Working with SynTouch and the Toccare

The Toccare™ successfully mimics the interactions of the human hand exploring a material and captures the sensations thereby obtained. Each material can then be described according to the **fifteen dimensions of touch** – The SynTouch Standard®. Some customers are satisfied to work with these values, akin to having the 'RGB' values of color, but for the haptic properties of materials. Others require a more nuanced analysis to relate the SynTouch Standard dimensions to their existing human testing data, analogous to understanding what constitutes a 'favorite color'. Here are some ideas for how to go about such an analysis.

Once we understand your application, we review the human preferences and testing data that you may already have available for your specific materials:

Qualitative Descriptions:
- Denoted 'best,' and 'worst' due to their overall tactile impression.
- Rated according to the 'most' and 'least' of the attributes you desire.
- Described via free-text association by reviewers.

Quantitative Assessments:
- Ranked by order of preference: first, second, third, etc.
- Assigned values for individual attributes by human judges, i.e. 'Softness values' of 13, 15, 25, etc.

No Available Human Testing Data
- If you do not have human testing data we can provide you with full-service options to acquire it.

We also review your desired outcome from our testing. Three categories for analysis are:

- **Similarity scores that compare how closely new samples feel to an ideal specimen.**
- **Grades for samples feeling 'best' to 'worst' on a scale unique to your materials.**
- **Values on custom dimensions that correlate with your current attributes, e.g. 'Soft.'**

If you purchase or rent a Toccare, we will coordinate these reviews and evaluations to happen before or during your installation period. If you are opting for services, this can happen independently of the future purchase of your Toccare. In either case SynTouch will safeguard your confidential data and analysis - the bespoke data processing that we develop is **your exclusive intellectual property**. There are myriad possible configurations for these studies that are best discussed in person. One example of this process is outlined below to provide a conceptual framework.

Suppose your company is an automotive OEM building a next-generation automobile interior. The head interior designer has specified a material as the 'best' leather for seats – a luxurious full-grain sample – that you simply can't buy at the price or quantity that you need. You've sourced a few inexpensive alternatives that your suppliers say feel closest to the sample you're trying to match, but they don't feel exactly the same. Both the head of interior design and your charismatic design-oriented CEO were able to blindly evaluate and rank the samples, and consistently preferred the full-grain sample as their 'number one' choice, and the others in a fairly consistent decreasing rank. Clearly, they have a preference for some feel in the samples. Your CEO described how they

Control the Feel of Your Products in 7 Easy Steps:

1. Discuss your products and needs

2. Share your human-based material evaluations

3. Send samples of your materials

4. Test your materials

5. Share test results and custom analysis

6. Provide ongoing testing as a service and/or

7. Install your own BioTac Toccare

vary in how 'lux' they feel. While you get what he means in principle, nobody at your company can define what it means in terms that you can quantify, specify and use to guide design and procurement. For your CEO, 'lux' seems to be some combination of softness, smoothness and warmth, but that's too vague for your needs.

SynTouch will talk with you about your application and your current materials challenges. SynTouch will sign your NDA so you can send us material examples and your existing data for analysis. We inspect the samples to make sure there are no technical issues before testing. Fortunately, we've worked with many samples like this and can test your leathers immediately. Your data allow us to understand your current situation: you have **qualitative descriptions** (one sample is denoted 'best'). You also have **quantitative assessments** (candidate samples are ranked first, second, third, etc.). You do not have human-based dimension measurements, i.e. 'lux values' are not rated for each sample.

You indicated in our teleconference that you wanted to know how close various samples would be to that 'ideal' leather. With your samples now tested by the Toccare ,we determine that a few additional leather samples from our own materials library would help to flesh out the data used to solve your problem. We ship SynTouch's leather samples to you to have your CEO evaluate these on the same scale – i.e. to rate his or her preference for each.

With your ranked samples, we can evaluate the psychophysics that your CEO is applying to the leathers. Each observer relies on a different weighting of key attributes, which leads to differing opinions about the 'best' values for each of the fifteen dimensions of touch. Some people have their main preference for leather driven by our adhesive dimension – values that are too high are perceived to be "tacky" like artificial leather made from vinyl. Other people notice the subtle variations in texture – macrotexture regularity plays a critical role in differentiating between artificial leathers that often have a repeated pattern and natural leathers that are always unique. 'Lux' is probably related to both of these attributes and perhaps others.

We find that the dimensions of adhesion and macrotexture regularity combine to drive the majority of correlation to 'lux' for the complete set of samples. For adhesion, the synthetic leather alternatives that were graded had either higher or lower adhesion than the ideal sample. For macrotexture regularity, we find that your CEO consistently preferred samples with lower regularity. The results of our analysis are compiled in our report to you.

We also compute a **bespoke metric** using these two dimensions and provide you with an objective measurement of 'lux' You can readily validate our metric by testing additional samples and verifying that your CEO and your bespoke algorithm produce the same rank ordering. From now on, samples of any new candidate material can be measured by this bespoke ranking algorithm and you can calculate how far away from the ideal leather each will be perceived by your CEO.

It is possible that other attributes such as compliance or heat transfer will become more relevant if you start to work with a wider range of materials and composites. Individual dimensions can be used to **steer the development** of new samples by your suppliers. The leather samples that are close to the ideal can have their textural, adhesive, compliance or thermal properties adjusted by the providers to come even closer to those of the ideal sample. The BioTac sensor at the heart of the Toccare collects all of that information. The SynTouch Standard includes virtually every attribute that a human can perceive and the Toccare keeps that information in the database for every sample you ever test. If your challenges change, we can **update your metrics** easil

You can now go back to your CEO and say that you can capture his or her preferred feel, objectively quantify it, and transmit the needed information so that your suppliers can adjust their leathers to better match his or her preference. If you decide to purchase your own BioTac Toccare, we will include your bespoke algorithm in your instrument, allowing you to capture this custom measurement in-house. Then you will have an objective measurement that is the equivalent to your CEO personally performing **quality control** tests on every incoming batch of materials.

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