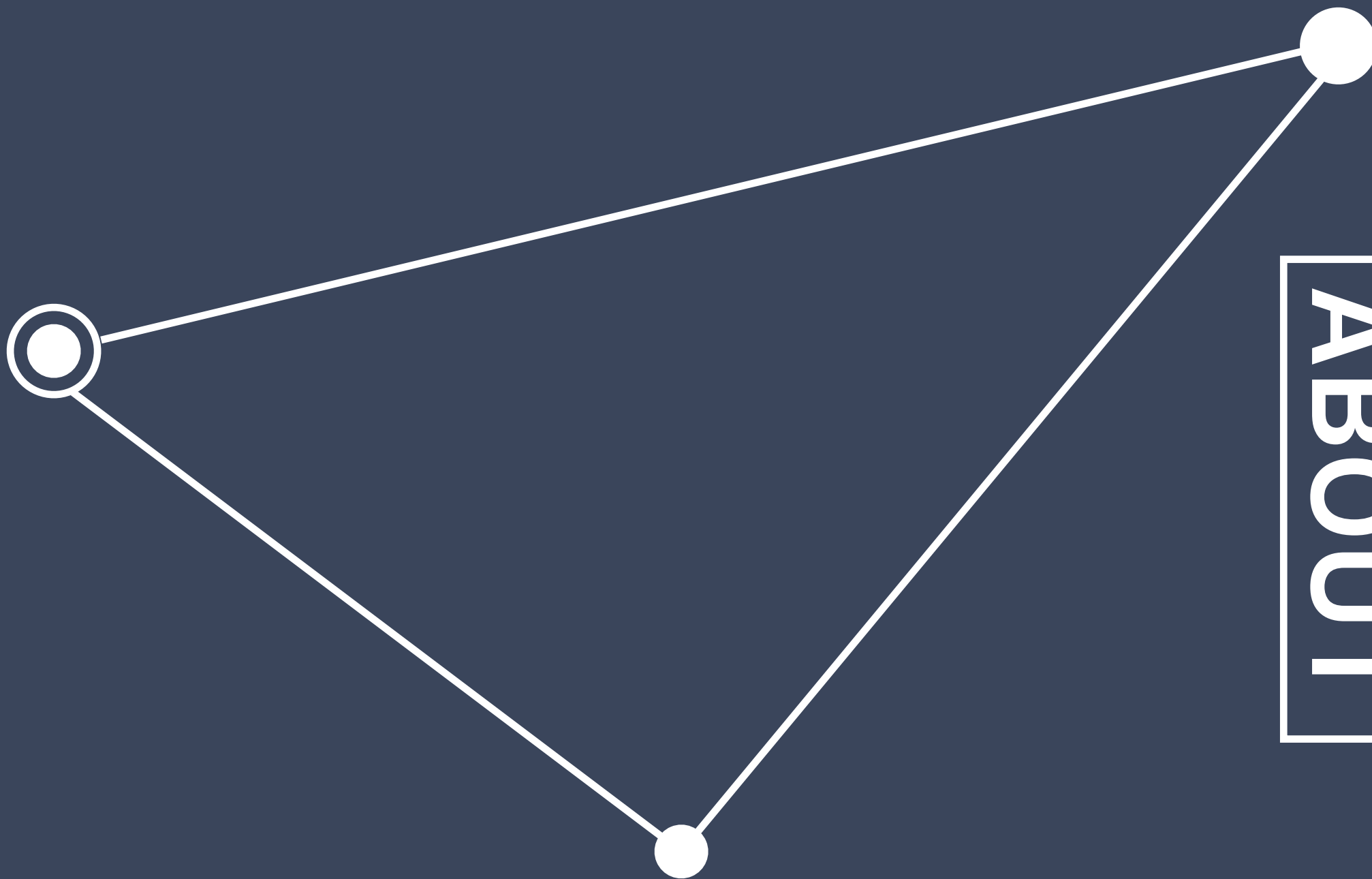


AI IN REAL ESTATE:

NAVIGATING THE
PARADIGM SHIFT



ABOUT

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Background:

The Center for California Real Estate (CCRE) is an institute founded by the CALIFORNIA ASSOCIATION OF REALTORS® (C.A.R.) dedicated to intellectual engagement in the field of real estate. Its mission is to advance industry knowledge and innovation with an emphasis on convening key experts and influence-makers. CCRE reflects C.A.R.'s increasing role in shaping the future of the industry by advancing innovative policy solutions and active dialogue with experts and industry stakeholders. Additional background on CCRE and C.A.R. can be found at centerforcaliforniarealestate.org.

INTRODUCTION

Artificial Intelligence is here. Forget the doomsday predictions of robots taking over the world- it's more than likely present in the smart phone you hold in your hands, or the virtual assistant you use to turn on the lights each night.

The rapid emergence, and equally rapid consumer acceptance, of artificial intelligence-enabled technology presents a critical juncture for the real estate industry at large - namely, how to protect a tried, proven and trusted business model without being usurped by AI-enabled disrupters or being branded with the reputation of being stuck behind the times.

But AI presents questions and opportunities beyond that point. AI-enabled technology promises efficiency gains on a micro-level - potentially enabling REALTORS® to strengthen their value proposition, improve productivity and gain a competitive edge.

What is AI?

By simple definition, Artificial Intelligence refers to the capability of a machine to imitate intelligent human behavior. Outside of academia, the term is often used in conjunction with machine learning, which extends that definition to encompass machines which are capable of progressively improving their performance on a specific task.

As is becoming increasingly apparent, the term Artificial Intelligence can be stretched to encompass a whole gamut of technological applications. It powers Amazon's Alexa, Google's Assistant and Apple's Siri - but the reality is that a huge proportion of AI powered interactions are going on behind the scenes.

For example, AI is dictating the kind of advertising you see online, learning what has the most resonance from your online searches. If you make an inquiry via

a company's web chat, you're probably speaking with a machine. And if your vehicle has autonomous driving aids, they're almost certainly powered by AI.

These are select examples, but if the numbers are anything to go by, business interest in AI is growing across the board. AI investment is growing fast, dominated by digital giants such as Google. In their 2017 report "Artificial Intelligence: The Next Digital Frontier?" McKinsey Global Institute estimates that tech giants spent \$20 billion to \$30 billion on AI in 2016, with 90 percent of this spent on R&D and deployment, and 10 percent on AI acquisitions. Venture capital and private equity financing, grants, and seed investments also grew rapidly to a combined total of \$9 billion.

What does it mean for REALTORS®?

It's fair to say that for the real estate industry, AI is, in equal measures, an incredibly exciting

and terrifying prospect.

The situation is not without precedent. One only need look to the financial services industry, in particular online tax tools and so called robo advice, to see the monumental impact artificial intelligence can have on traditional business models.

Future predictions surrounding the impact of AI certainly back up the financial services experience. A 2017 McKinsey study of the labor force in 46 countries, "A Future that Works: Automation, Employment, and Productivity," found that less than 5 percent of occupations could be fully automated using today's technology, but almost a third of tasks involved in 60 percent of occupations could be. "Predicts 2018: AI and the Future of Work," a briefing from research and advisory company Gartner forecasts that by 2022, one in five workers engaged in mostly nonroutine tasks will rely on AI to do a job and that by as soon

as 2020, 85 percent of customer interactions will be managed without a human.

For a customer-oriented business like real estate, these figures present, on the outset, cause for alarm.

REALTORS® have been here before. The internet presented a significant disruption to the traditional REALTOR® business model, and arguably still does, with online listings continuing to paint a cloud over the future form of the Multiple Listing Service (MLS) and arguments over data ownership a perennial industry flashpoint.

As with any emerging technology, there exists the question of the unknown: How best to embrace the technological gains promised by AI without compromising the core REALTOR® values when the technology in question is shifting at such a rapid pace, and so much is still unknown.

It was with these ques-

tions, and precedents, in mind that C.A.R.'s Center for California Real Estate convened this panel of AI experts to discuss how best to navigate the paradigm shift that the technology presents.

MODERATOR



Joel Singer, C.A.R. CEO

Chief Executive Officer of the CALIFORNIA ASSOCIATION OF REALTORS (C.A.R.), a statewide trade organization with 200,000 members dedicated to the advancement of professionalism in real estate.

He also is president and chief executive officer of zipLogix™, whose software is used by more than 600,000 REALTORS® in 48 states.

PANELISTS



Peter Jonas, President - West Regions, Compass

Peter Jonas is the President - West Region at Compass. He has been in the role since March 2018, based in San Francisco. Prior to joining Compass, Jonas was Director of Uber for Business at Uber, a role he held for one year. From 2010 to 2017, he was at Facebook - primarily working in their Games and Mobile Apps division, where he was a Director.



Marie Hagman, Director of Product, Machine Learning, Zillow

Marie Hagman is the Director of Product for the Artificial Intelligence division at Zillow Group, using deep learning, machine learning, NLP and computer vision to simplify the home buying process.

Hagman has worked on search technologies and knowledge graphs for over a decade at Microsoft, Facebook and the Allen Institute for Artificial Intelligence.



Prem Natarajan, Michael Keston Director, USC Information Sciences Institute

Dr. Prem Natarajan is the inaugural Michael Keston Executive Director of the USC Information Sciences Institute.

Prior to joining ISI/USC in 2013, Dr. Natarajan served as an executive vice president and principal scientist at Raytheon BBN Technologies, leading its speech, language, and multimedia business group.



Russ Cofano, Industry veteran/speaker on data, technology and innovation

Russ Cofano is a thirty-year real estate industry veteran who has served in executive capacities in various industry sectors.

Most recently, Cofano held the position of President and General Counsel of eXp World Holdings, Inc.



John Berkowitz, CEO and Co-founder, OJO Labs

John Berkowitz is the co-founder and CEO of OJO Labs, Inc. OJO Labs developed a unique, multi-patent pending, AI-based technology that can conduct conversations with consumers at scale.

Founded in 2015, OJO employs more than 80 professionals and is headquartered in Austin, TX.

Q & A

JOEL SINGER: I'd like to start by getting a little more definition, if we could, around AI.

RUSS COFANO: When people use that term, it's a big field; right? There are things like machine learning and natural language processing and text recognition and facial recognition, all those things that go into the whole concept of artificial intelligence. What you have is a lot of people that look at artificial intelligence [and think] that word is kind of scary, and lots of movies have talked about things taking over the world. Really there's this concept of artificial general intelligence which is this sort of independent thinking thing, and we're not close to that yet. That's, from some people's perspective, like Elon Musk has sort of said, the doomsday issue.

We're really more in narrow AI, which is more process defined, task defined, where humans very much are in control of teaching the machine to do things to make a process more

efficient and generally be analogous to the human behavior of analyzing data and predicting it or making decisions for us in narrow fields.

MARIE HAGMAN: I think AI is an umbrella term that covers a lot of different tools that you can use for different purposes. Classically, I think AI is sort of like what you see in the movie "Her." That's what people think about, where you have a machine that seems very lifelike and humanlike. I think that's the holy grail of the general intelligence, but right now we generally build machines that are fairly specialized. The AI that beat the world champion at Go can only play Go. I think probably there's a lot of research and debate about when can we get to that much bigger, broader vision of what AI can do. But practically for us right now in the industry, it's a toolset which includes machine learning, natural language processing, and understanding the visual. Computer vision is a huge, huge space right now, as

well.

JOHN BERKOWITZ: I define AI as the practice of making machines think more like humans, and humans do two things really well, that is, pattern recognition and learning. If you're in the field, if you're working on AI, you spend most of your time in awe of the human brain and how far away this technology is from coming anything close. If you're not in the industry, you're generally scared that AI is going to replace your job and do all these other scary things, take over the world, if you're Elon Musk. So I think that there is some truth in the middle of huge progress around these specialized applications that are delivering value, but there's a good amount of disconnect in the field in understanding of how far off it really is.

PREM NATARAJAN: There used to be all the expert systems and hype in the '80s and '90s. And those systems turned out to be very fragile because they were very explicit codings of human knowledge or experience. And as you tried to deal with more and more situations, you kept expanding the set of what you might call rules of logic. But those systems had a fundamen-

tal limitation in their inability to generalize to new or novel situations; right?

I think a key aspect of AI, at least as we look at it today, is that it should be able to deal with at least reasonably novel situations and do reasonable things in response to novel situations. If you simply said here's like a million different things you might see, and here's the actions you take for each one of those million situations, that's simply a look-up table. That's a super complex - that's like looking up a lot of information and finding the answer. But AI has to generate answers to situations it has not seen before; right? So that, in a sense, is the excitement today.

In terms of what is AI, it's increasingly becoming easier to maybe define what's not AI in the sense that very little is not AI, at least in the colloquial way in which we talk about AI. Sometimes I feel like if anti-lock, smart anti-lock brakes had been invented today, we'd call it AI brakes, right?

There is the ability also - I'll just make two more quick points. One is to learn, which is that you can teach a human one lan-

guage. You can teach the same human a different language. The same is true with machine-learning algorithms today. The same algorithm can be taught one language and it represents that knowledge in the form of some models or whatever it is. That same algorithm can be used to teach itself a different language, and then it has a different representation of it, and it can access each one, either one of these.

So there is a generalization ability in that you're developing algorithms that are useful across many different things. And the last thing is this has always been true. Machines can handle way more data than humans ever can. We can look at a sheet of paper and make really deep inferences into it. But machines can look at a million documents and find shallow stuff across those million things that we would never be able to do in our lifetimes. So those are some of the attributes.

PETER JONAS: That's a tough act to follow. Let's flip the script a little bit. How many of you in the last 24 hours have had AI as part of your day? Three or four? Okay. A handful of you. All of you have. So those of you who



"The reality is that AI is happening in increments every single day... And as you can probably tell, all of these things are getting better and better."

- Peter Jonas

didn't raise your hand, you're wrong. It's an awkward way to start this panel, but AI really is coming into your life in many different ways.

The reality is that AI is happening in increments every single day. And every single day, when you go into Google, and it tells you how long your commute's going to be before you ask for it to tell you your commute, that's AI. When you go in and Uber is doing your routing, and it's giving you the most effective routing, that's AI. And as you can probably tell, all of these things are getting better and better. So as that data builds, as that experience builds, that's how we get to the holy grail. It's not a matter of getting there just one single day, it's a matter of compiling data over a long period of time that gets us to where we're trying to go.

JOEL SINGER: Where have you deployed AI from your perspectives that has made the most difference?

MARIE HAGMAN: I think there are both really interesting and really boring ways that we've used AI. It's really hard to pick the one that's been the absolute most impactful. Probably the Zestimate, I think, for Zillow as a company has been most impactful, leading the way with that idea many years ago, and we're constantly working to improve it. But there are so many other applications within the company for AI, anything from as basic as just classifying things, parsing addresses, so we have to understand what dif-

ferent parts of the address are to process these real estate listings and property data that we get. Again that's probably more boring, but very, very useful and impactful application.

We do really cool things with images, deciding the quality of the home and the price point of the home based on the images. We can do 3D tours by just pictures on an iPhone, so you can actually create a 3D tour very inexpensively using Zillow's tools, and we have a 3D team that does that. So that's sort of a lot of the cooler stuff that's going on with vision.

One of the ways that is also really important is on the site search. Any time you do a search for a home that uses AI, we do personalization. We send people emails to say, "Hey, you might like these homes based on the homes that we know you've been looking at on the site. Here are some new ones that you might want to check out that are similar to the ones that seem to resonate." So that's a broader review. I could probably go on all day about all the little ways and big ways that we're using it.

JOHN BERKOWITZ: OJO is currently slightly less known than Zillow, so I should at least explain a little bit what it is. It's a virtual assistant that allows consumers to get access to all of their questions, search for homes, ask questions about homes, and navigate the home journey process. Real estate agents use it to stay engaged with consumers over a long pe-

riod of time.

AI has been the answer to all of our product problems. We need to be able to have conversations real-time, 24/7, with millions of consumers, and get to very small, specific answers in massive datasets. And we just couldn't do that with traditional algorithm software. And so a lot of NLP [Neuro Linguistic Programming] work, having natural conversations, allowing people to talk how humans naturally talk, looking through huge data sources to find the right home and the right piece of information within a home listing, or then going out and finding where answers might be. We use it internally to make better decisions on how to engage with people.

We're doing AI across the entire business. I'm seeing it in real estate in all ways, from pricing homes to figuring out what an agent should do, from figuring out who to match a consumer to, to have the best experience. So it's everywhere.

JOEL SINGER: What applications do you see as having had significant impact in real estate today from a pure AI standpoint?

RUSS COFANO: The industry shouldn't be afraid of AI in the iterations that are coming from these companies, in my opinion. I say "the industry," I'm talking about the people actually producing real estate, buyer and seller experiences, so the good agents out there. The biggest concern I have

from an industry standpoint is, whenever you use the word “data,” the industry always wants to put “listing” in front of it, and this is not about only listing data. This concept goes way beyond the whole topic of listing. Remove that word “listing” out of your vocabulary when talking about artificial intelligence because really the applications we’re seeing today, which is early days, but the ones that we’ll see beyond that go well beyond the listing piece or the property data piece of the equation.

But what I’m seeing, companies I’m following, there are some smart guys out of Iowa that are doing some really good stuff. Again, the low-hanging fruit. If you want to get agents’ attention, you talk about lead gen and capturing leads; right? There’s too many agents; there’s too few transactions. And I was at Realtor.com, and Zillow has the same issue. Lots of leads; horrible response. And the thing we know about machines is they will respond every time when you want them to. And they may sound like a machine, but at least the consumer is getting a response. You’re seeing the early days of AI and the industry really being focused on capturing the client, lead generation, cultivating them to a warm introduction, and we go from there.

PETER JONAS: The majority of AI in real estate right now, and frankly in the world, is pretty boring. Right? It’s happening everywhere, and it’s pretty boring. I think of the things that

I think are really interesting, I think frankly the virtual assistant, the chatbot sort of ecosystem that’s popping up and the opportunities there, seems like a really near-term opportunity to have real impact on the industry, either through working with buyers and sellers directly or through enabling agents, which is what Compass focuses on, this idea of how do we elevate the agents’ game through technology. I think that’s a big opportunity.

At a more foundational level, I’m super interested in the world of the Internet of Things. There are devices out there every day that have been developed that don’t often get associated with artificial intelligence, but they’re foundational in the world of artificial intelligence because they’re gathering data. Whether it’s a sensor under a sink for a real estate agent to know if an empty house has a leak, or it’s a remote lock, these are things that help the real estate agent, but also are arming us with better data to then build better artificial intelligence.

PREM NATARAJAN: You know, I’m not in the real estate business other than as a customer, so I thought I would add the voice of the customer. You’re talking about impact. As a user of real estate software online, whether at Zillow or Redfin, whatever, there was a big jump up or step up when there was automation. I can go search for what I want, I can zone an area, I can look at prices, I can look at history, etc. There’s really been nothing that’s made any differ-

ence to me as a user in terms of technology being deployed since then.

Now, it’s entirely possible that on the enterprise side you’re seeing efficiency gains. In many, many sectors, it’s too early to tell, I think, where AI has had the most impact. I think it’s not too early to say, though, that it will have major and transformative impact. I think automation is the first step, though, for AI. You need data for AI to be deployed. And platform companies like Zillow are generating that data, so now you have the basis on which to learn and then take actions based on that learning.

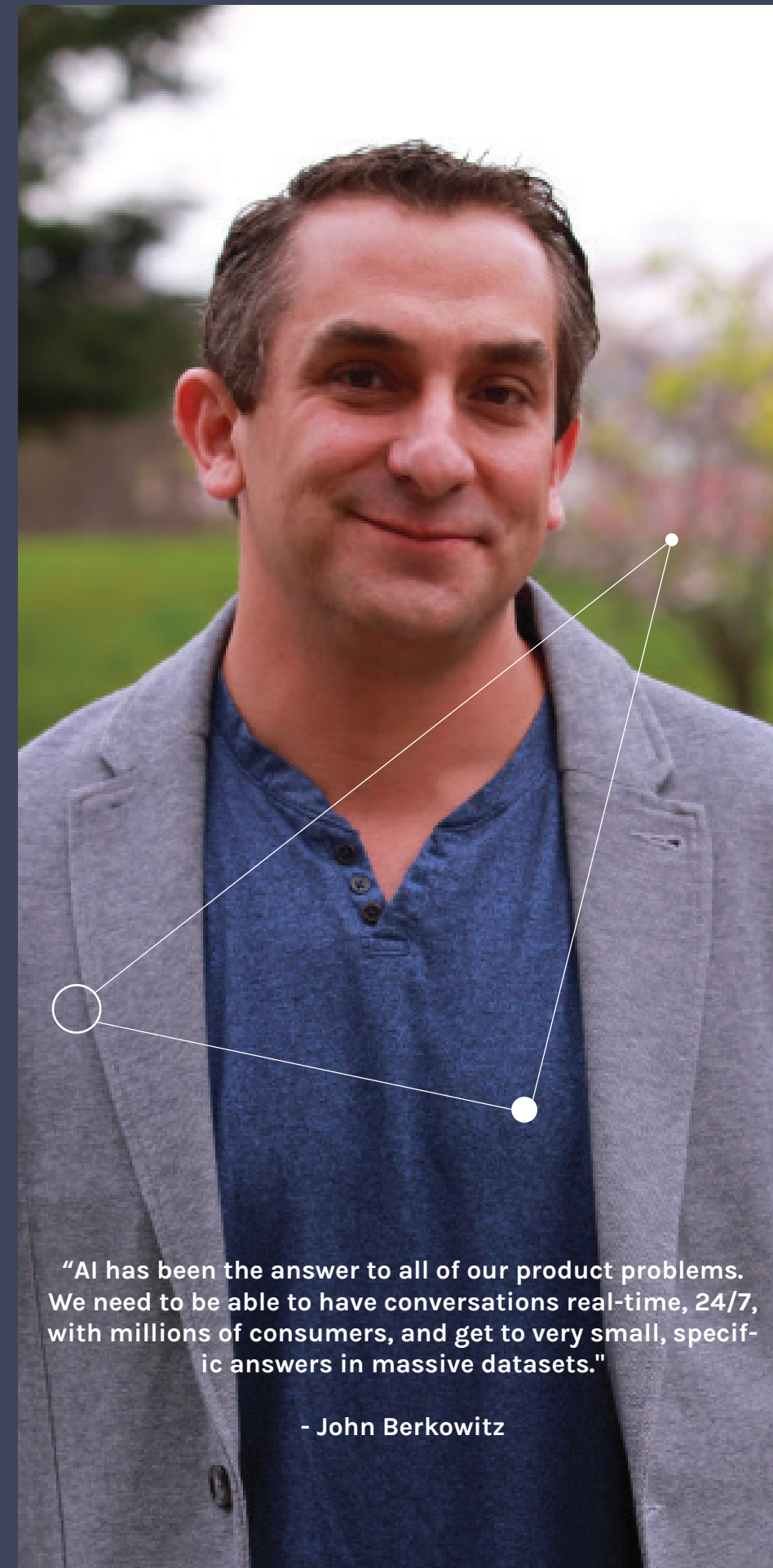
JOHN BERKOWITZ: There’s another place that we see it which is in images. In our product we try to figure out what kitchen you’re going to love. It turns out, if you ask me what kitchen I’m going to love, I have no idea because I don’t know pendant lights and granite countertops. I’m starting to learn this, being in the industry. But if I show you 20 pictures, and you tell me the ones you like, it turns out the machine, not looking for granite countertops, but really breaking it down to millions and millions of pixels, can find similarities that we don’t actually have any idea about. But then when I show you and say, “Hey, Joel, are these kitchens you love?” you’ll say “Yes.” that is unstructured algorithms doing things that we have no idea how they’re doing right now, giving answers that are better than human answers.

JOEL SINGER: TurboTax – let’s take that example. Do you see, in the tax environment, is artificial intelligence going to change that very much? And in this business, in terms of the difficult part of the transaction – there’s two parts of the transaction. Getting to contract is difficult. Especially getting a listing, right, is difficult. But when you get to contract, then the real pain starts, getting from contract to close, because you’ve got multiple parties in that part of the transaction. Which part is AI going to impact?

MARIE HAGMAN: All of it.

RUSS COFANO: There’s a company called LawGeex that has built an AI engine for legal contract review, and they just published a study. They went out and they applied, similar to the bot versus agent scenario, they applied their engine. They took 20 partners from major law firms across the country. They compared the AI engine ability to review a nondisclosure agreement and compared it with these 20 partner-level lawyers. And the engine was, first of all, faster in a time-based industry which creates all sorts of implications, but better than the lawyers.

Think about a brokerage operation. What happens when a contract is signed? It has to be reviewed by some broker; right? What if you replaced that broker with a machine that was better than the human, faster than the human, more efficient than the human? Now we have



“AI has been the answer to all of our product problems. We need to be able to have conversations real-time, 24/7, with millions of consumers, and get to very small, specific answers in massive datasets.”

- John Berkowitz

to convince our licensing agencies to say this machine, while it's being supervised by a human, is really going to be the one reviewing the contracts. That's the next iteration of artificial intelligence in this business. Brokerage companies, smart ones, are going to be looking at those things because we all know the company dollar is decreasing. If you can grab efficiencies out of ways of managing the transaction through versions of artificial intelligence, that's the next wave, in my opinion.

PETER JONAS: I would say that you're asking the wrong people in the room this question because the reality is the artificial intelligence product that's going to get built around transactions is going to be built around the needs of the agents in this room. It's not going to replace agents. That's just not going to happen any time soon, hopefully ever.

I think the interesting thing is, if I were to ask you guys what part of this process is most difficult, what part of this process would you like the most insight on, you might say, "It would be really great, Peter, to know that every contract of a house of this age in this neighborhood with these terms runs into these issues under inspection."

We can do that. With the data that is going to be collected over the next two, five, 10 years, we're going to start to be able to do that so that you guys can actually be armed going into this to say to your buyer or your seller, hey, here's the lookout. This

might happen, and I want you to be ready, and here's how I'm going to react to that.

MARIE HAGMAN: I would agree with Peter. I think about in TurboTax, when they tell you, "Here's your likelihood of getting audited and here's why," that to me is the intelligence. I think he's exactly right, the agents are driving - the tools that AI can provide are really to help agents. What are the parts of your day that are frustrating or mundane? Those are the things where AI can take over. Anomaly detection is widely used, so you can look at a document and see if there is something that was not correctly filled out, or that when you were filling in a form you fat-fingered the price or something like that. This is the type of stuff that AI can start with and then get more sophisticated as you go.

JOHN BERKOWITZ: I think you're going to see it creep into taxes a little bit, but why NLP? Because there's just millions of unlimited, unlimited options that you can combine to get different outcomes, and that is where this technology applies. There are a couple of things that we know, and a bunch we don't know. And there's all these different combinations to come together - conversation, images, different processes. That's where this technology's going to thrive. When it's fill out this form, and it results in this most of the time, you can creep AI into that, but it's not going to have big impacts. It's expensive technology, and so you're going to point it at hard, complex problems. If you want to see non-

rule-based algorithms, you've got to go to bigger, more complex problems, I think.

I think it is going to impact the behavior. It turns out that agents know the stuff they don't like doing, and that the consumers don't like them doing, and it's because it feels mundane, but there's a million ways that you can answer a specific question or give information to a consumer. And agents are going to say, "Hey, I would rather a machine do that better and create a better experience and allow me to do things that are more nuanced."

PETER JONAS: At that highest level is artificial intelligence going to replace the agent? My answer is an emphatic no. And the reality is I've spent almost a month - so I haven't been in the industry very long. I grew up with a mother who is an agent, has been an agent for 31 years, so I do have empathy and an understanding of what an agent does.

But as I've been going around talking to every agent, I've already spoken with 200 agents inside of my market. And as I learn more and more what makes an agent great is not the mundane texting back. How many people in this room believe their text game is why their clients are with them? Right? It's like, "Oh, my god, I have the best text game. Like I answer back with the price of that house or the square footage immediately." No, it's not. And that's the sort of stuff you can replace.

What you can't replace is the emotional side of this, the EQ. So real estate agents have an amazing balance of EQ and IQ. A lot of that IQ can be replaced. A lot of the things that IQ is being dedicated to can be replaced with artificial intelligence. We will never replace the EQ side of things. There is not the intuition. You guys know that you're out there gathering data or insights every single day, whether it's when you stopped at the Starbucks and you ran into someone who lives in your neighborhood, or when you were at an open house and reading the selling agent's body language. Those are data points that go into instinct, and you just won't replace that with artificial intelligence.

Artificial intelligence is never going to help that first-time buyer deal with the pain of losing that bid on that house that they thought was their dream house. Artificial intelligence is not going to be the partner and confidante for that mother of two just going through a divorce. And artificial intelligence is not going to find the family that's going to fill a house with love that that empty nester is looking for so that they can downsize.

These are the things that make you guys so remarkable and that differentiate you. The boring stuff is going to go away over time, and ideally that's the case. Artificial intelligence gives you the opportunity to, instead of doing 50 transactions, do 500 because you can focus on exactly what matters most

to driving your business.

RUSS COFANO: I want to piggyback on what you just said and disagree with the words you used because your first statement was it's not going to eliminate the role of the agent. And what the industry hears is "My job is safe." That's the wrong answer. That's the wrong answer because what you just said, the way you ended that, was instead of doing 50 transactions you're doing 500. Guess what? The industry doesn't create transactions. They service the demand. That's all you do; right? It will impact the industry. The job of the agent, the role of the agent, is safe. The role of every agent is not safe because at the end of the day, if this does not create efficiencies, people will be spending a lot of money on nothing.

The MLS (Multiple Listing Service) is the best invention of probably any cooperative industry. It allows everybody to access a listing at the same time on the same terms, go hustle, find a buyer, and get a commission; right? We will not have the same egalitarian approach to AI. From a pure cost standpoint it won't be deployed anytime soon across the industry. The people that have access to it, that use it, will get the lion's share of the business. And their jobs will change. And the rest of the industry will be catching up and, in my opinion, will go away. I think the long-term implication, our industry is going to shrink massively, which from an association standpoint, from a brokerage standpoint, has huge impacts.

MARIE HAGMAN: I'd like to stand at the midpoint of those two statements and say that I think that certainly agents' jobs will change, and you've already seen that happen. So, I mean, does anyone here remember the MLS books where the only way that you could find out what homes were for sale was to actually go to an agent's office and look in these giant books? And now with the Internet and search engines, buyers are just searching for homes online. Is anyone here less busy because of that change that's happened? I don't think so.

I think that the job has changed. The efficiencies that you gain, I think, will make transactions happen more quickly. Maybe on the buyer side we might see people changing homes more often than every five to 10 years because it becomes a less painful process. But I think that absolutely the job will change. But think about other ways that you've found to fill your time when you don't have agents coming into your office looking at these books. Now we can develop 3D tours, like I said, from pictures on your iPhone that you can take, and offer you new ways to market listings to people that aren't even in the same area. People are moving more frequently to find jobs; if someone is out of state, they can actually buy a home sight unseen. Forty percent of millennials are willing to make offers on homes they've never walked into.

I think that the world is definitely changing. I don't think

that AI will replace agents. I like to reference Elon Musk's statement that that's like worrying about overpopulation on Mars. I don't think that's going to happen.

PREM NATARAJAN: It's very difficult to predict the shape of the disruption that comes in the wake of technology; right? It's almost impossible to predict the shape of the disruption.

What you can see, though, in the real estate thing is, of all the elements that I think disrupted other sectors, it's a multimodal experience sector. There is a lot of searching and analysis that happens, so it's a data-hungry sector in the sense that this is probably one of the biggest decisions people make in their lives. Every time they make it, it's a big decision, even if they make it multiple times. I find myself, I've bought like five or six times over the course of my life - every time I think I'll spend less time the next time, but I end up sort of thinking a lot about what investment we're making.

This whole generational trend, like what you were saying that people are willing to buy sight unseen. But it's maybe beyond that. Maybe the 3D experience you can get is going to be way better than anything that you can see. Maybe if I'm buying a house in Boston I want to see how it looks in the winter, how it looks in the fall, what is the context. No agent can do that for me. So the machine is going to have a much more stronger emotional connection with me because it's responsive to my

needs for seeing how this house might look like under different conditions.

I don't think it's easy to draw that line. I just don't see it happening without any human involvement on both sides, so that much is definitely true. But machines don't have to be emotional in and of themselves in order to service our emotional needs. Right? I mean, they can be pure logical beasts that can still satisfy some emotional craving we have.

JOEL SINGER: I think John's point that a machine can tell you what your taste is in kitchens better than you can tell yourself what your taste in kitchens is, that's a telling point; right? That goes to the heart of whether these machines become emotional, and what that means in terms of why you can't sit tight and not worry. Right?

So let me switch gears a little bit. For our audience here who are obviously using AI directly and indirectly, what would you recommend they do to accelerate the process so that they're one of the people who are able to make that transition to the higher number of transactions, that they're the ones who actually get the maximum benefit from AI.

PETER JONAS: I think the key is to make sure that you're on the right side of this. I think artificial intelligence can be built by people who are looking to disintermediate agents, and it can be built by people who are looking to accelerate the growth of

agents' business and making sure wherever you're working, wherever you're sending your data, that they are looking to accelerate, not displace.

JOHN BERKOWITZ: It actually goes back to before on can the machines actually do any of this emotional stuff? And I actually believe that - you were getting to this - that is pattern recognition, and machines are pretty good at pattern recognition, and so they can do this. I believe it will not happen as quick, like in the next decade, because companies aren't going to allow it to happen, because it's a big risk to say okay, I'm going to let this machine just go off the rails and say whatever it wants to figure out the best way to do it, especially when in real estate you're chasing this huge transaction, so the cost of experimentation is very high.

I think real estate agents can do more experimentation and trust these technologies to give it a try and say, "Let me experiment and let the machine determine the better way to do things." To give out a little bit of that trust, that control, to see the result. As the CEO of the company, I'm not willing just to let the machine go say whatever it wants to people. And Zillow won't do that, and no other real players will. Compass isn't going to say just go tell the agents for the next year to go try whatever the machine recommends. The people that take the risks will make the most progress. And it turns out individuals in smaller scale have more freedom to do it.



"What are the parts of your day that are frustrating or mundane? Those are the things where AI can take over."

- Marie Hagman

I think it's more trying to understand where the technologies can perform and trusting them is how you're going to leap ahead. Agents that don't will be replaced, and agents that do will get more transactions. But that's what you were subtly saying will happen over time, and I agree with it.

JOEL SINGER: I think the easier example, quite frankly, is if we look at the securities brokerage industry, where it's a non-emotional, purely financial investment. You might want to, those of you who like to invest, you might play around with your own investments versus running a bot to do investments and see what happens, because that's where the bot really starts proving how useful it can be.

RUSS COFANO: I'd like to piggyback on the comment here about experimenting. I think, you know, in the software world there's a term called A/B testing, and I think every agent should be an A/B tester in terms of try ways of comparing different tools - whether it's OJO or whether it's Structurely or roof.ai or a number of these companies, try them out and compare them to your current ways of interacting with your clients. Don't go one or the other.

But I think the thing that this industry can do in a really big way is be a participant in this process as opposed to a recipient in the process. It's much more powerful. And sometimes I think the industry - again, I was talking with somebody earlier - it likes to have a villain; right? And in the early days it

was AT&T, and then it was Microsoft, and then it was the banks, and then our friend Zillow, and now it's AI. Instead of having the villain perspective, find a way to engage with this in a cooperative way, be part of the solution. I think you'll be way further ahead in that context.

MARIE HAGMAN: If you evaluate your own day and think about the things that you would rather not be doing, and what would you rather be spending your time on, I don't think that anyone here is bored out of their mind trying to figure out what to do with themselves. I think that everybody is probably extremely busy and working really hard. Evaluate what tools make sense for you and give the feedback to Zillow and to other companies to inspire ideas as

to how to make your job easier because I think that that is going to be the virtuous cycle that really supports the industry and makes everyone more productive and ultimately is the right thing for the consumer.

Zillow doesn't really have a future without agents, and Zillow is here to actually create the tools to help you be more productive, do your work better, and even maybe have a little more free time, if you need it.

JOEL SINGER: How does data fit into this, and how should the real estate community look at protecting that data? I hate to use those words because that kind of doesn't allow us to experiment as much as I'd like to see.

RUSS COFANO: Think about the telecom industry, fiber networks - it's very expensive to lay that last mile. You are the last mile to the data. So you've got this amazing asset, but the last mile to one house is not worth much. You've got to aggregate that last mile across many houses for it to be worth a lot in a network. So you take that analogy, you've got to find a trusted source to aggregate that. It's a really fundamental question because in the brokerage industry there's always been this sort of collective tension between the agent and the broker. Even though they sort of sit together, they're not always on the same page.

I remember when I was at a big brokerage company. We wanted to build an in-house CRM, and we just needed the agents' data, but they wouldn't give it to us. And it's

like, "Well, you don't trust us?" "No, we don't trust you." You're going to have to trust somebody. That's the issue. Because individual agents alone won't be able to participate. You don't have enough data. And the question is whether even brokerage companies have enough data. You think about the MLS, right, and does the MLS become a federation of brokerage data - not listing data, but data generally that is available to the industry. That changes the entire MLS picture.

The question is super complicated, but there will be an answer, probably multiple answers, as how people go about the process. What those answers are will have profound impacts as to where this thing goes.

MARIE HAGMAN: I agree. I agree in particular with the data about the last mile being valuable in aggregate. How do you make the data that you have work for you? Because if you're just squirreling it away and not doing anything with it, then it really has no value to anyone. You can actually make the data that you have work for you by choosing who to trust and enabling that data to be combined because the power is where you connect the dots.

If we can connect the dots between, say, the hundreds of millions of users on Zillow's site with the types of user or clients that you have transactions with, and find who are the people that are the best leads for you, those are the ways that

we can actually combine information to make it useful for everybody in question. It means a better experience for consumers to find the right agent, better likelihood of closing a transaction for an agent, and then you end up with just a win-win all around.

I think that there are lots of examples that you can think of, of data information that you have and how that can be used, when combined with a broader set of data, to actually provide benefit to you. That's how I would look at it.

JOHN BERKOWITZ: I think no progress is going to come out of fear and hoarding. Frankly the industry needs to wake up and realize that the majority of the data that it's trying to protect is not its data. I mean, it's consumers' data on their homes and their behavior. I think embracing that and then figuring out how to get access to clean data and collaborate with it is the right intention. And I think that is one thing that real estate's going to have to change because other people are going to come in and get it in different ways, if people don't embrace that. I think that's a hard thing to realize because that's been the asset.

PREM NATARAJAN: One thing across all industries, the new entrants argue for data to be free. They get entrenched. Suddenly the data becomes proprietary because they've added incredible value to the data, and now they won't give public interface. This is sort of a tired



It will impact the industry. The job of the agent, the role of the agent, is safe. The role of every agent is not safe because at the end of the day, if this does not create efficiencies, people will be spending a lot of money on nothing."

- Russ Cofano

discussion of mine. I think I agree with you. I'm sure you have your own reasons to take it, but it is my data. It is my house. It is my property; right? It is my government, the town that owns the data; right? I think the longer term trend here is I think sooner or later, with all the other stuff that's been going on, there's going to be a reassertion of the individual ownership of data, and then maybe we create some kind of societal data model where things are shared, where there are no intermediaries.

I mean, from the customer's perspective, what do we care who it is that asserts they own that data? It's our data. I'm sure Zillow feels like certain data should be free, but not others. And I would feel the same way in different positions; right? But it's all about value addition. I don't know if you're going to get to it later, but there's one thing, as I was thinking about this panel I was wondering, there are all kinds of regulations or laws that the real estate industry is subject to, especially with respect to discrimination or fairness.

In machine learning, we will often say the models are just as good as the data used to train them; right? Now, that in itself might be a problem in the sense that, if you predict a certain demographic or a certain kind of thing, it's more likely to close the transaction faster. Therefore you always, as a machine, recommend that that's the most logical choice to make. Now certainly over time you've built up a profile of

provable discrimination; right? The problem might actually be more vexing than that because there are researchers, not me, who are focused on the fairness, analysis of the fairness of machine algorithms, and there is evidence that at least in some cases these algorithms can amplify the biases in data. For example, there's a researcher at UCLA who's working on studying - everybody's heard about automatic generation of captions for images and videos. This is sort of hot stuff, for what, three or four years now. Well, if you show it a picture of somebody in a kitchen chopping vegetables, if you look at it, 84 or 85 percent of the time, according to this analysis, it predicts that it's a woman working in the kitchen.

Now, it turns out that the underlying data is distributed two thirds/one third, which is like two thirds of the pictures do show women in the kitchen, and one third show men in the kitchen. But the model has learned it and then amplified that bias to where now you can actually say the bias is 85/15 percent or 84/16 percent or whatever it is.

In that case, it's sort of a nice academic topic, but when it comes to transactions and somebody's sort of life or their home for their family, it's far less tolerable. It's intolerable maybe is the right word to use in that [sense of] discrimination. I think as you deploy AI into the world, especially in a place like real estate where already there's a case to be made

that there are inbuilt biases in the system, I think this is going to become an important challenge for the community of AI developers for real estate because guess what? Because it's all instrumented, there is a track record.

You might own the data until a judge says "Show it to me;" right? Then you don't own the data, and then you have a recorded set of transactions. Now you're going to show those transactions, and it's going to prove whether or not there was discrimination in the system. I think a case can then be made. The company is responsible because how could you possibly say you were unaware that machine-learning algorithms learn from data? You were the one who kept saying they learn from data. So I think there are these inherent risks, especially for sectors like this.

JOEL SINGER: We were recently talking about in the context of dating sites because dating sites obviously show discriminatory behavior. Then that does get amplified in a whole series of ways. In real estate you actually have a problem that is a documentable problem in terms of the ability to attract diversity to neighborhoods.

PREM NATARAJAN: But it's also a legal issue; right? On a dating site it's bad; it's distasteful; it's not good for society. And it's bad PR, and it might close it down. But here you have a legal...

JOEL SINGER: It's a huge legal

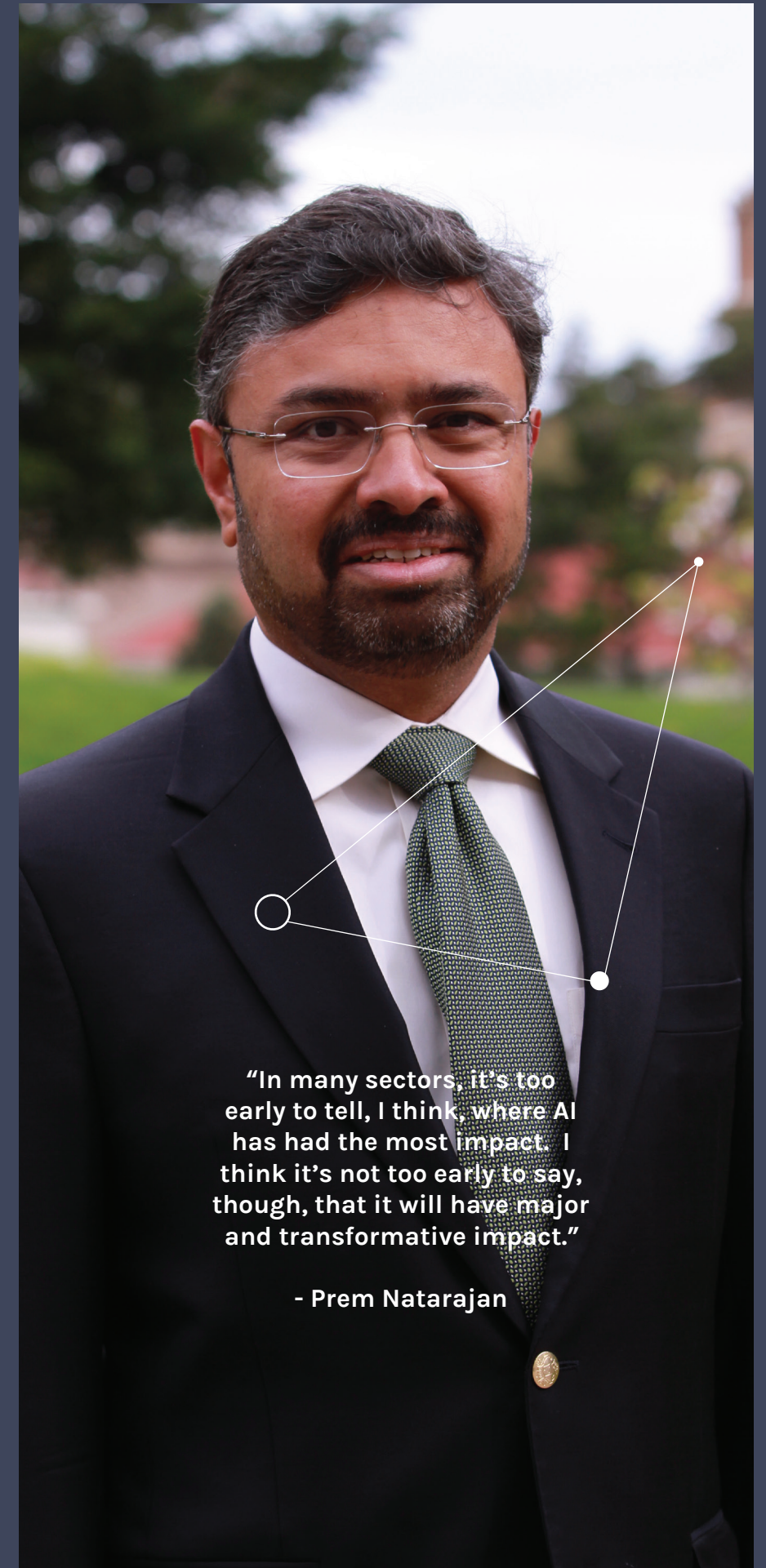
issue, absolutely.

PETER JONAS: How would I think about my resources and where I would open the door to my data? There are a couple of things. One, you have to have trust, so you need to trust the company; right? How are they using the data? How are they thinking about the data? How are they thinking about you? Are you a partner or are you something that just is an ends to a means?

The second thing is alignment of their business model. So as you look at their business model, are they making money off of you? That's fine for them to make money. Everyone needs to. But are they making more money when you make more money, or is your performance completely uncorrelated with their success? So I think that's a good thing to think about.

Then, finally, you want to pick a winner. This is going to be a world where there are going to be winners and losers from a technology perspective, those that are able to build the future of real estate. And you guys want to find your way, whether it's picking specific technologies like OJO or going to a brokerage like Compass, you want to pick someone who's going to be in the victory circle or on the stand at the end of this whole thing.

JOHN BERKOWITZ: Totally. I think you need to trust them and their intents. Right? I think that goes back to the first thing, which is trust. Is their intent to go out there and, excuse my language, but screw you any way they can just to get to their ultimate des-



"In many sectors, it's too early to tell, I think, where AI has had the most impact. I think it's not too early to say, though, that it will have major and transformative impact."

- Prem Natarajan

tinuation, or is their intent to go out and build a business that actually benefits you? That's a great question: Who's going to be a winner? If I could do that, I'd be on an island somewhere and it would be my island.

PREM NATARAJAN: Should the community be pushing for some kind of standardization of these algorithms so that they don't pay a price for picking the wrong thing; so that there's some interchange, standard, there's some ways in which things can be processed back and forth?

Data wants to be free, data also wants to sort of flow easily; right? So the way you can make it flow easily if there are standards that are set up saying this is how we expect things to process this input; this is the kind of format in which we expect the output.

JOEL SINGER: Data standards is obviously a discussion, and it's one that's been ongoing. But with an industry this fragmented, the tendency has been not to create a binding standard. And then I think it would be fair to characterize the industry as not really being focused on where their data resides and under what rule it resides. And I think the point out of all of this discussion, and maybe even more so, how many of you watched the Facebook discussions in Washington? Again, the data has real value. In the case of that business model, the data is the value equation. That's why you don't get charged to be on Facebook, right, because

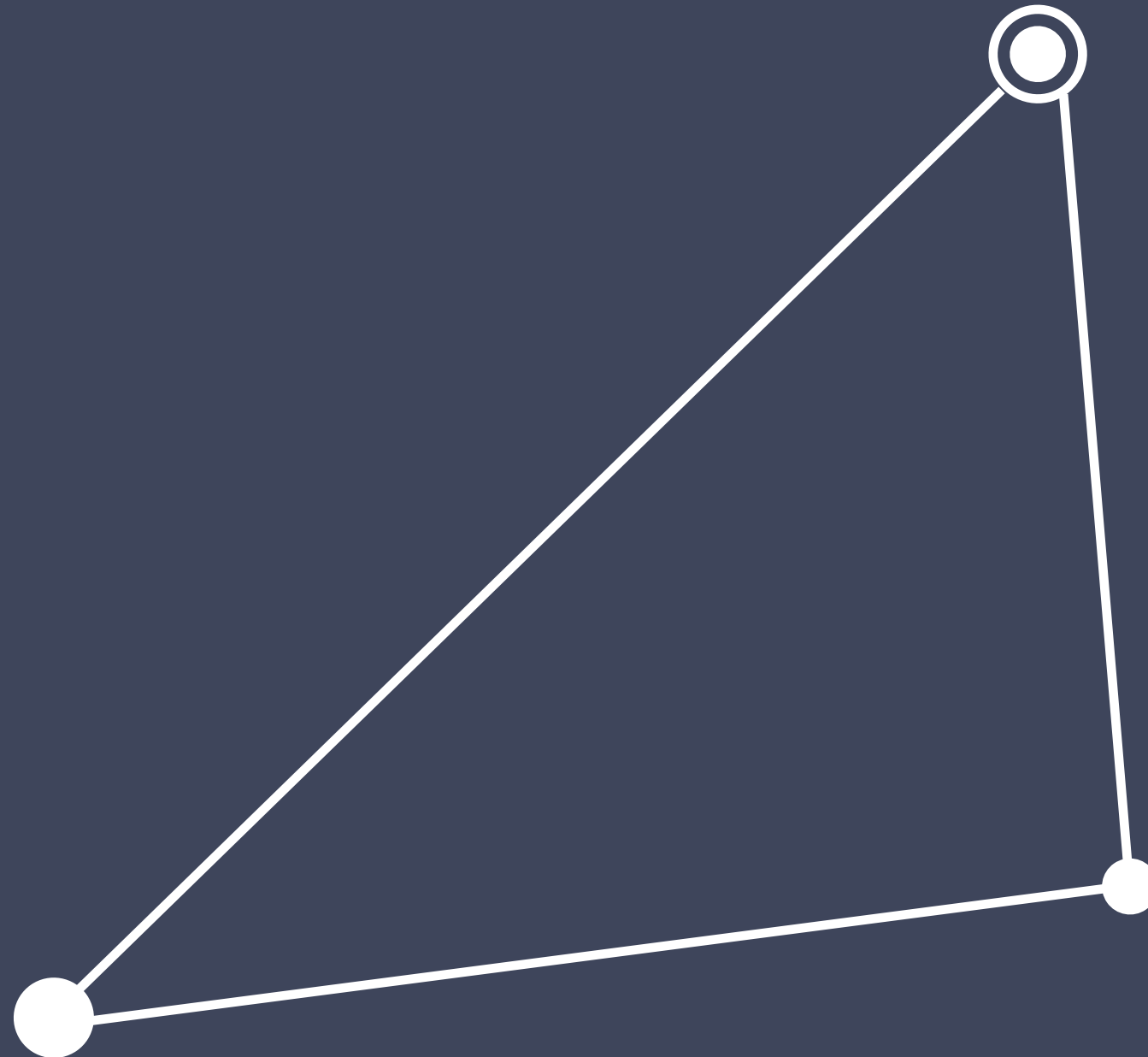
they can monetize your data in different ways.

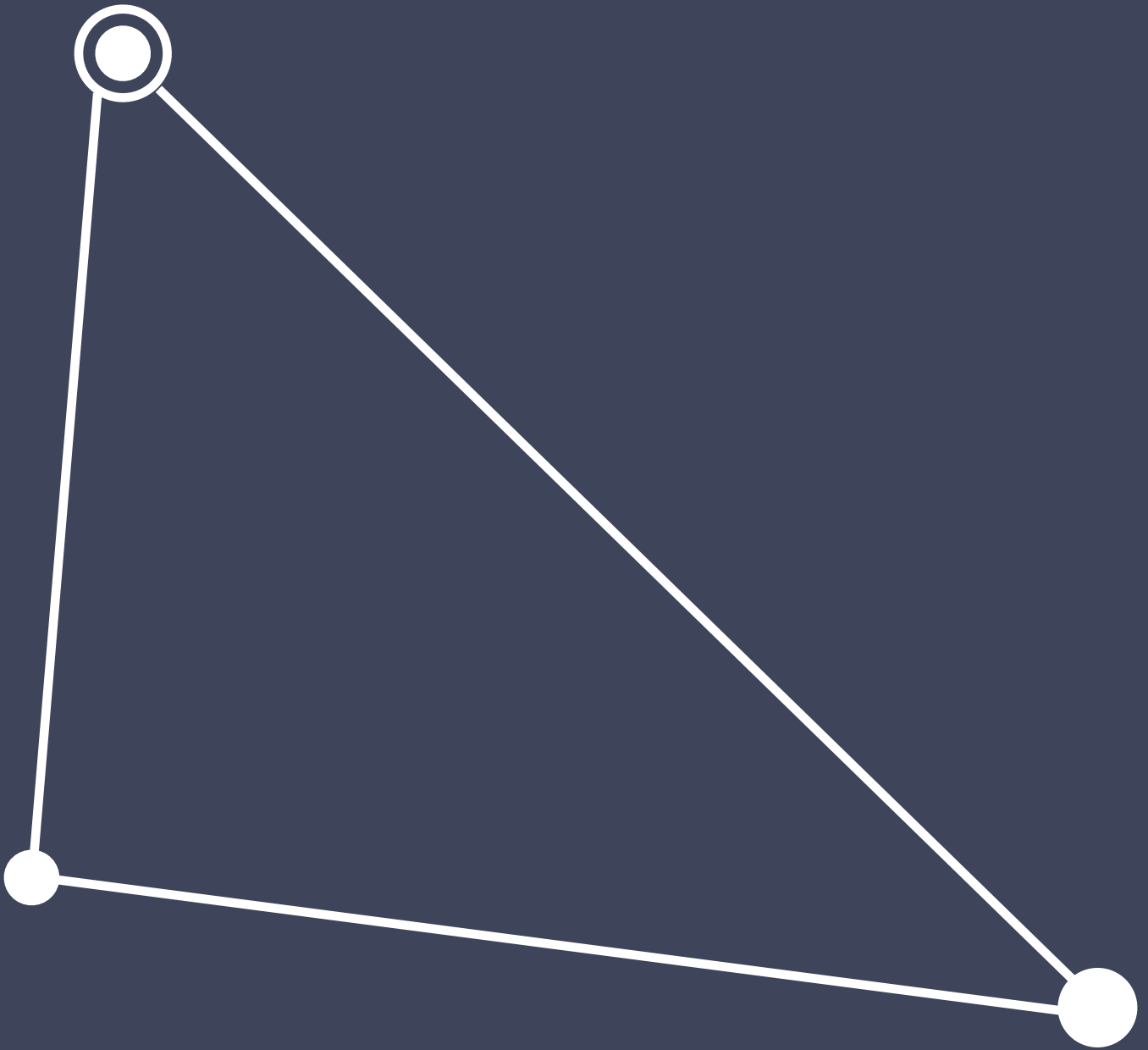
We haven't had that kind of open discussion in this industry for a while. We had it in the context of fear. We had it in the context of keeping people out. I think we need to have that discussion in the context of the acquisition costs and the relative value. And then I think Peter's point on not so much about picking winners and losers, it's about which rules are the right rules, both for consumers and for those who aggregate the data.

I want to finish this conversation up by commending everyone who's here, because the one thing I'm convinced of is, observing this industry for a long time, is that the best agents are the agents who have all those interpersonal skills, all those relationships, all the emotional intelligence, who then couple that with the best possible technology for the situation.

If you all do that, you're going to find that, not only are you successful, but you're going to be among those agents who are highly valued as expert advisors, as neighborhood experts, as trusted companions when you go into this terrible, terribly difficult field of securing a home.

What you do is so very important. You put people into houses. You change their lives. Using technology that makes you better is going to be the answer to a lot of things.





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