There are four experiments being done that will utilize Pianos, and each will have different functionality, so each will likely need specific tailoring.

**EXPERIMENT ONE – Pilot Study**

This is the most documentation-intensive of the experiments. It will need a lot of question-and-answer functions, and some new tools.

Each mark will be shown for Analysis ONLY (no comparison phase).

As each mark is shown, I would like to be able to force the participants to consider only a single aspect of Analysis at a time.

I would also like to be able to provide a tutorial on compound minutiae terminology, one on Target Groups, and another on Level 3 Detail before they begin any markups – can this also be done within Pianos as demos?

Level One

When the mark is first presented, I would like the participants to focus on the Level I detail. There should be a drop-down menu for them to select the pattern type of the mark, with one of the options being “I would consider more than one pattern type”. If this option is selected, the participant should then be presented with checkboxes (of all the remaining pattern type choices) so that they may select all of the pattern types they believe the mark may be.

Once a pattern type is selected, the participant should be presented with the following questions regarding pattern:

* Is it rare? (Christophe and I need to come up with an answer scale for this)
* Is it recognizable?
  + The answers to this can be a drop-down where they can select something like: Run-of-the-mill, Somewhat unusual, Highly Distinctive (I would like to have text and images to explain these choices to the participants – I don’t care where this is done. It can be within Pianos, or with the written instructions that are provided to participants before they sign in).
* Is there risk? (For this, there should be two answer categories):
  + Checkbox options for: Low clarity, Low contrast, Background interference, Distortion, Overlaid print or Double-Tap, Scarring, Misaligned Ridges, and No Risks
  + Also a drop-down category from 1 to 10 (with text to explain that 1 is no risk and 10 is very risky)
* Is it useful?
  + Checkboxes to indicate: This pattern type would help me make my Analysis decision; This pattern type would carry weight during the Evaluation decision; This pattern type would aid me in searching; and I would give no weight or particular notice to this pattern type

All these questions can be asked in the GP popup (while some, if not most, of them should be dropped in the general PiAnoS trunk)

Level Two

*Minutiae*

Because we are interested in compound minutiae as well as ridge endings and bifurcations on their own, and because we want consistency (as much as possible) in how people are marking features, I would like Pianos to drive this process. I would like to have a demo in which a high quality mark is shown and we demonstrate (through some kind of highlighting?) an example of each type of minutia of interest.

When it comes time to mark up the actual mark, I would like to have a minutia tool that allows for compound minutiae. In other words, if it is a ridge ending or a bifurcation, the current method of a single click with a directional drag will work. But if it is a compound minutia (for instance, a lake/enclosure), two clicks will be needed to define the two portions of the feature (in this case, each bifurcation that makes up the enclosure), but the program should recognize this as a single compound minutia.

In order to ensure that only minutiae that we define are marked, I would like to have a list of our minutiae of interest (possibly on the right hand side of the screen where there is a lot of white space available). The participant should be able to select each minutia type one at a time, and while it is selected, mark all minutiae they see OF THAT TYPE. They will then move onto the next type, until all have been considered. If they do not see any minutiae of a given type, they should be able to somehow note that there are none present/noted in the mark.

As EACH MINUTIA (whether simple or complex) is designated on the mark, the participant should be prompted to answer a series of questions about that minutia. It doesn’t matter to me where on the page this occurs or how it looks, as long as they are forced to answer the questions before moving on.

The questions that should appear for each minutia are:

* Is it rare? (Christophe and I need to talk about how to score this one)
* Is it recognizable?
  + The answers to this can be a drop-down where they can select something like: Run-of-the-mill, Somewhat unusual, Highly Distinctive (As with the same questions above, I would like to be able to provide text and examples for each category)
* Is there risk? (For this, there should be two answer categories):
  + Checkbox options for: Low clarity, Low contrast, Background interference, Distortion, Overlaid print or Double-Tap, Pattern Force Area, and No Risks
  + Also, a drop-down category from 1 to 10 (with text to explain that 1 is no risk and 10 is very risky)
* What is your confidence in:
  + The presence of the minutia (Drop-down: Low, Medium, High)
  + The identity of the minutia (Drop-down: Low, Medium, High)
* What weight do you assign to this feature? (Drop-down on a scale of 1 to 10 with text to explain that 1 means they give it no weight and 10 means they give it the most weight they would give to any feature)

This is quite a big TODO, but nevertheless it can be done, using a specific popup that fills “advanced” properties for minutiae.

*Target Groups*

I would like to have a new “Target Groups” Tool. This tool would be used to designate target groups that the participant would consider, both in making an Analysis decision, and for searching, were they to take this mark on to Comparison.

The things I would like this tool to be able to do are:

* Select the tool
* Click on multiple minutiae that comprise the target group
* Have a way to STOP adding minutiae to the target group (and have the flexibility for different target groups to be made up of different numbers of minutiae)
* Have the ability to create more than one Target Group in a particular mark.

Can we somehow force that all minutiae are selected, as above, prior to being able to use the Target Group tool? Also, I would like some tutorial on how to appropriately define and select a Target Group. Is this best done within Pianos, or separately, prior to beginning the study?

Quite a big TODO, but if it’s needed, this can be done – although the mean doesn’t really matter (new shiny tool, or quick-n-dirty hack)

Level Three

Christophe, we spoke about defining for the participants what we consider to be operationally useful L3D that we would like them to focus on. I like this idea. I wonder if we should do a pre-survey before participants begin the study in which we list a number of features that are often considered L3D and ask for each one: (1) Do you consider it to be L3D; and (2) Do you actually *use* this type of feature and give it weight in casework? I think it might be interesting to see if there are things (like pores) that are traditionally thought of as L3D, yet nobody actually uses.

Pre-survey aside (the results of which might inform how we think about L3D in the main study), Christophe and I need to select the L3D features that we feel are operationally useful and somehow give the participants examples of what these details look like in a real mark (again, to try to maximize consistency in interpretation).

Once this is done, we need a way to have participants document in Pianos what they see. I’m not sure what this would look like. Should we simply have them mark off each TYPE of L3D they note somewhere in the mark? Or do we want them to somehow mark the specific instances that they see? It seems that the first way is much simpler, although it gives less specific information. I don’t think we need the current polygon-based “Other” tool that exists. I don’t think it captures the information we are aiming at.

Again, as in the previous two categories, I would like to ask questions regarding each L3D that is documented. I believe this can be done categorically (i.e. if the participant selects that TYPE of L3D as being present, we can then ask the questions about it, rather than depending on each INSTANCE of the detail, but I would like to hear Christophe’s thoughts on this).

For each L3D documented, we ask:

* Is it Recognizable? (Same answer categories as above)
* Is there Risk?
  + Checkbox options for: Low clarity, Low contrast, Background interference, Distortion, Overlaid print or Double-Tap, and No Risks
  + Also, a drop-down category from 1 to 10 (with text to explain that 1 is no risk and 10 is very risky)
* What weight do you assign to this feature? (Drop-down on a scale of 1 to 10 with text to explain that 1 means they give it no weight and 10 means they give it the most weight they would give to any feature)
* How likely would you be to move toward an exclusion decision if you did *not* see this feature in the print? (Drop-down on a scale of 1 to 10 with text to explain that 1 means it would not affect their decision and 10 means that they would give heavy consideration to an exclusion if they did not see the L3D in the print)
* It would also be nice to have a text box in this section where participants could describe anything unusual they noted that they categorize as L3D

Clarity

I would like to leave the Quality tool that already exists in place and request participants to use it to mark areas of high, medium, and low clarity. Once they are done, I would like to ask them:

* What is the overall clarity of the mark? (Drop-down for: High Clarity – features clearly visible through the mark; Medium Clarity – features clearly visible in approximately half the visible area; Low Clarity – features clearly visible in only a limited area; Very Poor Clarity – features difficult to make out)
* Does the clarity of this mark impact your Analysis decision? (Drop-down for: The clarity of this mark adds weight to my desire to keep the mark; The clarity of this mark adds weight to my desire to discard the mark; and The clarity of this mark does not impact my Analysis decision either way)

Distortion

I would like a series of questions dealing with the distortion that was observed in the mark. We should ask:

* Overall, how much has distortion impacted this mark? (Drop-down for: High Distortion – There are major distortion factors that severely impact the interpretation of the mark; Medium Distortion – There are areas of significant distortion, but also areas of low distortion with usable features; Low Distortion – There are minor distortion factors that are easily explained or worked through; No Distortion – There are no distortion factors that impact the interpretation of the mark)
* Did you discount data that were in the distorted area(s)? (Drop-down for: Yes; No; N/A – there was no distortion impacting the mark)
* Did distortion impact your overall Analysis decision? (Drop-down for: Yes; No; N/A – there was no distortion impacting the mark)

Other Factors

Christophe, what I have described so far does not include any data capture on Area (size of the mark), Distal Orientation, or Anatomical Source. While I think that these all have a place in the Analysis of a mark, and I had included them in my original questionnaire, I am not sure they have a place in this research. The trouble I have in thinking about this is: (1) if our research uses only fingerprints, anatomical source is not relevant; (2) if we present the marks already correctly oriented, Distal Orientation is not relevant; (3) Do you think we should include area? It could be done with just questions, like the Distortion section…

Basically, do you think there is value to trying to keep these components in? It would be nice to collect data on every aspect of Analysis to feed to Hugin and see if they deserve any weight. On the other hand, they seem clunky and laborious to collect and I suspect that, while they are considered during Analysis, they don’t add much to the final decision. What is your thought on this?

Analysis Decision

At the end of Analysis, I would like to force the participants to subjectively assign levels of value to the mark in a number of categories. For each category set, I would like the participant to HAVE to choose one answer, but be able to choose only ONE answer. Radio buttons would probably be best for this.

The categories would be as follows:

* Value Decision
  + Of Value
  + Not of Value
* Complexity
  + Complex
  + Non-Complex
* AFIS Quality
  + AFIS Quality
  + Not AFIS Quality
  + AFIS Quality, but Additional Caution Recommended
* Difficulty
  + Easy
  + Medium
  + Difficult
* Appropriateness for a Conclusive Decision
  + A conclusive decision (Identification, Exclusion) would be appropriate
  + There is enough information here to do a comparison and possibly find information in common (or not in common), so the mark has probative or investigative value, but there is not enough here to warrant a definitive conclusion
  + This mark lacks sufficient information to proceed with a comparison

I would like each of the above categories to have text or a help bubble available to fully explain the category options to the participants.

All these aspects (Clarity, Distortion, Other Factors, Analysis decision) constitute a “final” questionnaire – which could be split into sub-parts (using a kind of wizard with pages 1-2-3-4).This is a really big TODO, and it needs a more precise specification before we go on. Take a sheet of paper, and draw the wizard with the appropriate questions/pages/behaviours, remove all question marks, and we can go on.

**EXPERIMENT THREE – Documentation** (\*\*You didn’t miss Experiment Two – it just has no Pianos needs)

This experiment will also deal with Analysis phase ONLY.

Participants will be broken into three groups, and each will have slightly different tools available to them.

Group One

This is the control group. They will be shown marks, and asked to consider features in several categories (the categories have not yet been determined, but will be things such as: number of minutiae, overall clarity of the mark, rarity of the features, etc). This group will be given NO TOOLS to mark up the mark. They will simply look at the mark. At the end of their Analysis, they will be asked to give their Analysis decisions. These categories will be the same ones listed above, under “Analysis Decision” for Experiment One.

Group Two

Experimental Group 1. This group will be shown marks and will have all the same tools, and questions asked, as in Experiment One, above (except that we may have cut some of the categories, based upon what we learned in Experiment Two).

There is one possible main difference here from Experiment One, depending on what Christophe thinks… Christophe, read ahead to Group Three, and then come back to read this and tell me what you think of this. Since Group Three will have a separation between when they annotate the mark and when they make the final Analysis decision, should this Group follow the same structure so that we can directly compare the two? That way, we are holding the variable of time between annotating and making an Analysis decision steady. Or do you think it is better to have Group Two complete the entire Analysis in the natural way (i.e. annotate and make the decision in a single process) and compare that to the group that only has access to their high-quality annotations?

Group Three

This group will have all the same tools and questions as Group Two. The difference is that they will NOT make the Analysis decision at this time. They will simply annotate each mark, and then be moved onto the next mark. Once all of the marks have been annotated, they will be presented all of the same marks again (in a random order). They will be shown these marks with their own annotations; however, only the areas and features that they marked with high confidence will be visible to them. Thus, they will not be allowed to consider low confidence information while making their Analysis decisions. Pianos will have to mask the areas that were marked with low confidence during the original annotation phase.

(Note: if Group Two is asked to make their Analysis decisions as a separate step as well, they also will be shown the same marks in a random order and when they see them the second time, ALL of their saved annotations will be visible to them).

**EXPERIMENT FOUR – The Main Experiment**

By this point, the new metric/decision engine should be running, based on the data collected in the pilot study. So, we can dispense with all the risk, rarity, etc questions that we were asking during Experiment One. We are still dealing with Analysis phase ONLY.

For this experiment we will show a mark, and all of the tools for mark up will be available IF THEY WANT to use them, but they will not be directed, or required, to use them. The only requirement will be that they answer a new set of questions about what they see, and that they do the final value determinations in all of the categories from Experiment One.

The only trouble here is that we won’t know what set of questions we need to ask them until we have completed the pilot study, fed the data to Hugin, and determined what our data of interest are.

I would like to still include all of the tutorials (the three we spoke about in Experiment One) in this experiment. So, if they were in Pianos before, they still should be now.

**EXPERIMENT FIVE – Validating the Metric for Final Outcomes**

This experiment is the first time that actual comparisons will be done. So, we will need a version of Pianos that can do both Analysis and Comparison.

The Analysis portion of this experiment will look just like in Experiment Four. The Comparison portion can look much as it does now, with the exception that we might add some additional possible conclusions.

**Overall**

I don’t think the questions that are currently located at the bottom of the Analysis screen (Distorion observed in mark; Quality of L1, L2, and L3 Detail; Suitability of mark) are needed. It would be nice to still have the Case Notes text box section.

Also, as I mentioned above, I don’t think we need the “Other” tool that is currently in Pianos.