College of Business
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ilLUminate Blog Transcript: David Rea on Fairness and Efficiency

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ANNOUNCER: 00:02	[music] This podcast is brought to you by ilLUminate, the Lehigh Business blog. To learn more, please visit us at business.lehigh.edu/news. [music]
STEPHANIE VETO: 00:13	Welcome to ilLUminate, the podcast for Lehigh University's College of Business. I'm your host, Stephanie Veto. Today is September 15, 2025, and we're talking with Dr. David Rea about his research in fairness and efficiency. Dr. Rea is an assistant professor in the Decision and Technical Analytics Department, and he holds a courtesy appointment with the College of Health. He's interested in improving human well-being inside service systems, largely focusing on operational problems in the delivery of basic needs services. Hi, David. Welcome to the show.
DAVID REA: 00:45	Hi, Stephanie. Thanks for having me.
VETO: 00:47	How did you get interested in using math and data to try and solve complex world issues?
REA: 00:53	I started my graduate studies in a program for mathematics. I realized that what I found valuable about math was its ability to solve problems. And so I switched into a program for operations and business analytics, which is exactly what we try and do. We try and use data to make better decisions. So my key example is I was embedded in an emergency medicine department while I was studying. I got to see the challenges that doctors and other caregivers faced on a daily basis, get their perspectives and connect it to data. So this led to my general mantra that I always share with my students is data is not reality, it's a reflection of the system that created it. So you have to understand how data was created to actually really use it effectively. And the benefit here is I got to work on real-world problems and see how that translates into better decisions.
VETO: 01:43	I think it's interesting because you're working on things that obviously you care about. Everybody cares about them. They're world issues on so many different levels. But you get to approach fixing these or solving these things through a different lens, through the lens of math and data, where it's not so much that emotional first thing where, again, obviously you care, but it's through trying to solve it with the data. Can you talk about that a little bit?
REA: 02:17	I think that business research and business in general is very good at being efficient, right? That's what we try and do. And it's a good thing. Efficient businesses provide things that are cheaper for us, right? They're also just generally going to survive better. A business that's more efficient tends to be more sustainable. They're not using as much resources or wasting as much, right? So it's good to be efficient. The problem is that when we focus solely on efficiency, we end up with solutions that we feel is undesirable. And there's plenty of cases where the goal is not always just to be the most efficient. So if we're distributing food to people who need it, right, our target is not the most efficient system. We're targeting the people who need it. But we still want that system to be efficient, right? So the question is, how do we balance these principles? We have scarce resources. They need to be distributed in a way that

is reflective of whatever principles we want to apply. And how do we do that in a way that balances them?

VETO: 03:23 So let's talk a little bit about the difference between equality and equity.

REA: 03:29 Yeah. So these concepts are often conflated and treated the same. I tend to view this through the philosophical lens of distributive justice. So it says that we have a few different principles we might apply when we make distribution decisions or allocation decisions. So we have equality, which we generally understand, means that we want outcomes to be equal. Or we want to, say, apply the exact same rules to everyone. Then we have equity, where we are going to try and prioritize merit, that is, prioritize people who deserve it. This usually comes in many more business scenarios. And then we have need where we're going to prioritize people or organizations or whatever we're allocating to based on the actual need. So I already gave the example of food distribution. That's what we do there. We do the same with healthcare. In merit situations for equity, we can prioritize people based on their performance. This happens, again, all the time. So compensation pay for salespeople is an explicit example there. And just equality is useful because it's the most easy to understand, right?

VETO: 04:43 So your research draws on analytical and philosophical aspects. You talked about that a little bit before. Can you explain how you're doing that?

REA: 04:54 The key, I think, differentiation, I think, is to think about the difference between principles, that is, what we want to embed in a system. So that is equality, equity, need, efficiency. And then the outcomes and how we perceive those outcomes. So that philosophical underpinnings of those terms, so equity, equality, need, that is what we try and design the system around. If we look at the other side where we say we want a system to be fair, that is perceptual. And so we can only really judge it based on how we feel about it. Typically, what people will say is they want to design a fair algorithm, and they end up with a method that is trying to incentivize equality or trying to make things very, very equal. We tend to conflate those terms. It must be equal to be fair. But this just isn't true, right? There's plenty of scenarios where we want other things. We want to be prioritized for our merit, or we want to be rewarded for it. We want people in need to receive what they actually need. And so if we're going to design algorithms that are principled, that is, we want them to be perceived as fair, we have to think about the principles we put into them. On the other side, what people actually expect. If those are disassociated, then you're always going to end up with an algorithm that people don't want or don't like the outcomes from.

VETO: 06:21 And one of the papers you're working on right now is about, obviously, fairness and efficiency, but how they are benefiting each other. You've warned me that it's very math-heavy, but we're going to try and understand it today. So good luck to you because I am horrible at math. Can you give a brief description of the study?

REA: 06:42 Yeah. So the math looks more complex than I think it really is, right? So I'm a former high school algebra teacher, so I do appreciate a good challenge here.

VETO: 06:55 Good luck again.

REA: 06:58

So yeah, I think that what it actually boils down to is pretty comprehensible, right? So the motivation here was we have theoretical results that suggest if you want a system to be efficient, then it can't be fair. There's some trade-off between those two. Typically, what this theoretical research shows or defines fairness to be is very equality-based. On the other hand, we have academic research that goes into systems that's more applied and says, "Can we make the system better and that is more efficient? And can we make it more fair?" And they find that they can. So on one hand, we've got theoretical research saying there has to be a trade-off between fairness and efficiency. On the other hand, we have research that says we can do it. Fairness and efficiency can be improved at the same time. And so what we're trying to understand with this paper is why are these things misaligned? And so we take a very analytical approach. We show that if you take a different view of fairness, that is, you let it follow those principles we talked about, equity, equality, need, then you will actually see exactly what we show, exactly the theoretical results and the empirical results at the same time. If you prioritize equality, like the most equal system and the most efficient system, there will be a trade-off. You can't have both of those. If you prioritize equity or need, you try and get proportional to something, you can actually have a system that is both efficient and fair. So equity can give you a little bit of a boost to an efficiency in particular scenarios. So I started off by saying that this boils down to something that's very comprehensible. It really does. It's just, is your measure of efficiency correlated with your measure of equity? And if it is, then generally, you'll find that being equitable is actually efficient.

VETO: 08:56

Do you have some examples of what you studied to test this formula?

REA: 09:05

Yeah. So in the paper, we do a little case study. Like I said, it's very analytical. So we do look at emergency food distribution, but we don't really solve that problem. We don't try and claim we do. We treat it as a test example, right? So we take a look at state funding. That is how much funding that states are going to allocate to emergency food distribution. And then we look at where people are most in need across counties in those states. And we say, "Okay, how would you allocate this funding based on different principles?" So let's say we want to just allocate the exact same funding to all counties. It's equal. Right. That would be simple to do. And sure, it can be argued that that's fair. We don't do that in real life. We prioritize the counties with the people who are most in need as makes sense, right? Well, it turns out that it depends on how you define equity. So let's just say you target overall food-insecure populations. So just take the number of people who are food insecure in this county, and we're going to allocate our resources based on that in proportion. Well, that can lead to, say, an efficient system. In that case, I'll give you one example, explicit example. In that case, for main, equality is less efficient than equity. So if you target the overall food-insecure population, equality is less efficient. The reasoning is that it depends on how much food costs in different counties, right? This is where the difference is coming from.

REA: 10:37

So let's say we switch our measure for equity, and we say we're going to try and target the overall food-insecure population that's above the SNAP cutoff. So the SNAP cutoff is how much a family makes so that they stop receiving food stamps or support from the federal government, right? So you're still food insecure, you still really are having trouble finding food, but you're not getting federal money. So another way we

could define need, right? If we do that, then equality is actually more efficient, right? So the point here is that it depends on how you define what is equitable, what is need, what's your target measure, and what's your measure for efficiency. And this can be true in plenty of scenarios.

VETO: 11:24 So what is perceived fairness?

REA: 11:26 So perceived fairness is how we interpret the outcomes, right? In fact, I would argue that fairness is only perceptual, that we cannot embed or describe fairness mathematically. We can describe the principles of justice. We can describe equity, equality, need in mathematical terms. But fairness is what we feel. So I'm sure everyone has found a situation where they show up-- let's say that you show up to a line and someone cuts in front of you, right? Generally, we could perceive that to be unfair, at least in Western cultures, right? So we feel it, right? But we can't always describe it in mathematical terms.

VETO: 12:12 Why is efficiency important to these issues then?

REA: 12:16 So, as we were discussing a little bit earlier, right, efficiency is just kind of fundamental to how organizations and businesses work. If we have inefficient systems, then we're going to be extremely wasteful, and we're not going to really reflect the outcomes at all, overall, right? We'll end up with higher prices, we'll have more waste, all these bad things that come with inefficient systems. So the problem is that when we chase efficiency at all costs, we get those undesirable outcomes, things that feel unfair. Now, the good news with this research that I'm showing is that just because you prioritize just a little bit of efficiency or just a little bit of equity, a little bit of equality, you can still have a very efficient system, almost like no real cost to you, but the outcomes can be much, much better, at least perceptually better.

VETO: 13:09 I think it speaks for itself, but what do you think the intended goal or what do you want the goal of this study to be?

REA: 13:17 So I think that it depends-- for different audiences, I have a few different messages alike, right? So, academics, I've been trying to make the case that fairness is more than just equality. And we have to think a little more broadly about these principles. We have distributive justice. These are really, really old principles. Decades of work goes behind showing that we as humans think this way. We allocate stuff this way intrinsically. And so we have to think a little bit harder in academia, how do we embed this inside systems. For businesses, I hope that this shows that there's some value in just thinking about equity. We came up with the example of sales compensation. So that's merit-based. That is an equitable way to allocate pay. It's not the best way in all cases, but it's a good example, right? It is efficient to reward people who are performing well. The complication is it's difficult to define equity. And so hopefully by showing that it is sometimes more efficient to be equitable, then we can-- it makes it worth going to the effort of figuring out what we're going to prioritize. For the audience, in general, I'm kind of hoping that you take this language and start to-- when you see something or feel something that's not fair, see if you can apply the language to it, right? What is the principle that you think was not justified? And see if you can see which one you expected, right? So if I expected equality, but equity was being prioritized, I'm going to feel it's unfair. And that language is kind of powerful,

right? It gives us a way to describe what's going on and also potentially a solution to that problem.

VETO: 15:06

I think I get stuck on the perceived fairness of a lot of things, and that's where it kind of stops for me. So I find this all really intriguing to apply to different things, real-world things, or anything you see, because there's so many-- things are so not black and white. I mean, you've got organ donations and things like that where it's like, well, yeah, of course that's a good person, but the other person was in line first, but this person needs it more. And there's so many different things, or even just getting cut in line in Western culture. I'd be like, "That's not fair. Wait a second." So I get stuck on it. And what I'm gathering, though, is that equal distribution isn't always fair, right? But does that mean that it's not always the most efficient? And I know we've been explaining this the whole time, but I'm still-- let's go over it again.

REA: 16:00

Yeah. Again, it depends on the scenario, right? So equality can be-- it may be most efficient. So we gave the example of giving higher compensation to people who sell more or salespeople who sell more, right? That's very equitable. You're prioritizing merit. If you just say gave pay equally, it would probably be less efficient, right? You're not really incentivizing what you want to incentivize, that is, selling more. On the other hand, if we had another scenario where, say, equity and efficiency were pointing the opposite directions, right, completely misaligned. So if we go back to the food distribution example, if the areas where people are most in need are also the highest cost areas to provide food, well, then being equitable is going to be less efficient than being equal. That said, we probably still wouldn't want to choose the system that is the most efficient one, we'd want to choose the equitable one. Because in that case, our goal is to help people who are in need, right? So we're not trying to say that one of these principles is better than the other in any given scenario, we're just trying to provide a tool to understand when one will be efficient compared to the other and show that this little more nuanced language can help us describe what we want in a system.

REA: 17:20

So broadly, I think as we have more and more algorithms govern decisions in our lives, if we can be more transparent about the principles that are applied in those algorithms will lead to better trust and acceptance of these algorithms and better algorithms overall. It's just more complicated. We can think about plenty of scenarios where we want this, right? We might not want to wait longer at the emergency room, but we understand that if we have a broken ankle and someone comes in with a heart attack, the person with a heart attack's going to be prioritized. We may not want to wait a few extra minutes for a rideshare ride, but at least I might accept that if I knew that it helped ensure that the high-quality drivers were getting better pay, right? And you can think of tons of examples where we can have better outcomes if we prioritize principles. We think it through.

VETO: 18:17

How long have you been working on this formula?

REA: 18:21

So I've been working on this for about 10 years. I've been thinking through different scenarios, different problems. And as I've said, now I just view the world through this lens. And I think it's a useful lens to try and think through what's going on.

VETO: 18:36

I could see you just doing everything, grocery store, like you said, emergency room, whatever, and like, "Aha."

REA: 18:43 Yes, my spouse is perhaps tired of me viewing the world through this lens and explaining.

VETO: 18:51 "Well, if we do it this way, this might not be the fastest route. However--" oh, boy. I think I need some of that, though, because again, I get stuck on that. "That's not fair." So we've got a couple minutes left. Is there anything else that you're working on that you want to talk about?

REA: 19:12 I have a couple other related papers. One is just looking at how people make these choices. So it's a study of supply managers who are making decisions about where a scarce resource they have, that is, the items that they have. So, say their production was cut and they just can't meet all their orders, who gets those orders? And what we find is that supply managers will have some implicit preference for these different principles, equality, equity, need. And that determines, or at least partially determines, how they make those allocation decisions. So, to get back to the story about how we do this in algorithms, which is the study we talked most about, this just shows that people do this, right? So we do make these decisions. We apply these principles in different ways based on the context. And so we should probably design our algorithms to do the same thing, to balance these different principles.

VETO: 20:09 What about those principles, like even in aspects of business, you said supply chain, but working with people you prefer maybe because they're, I don't know, nicer to you or whatever, they get more treatment. And then if you've got that better relationship with someone, does that fall into that realm?

REA: 20:33 So I do think relationships matter. I mean, you tend to have a preference to work with people you know more. Something in that study I just described is-- we kind of take that away, right, because we're describing it in a more generic fashion. But yeah, for sure that people have their preference for who they want to work with. You could technically map this onto one of those principles, though. So if you're, say, want to work with a particular person because they make your life easier or they're particularly good at something that you need to have done, well, that's prioritizing equity. You're prioritizing merit, right? This person is making things better or easier. It just goes to show that, yeah, we apply these principles naturally, right? We just may not always have the language to describe them.

VETO: 21:26 David, thank you so much for taking the time to be on the podcast. It was so great meeting you.

REA: 21:31 Yeah, thank you so much. I enjoyed it. I appreciate the time.

VETO: 21:35 That was Dr. David Rea speaking with us about fairness and efficiency and how they can work together. This podcast is brought to you by ilLUminate, the Lehigh Business blog. To hear more podcasts featuring Lehigh Business thought leaders or to follow us on social media, please visit business.lehigh.edu/news. This is Stephanie Veto, host of the ilLUminate podcast. Thanks for listening.