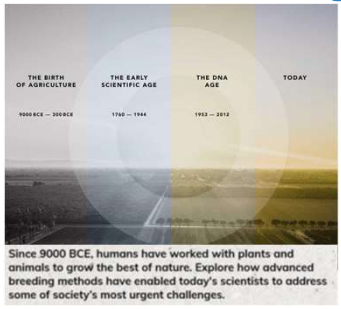
Emphasizing the Naturalness of Gene Editing

What is industry practice now?

Frame the naturalness of human involvement



Innovature. (2019, December 16). Retrieved from https://innovature.com

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Tell a Good Conversion Story

Deactivate Disgust: Case #3

Tell a Good Conversion Story

Example (see citation):

Participants either watched a video of Mark Lynas explaining:

- His current views on GMOs
- His past and current views on GMOs
- His past and current views, along with an explanation of his reasoning process

Lyons, B. A., Hasell, A., Tallapragada, M., & Jamieson, K. H. (2019). Conversion messages and attitude change: Strong arguments, not costly signals. Public Underst. Sci., 28(3), 320–338. doi: 10.1177/0963662518821017

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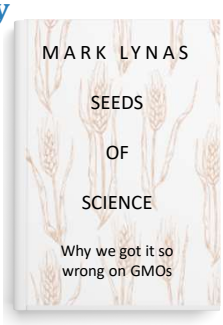
Tell a Good Conversion Story

The Idea:

Hearing how someone else like you (with similar identity or similar values) has changed their mind can deactivate initial negative reactions to their message.



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Tell a Good Conversion Story

Study result:
After watching the video, respondents were asked questions like:

I would support a ban on growing genetically modified crops.

Conversion messages were more effective than advocacy whether equivalent in length, or longer.

Conversion messages and attitude change: Strong arguments, not costly signals

Benjamin A. Lyons; Ariel Hasell; Meghnaa Tallapragada; Kathleen Hall Jamieson

ABSTRACT
A conversion narrative recounts the process that led the speaker to reject one belief for a different, usually incompatible, alternative. However, researchers know little about whether, when, and, if so, how such messages affect audience attitudes about controversial science. Using a general US population-sample…

Lyons, B. A., Hasell, A., Tallapragada, M., & Jamieson, K. H. (2019). Conversion messages and attitude change: Strong arguments, not costly signals. Public Underst. Sci., 28(3), 320–338. doi: 10.1177/0963662518821017

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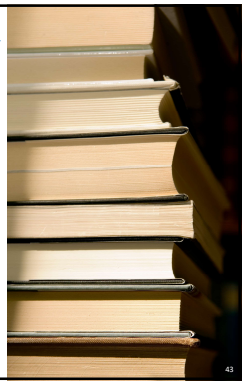
Tell a Good Conversion Story

Which "conversion story" can you tell?

- Our company didn't used to talk about X …
- I didn't used to believe that Y was good for me …



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Tell a Good Conversion Story

What is industry practice now?

- Engage public figures
- Who else could be engaged in public discussion (or small group discussion)?

Genetic Literacy Project – Science Not Ideology
Podcast: 'OMG, GMOs!' Bill Nye answers your questions about biotech crops
Bill Nye, Rob Fraley | Science Rules | November 25, 2019

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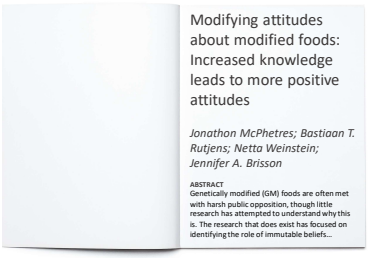
Create Exposure to Increase Familiarity

Deactivate Disgust: Case #4

Create Exposure to Increase Familiarity

Example (see citation):

Researchers offered a 5-week course explaining the basic science behind GM technology



Modifying attitudes about modified foods: Increased knowledge leads to more positive attitudes

Jonathon McPhetres; Bastiaan T. Rutjens; Netta Weinstein; Jennifer A. Brisson

ABSTRACT
Genetically modified (GM) foods are often met with harsh public opposition, though little research has attempted to understand why this is. The research that does exist has focused on identifying the role of immutable beliefs...

McPhetres, J., Rutjens, B. T., Weinstein, N., & Brisson, J. A. (2019). Modifying attitudes about modified foods: Increased knowledge leads to more positive attitudes. Journal of Environmental Psychology, 64, 21–29. doi: 10.1016/j.jenvp.2019.04.012

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Create Exposure to Increase Familiarity

The Idea:

Learning some details of the scientific process, in a hands-on way, may increase familiarity, and reduce negative feelings.

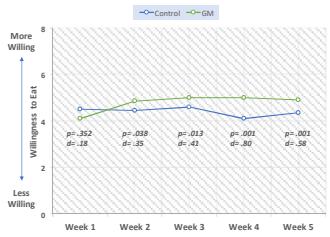
McPhetres, J., Rutjens, B. T., Weinstein, N., & Brisson, J. A. (2019). Modifying attitudes about modified foods: Increased knowledge leads to more positive attitudes. Journal of Environmental Psychology, 64, 21–29. doi: 10.1016/j.jenvp.2019.04.012

47

Create Exposure to Increase Familiarity

Study result:

Learning about the science behind GM technology led to more positive explicit attitudes towards GM foods, greater willingness to eat GM products, and lowered perceptions of GM food as risky



McPhetres, J., Rutjens, B. T., Weinstein, N., & Brisson, J. A. (2019). Modifying attitudes about modified foods: Increased knowledge leads to more positive attitudes. Journal of Environmental Psychology, 64, 21–29. doi: 10.1016/j.jenvp.2019.04.012

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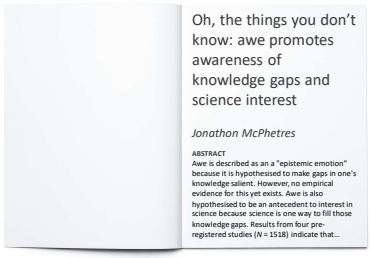
Create Exposure to Increase Familiarity

Which "science details" can you tell:

- While you may not be able to offer a 5-week course, you might be able to initiate self-education



Oh, the things you don't know: awe promotes awareness of knowledge gaps and science interest

Jonathon McPhetres

ABSTRACT

Awe is described as an a "epistemic emotion" because it is hypothesised to make gaps in one's knowledge salient. However, no empirical evidence for this yet exists. Awe is also hypothesised to be an antecedent to interest in science because science is one way to fill those knowledge gaps. Results from four pre-registered studies (*N* = 1518) indicate that...

McPhetres, J. (2019). Oh, the things you don't know: awe promotes awareness of knowledge gaps and science interest. Cognition and Emotion, 33(8), 1599–1615. doi: 10.1080/02699931.2019.1585331

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Create Exposure to Increase Familiarity

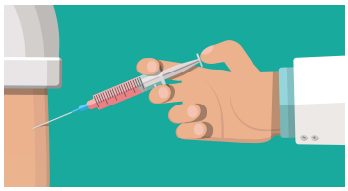
What is industry practice now?

- Science outcomes and end technology
- …less about process, behind the scenes

Create Exposure to Increase Familiarity

What is industry practice now?

How can we give "emotional respect"



Pediatrician: How I partnered with parents who didn't want to vaccinate

by Dr. Edith Brancho-Sanchez, CNN | February 9, 2019

Dr. Edith Bracho-Sanchez, C. (2019, December 16). Pediatrician: How I partnered with parents who didn't want to vaccinate. CNN. Retrieved from https://www.cnn.com/2019/02/09/health/parents-who-refuse-vaccines/index.html , https://www.thinkingandeating.com/post/helping-people-make-tradeoffs-through-emotional-respect

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How Can We Help People Think About Technology Risk?

Better reasoning in two steps:

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What is a Trade-off?

Trade-off:

Do the benefits outweigh the costs?

Merriam Webster Dictionary

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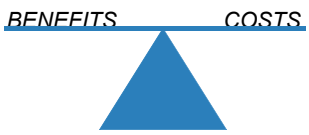
What is a Trade-off?

Trade-off question:

Do the benefits of using gene editing (vs. traditional methods) to save the banana outweigh the costs?

The banana is dying. The race is on to reinvent it before it's too late.



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What the Anti-Activists Do

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Activate Disgust

Muddy the Trade-offs

Friends of the Earth. (2019, December 17). Retrieved from https://foe.org/news/new-report-gene-editing-agriculture-poses-new-risks-health-environment

What the Anti-Activists Do

Examples of muddying the trade-offs:

"The real question is whether GMOs are needed in agriculture at all. Advanced conventional breeding is now **highly effective** at producing the traits in plants and animals that both farmers and consumers desire and entails **less risks** to the environment and human health."

Muddy the Trade-offs

Friends of the Earth. (2019, December 17). Retrieved from https://foe.org/news/new-report-gene-editing-agriculture-poses-new-risks-health-environment

Clarify Trade-offs

What is a Trade-off?

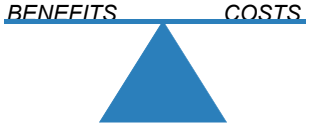
Trade-off question:

Do the benefits of using gene editing (vs. traditional methods) to save the banana outweigh the costs?

Trade-off stories are often wrong:

1. *"Gene editing has no benefits"*
2. "Gene editing costs are enormous"

The banana is dying. The race is on to reinvent it before it's too late.



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Example

"The real question is whether GMOs are needed in agriculture at all. **Advanced conventional breeding is now highly effective** at producing the traits in plants and animals that both farmers and consumers desire and entails less risks to the environment and human health." *Friends of the Earth*

Trade-off stories are often wrong:

1. *"Gene editing has no benefits"*
2. "Gene editing costs are enormous"

Correcting false trade-off stories:

1. *Conventional breeding may take 15 years to create a solution that gene editing can do in less than a year. Many problems won't wait 15 years for a solution.*

Friends of the Earth. (2019, December 17). Retrieved from https://foe.org/news/new-report-gene-editing-agriculture-poses-new-risks-health-environment

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Example

"The real question is whether GMOs are needed in agriculture at all. Advanced conventional breeding is now highly effective at producing the traits in plants and animals that both farmers and consumers desire and **entails less risks to the environment and human health."** *Friends of the Earth*

Trade-off stories are often wrong:

1. *"Gene editing has no benefits"*
2. "Gene editing costs are enormous"

Correcting false trade-off stories:

2. *We know much more about basic biology than we did 30 years ago. Genetic "havoc" is common in nature, and gene editing does not increase havoc. Furthermore, negative effects have not emerged.*

Friends of the Earth. (2019, December 17). Retrieved from https://foe.org/news/new-report-gene-editing-agriculture-poses-new-risks-health-environment

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Trade-offs Are Inevitable. Choices Are Inevitable.

There are real problems that need solutions.

When technological disgust reigns, people may deny the reality of the problem, and deny that there is a choice.

The banana is dying. The race is on to reinvent it before it's too late.

China could release emergency pork reserves after losing 100 million pigs to swine fever.

The end of Florida orange juice? A lethal disease is devastating the state's citrus industry.

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Doing Nothing is a Choice! Doing Nothing Has a Cost!

Allow bananas to die off

Healthy, productive banana trees

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Doing Nothing is a Choice!
Doing Nothing Has a Cost!

Brown Apple

Apple Color Apples

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Conclusions

How Can We Help People Think About Technology Risk?

Better reasoning in two steps:

Deactivate Disgust

Emotions can be deal breakers. They end the dialogue. Let's temper them so we can keep talking.

Clarify the Trade-offs

Trade-offs are necessary. Let's understand them so we can choose wisely. Because we must choose.

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Credit Claiming

You must complete a brief evaluation of the program in order to obtain your certificate. The evaluation will be available for 1 year; you do not have to complete it today.

CREDIT CLAIMING INSTRUCTIONS:

1. Login to www.CE.TodaysDietitian.com.
2. Click "My Courses" and select this webinar's title.
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