Following is the full transcript of voice expert Rébecca Kleinberger’s presentation talk: **Why You Don’t Like the Sound of Your Own Voice** at TED Talk conference.

Rébecca Kleinberger – Voice expert

If you ask evolutionary biologists when did humans become humans, some of them will say that, well, at some point we started standing on our feet, became biped and became the masters of our environment. Others will say that because our brain started growing much bigger, that we were able to have much more complex cognitive processes. And others might argue that it’s because we developed language that allowed us to evolve as a species.

Descent of the larynx

Interestingly, those three phenomena are all connected. We are not sure how or in which order, but they are all linked with the change of shape of a little bone in the back of your neck that changed the angle between our head and our body. That means we were able to stand upright but also for our brain to evolve in the back and for our voice box to grow from seven centimeters for primates to 11 and up to 17 centimeters for humans. And this is called the *descent of the larynx*.

And the larynx is the site of your voice. When baby humans are born today, their larynx is not descended yet. That only happens at about three months old. So, metaphorically, each of us here has relived the evolution of our whole species.

And talking about babies, when you were starting to develop in your mother’s womb, the first sensation that you had coming from the outside world, at only three weeks old, when you were about the size of a shrimp, were through the tactile sensation coming from the vibrations of your mother’s voice.

So, as we can see, the human voice is quite meaningful and important at the level of the species, at the level of the society — this is how we communicate and create bonds, and at the personal and interpersonal levels — with our voice, we share much more than words and data, we share basically who we are. And our voice is indistinguishable from how other people see us. It is a mask that we wear in society.

But our relationship with our own voice is far from obvious. We rarely use our voice for ourselves; we use it as a gift to give to others. It is how we touch each other. It’s a dialectical grooming.

But what do we think about our own voice? So please raise your hand if you don’t like the sound of your voice when you hear it on a recording machine. Yeah, thank you, indeed, most people report not liking the sound of their voice recording.

So what does that mean? Let’s try to understand that in the next 10 minutes. I’m a researcher at the MIT Media Lab, part of the Opera of the Future group, and my research focuses on the relationship people have with their own voice and with the voices of others. I study what we can learn from listening to voices, from the various fields, from neurology to biology, cognitive sciences, linguistics.

In our group we create tools and experiences to help people gain a better applied understanding of their voice in order to reduce the biases, to become better listeners, to create more healthy relationships or just to understand themselves better. And this really has to come with a holistic approach on the voice. Because, think about all the applications and implications that the voice may have, as we discover more about it.

Your voice is a very complex phenomenon. It requires a synchronization of more than 100 muscles in your body. And by listening to the voice, we can understand possible failures of what happens inside. For example:

listening to very specific types of turbulences and nonlinearity of the voice can help predict very early stages of Parkinson’s, just through a phone call. Listening to the breathness of the voice can help detect heart disease.

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And we also know that the changes of tempo inside individual words is a very good marker of depression. Your voice is also very linked with your hormone levels. Third parties listening to female voices were able to very accurately place the speaker on their menstrual cycle. Just with acoustic information. And now with technology listening to us all the time, Alexa from Amazon Echo might be able to predict if you’re pregnant even before you know it.

So think about the ethical application of that. Your voice is also very linked to how you create relationships. You have a different voice for every person you talk to. If I take a little snippet of your voice and I analyze it, I can know whether you’re talking to your mother, to your brother, your friend or your boss. We can also use, as a predictor, the vocal posture. Meaning, how you decide to place your voice when you talk to someone.

And you vocal posture, when you talk to your spouse, can help predict not only if, but also when you will divorce. So there is a lot to learn from listening to voices. And I believe this has to start with understanding that we have more than one voice. So, I’m going to talk about three voices that most of us posses, in a model of what I call the *mask*.

So when you look at the mask, what you see is a projection of a character. Let’s call that your outward voice. This is also the most classic way to think about the voice, it’s a way of projecting yourself in the world. The mechanism for this projection is well understood. Your lungs contract your

diaphragm and that creates a self-sustained vibration of your vocal fold, that creates a sound.

And then the way you open and close the cavities in your mouth, your vocal tract is going to transform the sound. So everyone has the same mechanism. But voices are quite unique. It’s because very subtle differences in size, physiology, in hormone levels are going to make very subtle differences in your outward voice. And your brain is very good at picking up those subtle differences from other people’s outward voices.

In our lab, we are working on teaching machines to understand those subtle differences. And we use deep learning to create a real-time speaker identification system to help raise awareness on the use of the shared vocal space — so who talks and who never talks during meetings — to increase group intelligence. And one of the difficulties with that is that your voice is also not static. We already said that it changes with every person you talk to but it also changes generally throughout your life.

At the beginning and at the end of the journey, male and female voices are very similar. It’s very hard to distinguish the voice of a very young girl from the voice of a very young boy. But in between, your voice becomes a marker of your fluid identity.

Generally, for male voices there’s a big change at puberty. And then for female voices, there is a change at each pregnancy and a big change at menopause. So all of that is the voice other people hear when you talk.

So why is it that we’re so unfamiliar with it? Why is it that it’s not the voice that we hear? So, let’s think about it. When you wear a mask, you actually don’t see the mask. And when you try to observe it, what you will see is inside of the mask. And that’s your inward voice. So to understand why it’s different, let’s try to understand the mechanism of perception of this inward voice.

Because your body has many ways of filtering it differently from the outward voice. So to perceive this voice, it first has to travel to your ears. And your outward voice travels through the air while your inward voice travels through your bones. This is called **bone conduction**. Because of this, your inward voice is going to sound in a lower register and also more musically harmonical than your outward voice.

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Once it travels there, it has to access your inner ear. And there’s this other mechanism taking place here. It’s a mechanical filter, it’s a little partition that comes and protects your inner ear each time you produce a sound. So it also reduces what you hear.

And then there is a third filter, it’s a biological filter. Your cochlea — it’s a part of your inner ear that processes the sound — is made out of living cells. And those living cells are going to trigger differently according to how often they hear the sound. It’s a habituation effect. So because of this, as your voice is the sound you hear the most in your life, you actually hear it less than other sounds.

Finally, we have a fourth filter. It’s a neurological filter. Neurologists found out recently that when you open your mouth to create a sound, your own auditory cortex shuts down. So you hear your voice but your brain actually never listens to the sound of your voice. Well, evolutionarily that might make sense, because we know cognitively what we are going to sound like so maybe we don’t need to spend energy analyzing the signal. And this is called a **corollary discharge** and it happens for every motion that your body does.

The exact definition of a corollary discharge is a copy of a motor command that is sent by the brain. This copy doesn’t create any motion itself but

instead is sent to other regions of the brain to inform them of the impending motion. And for the voice, this corollary discharge also has a different name. It is your inner voice. So let’s recapitulate.

We have the mask, the outward voice, the inside of the mask, your inward voice, and then you have your inner voice. And I like to see this one as the puppeteer that holds the strings of the whole system. Your inner voice is the one you hear when you read a text silently, when you rehearse for an important conversation. Sometimes is hard to turn it off, it’s really hard to look at the text written in your native language, without having this inner voice read it. It’s also the voice that refuse to stop singing the stupid song you have in your head. And for some people it’s actually impossible to control it. And that’s the case of schizophrenic patients, who have auditory hallucinations, who can’t distinguish at all between voices coming from inside and outside their head.

So in our lab, we are also working on small devices to help those people make those distinctions and know if a voice is internal or external. You can also think about the inner voice as the voice that speaks in your dream. This inner voice can take many forms. And in your dreams, you actually unleash the potential of this inner voice. That’s another work we are doing in our lab: trying to access this inner voice in dreams.

So even if you can’t always control it, the inner voice — you can always engage with it through dialogue, through inner dialogues. And you can even see this inner voice as the missing link between thought and actions.

So I hope I’ve left you with a better appreciation, a new appreciation of all of your voices and the role it plays inside and outside of you — as your voice is a very critical determinant of what makes you humans and of how you interact with the world.

Thank you.