Frist, it doesn’t read clearly.  There are a ton of typos and wording problems, especially in the last section. It’s often hard to see exactly what you mean.   I’m assuming that Mike or your colleagues will work closely with you in clearing that up.

One of my main points at your defense still holds in this draft.  This isn’t by any means approaching any kind of careful systematic study that, for example, the assistive or even the CHI community would do.  It’s not a scientific thesis, and shouldn’t pretend to be that.  What it seems to be is a bunch of design probes that you quickly tried out on people.  I’ll drill into a few examples of that below.  So you should say that up front - e.g., ‘that this is a series of design studies rather than systematic studies into the different implementations’ or something like this, so expectations are properly set.

Going further, you use strong words in this thesis like ‘prove’.  To be honest, you haven’t proven anything here, as I can find a zillion ways any one of your tests is flawed of falls short or istn’t exactly sure what you’re measuring.  So I’d not use the word ‘prove’ or ‘proven’ or even ‘have shown’ anywhere.  I’d say instead that you ‘see indication of’ or ‘our data hints at’ etc.  I also would be careful at calling anything ‘successful’ - your rate over chance isn’t very high for most of your rigs.  You have indications here - call it what it is.  They just aren’t great ‘senses' to rely on.

People doing this kind of work for real live with these systems.  They have people keep them on for days or longer, to really look at how the brain adapts to and assimilates the information - we talked about this at your defense.  You don’t do any of this - you have people try something for some minutes or an hour or so - no time to really explore what kind of adaptation or improvement you get with these new ‘senses’.  You should say this up front too - say that you’re not exploring long term adaptation with any of these rigs - just getting first impressions of fresh users.  It’s more of an HCI approach than a sensory approach.  You say this somewhere in the text, but it should be up front too.

I have a problem with the flat thesis structure - it’s hard for me to see what section is what and where they change.  You probably would want to adopt a more standard big heading for chapter transitions, with page break, etc.  That’s up to Mike.

Now specific comments as I read through.  Note that I didn’t point out any of the grammar or wording problems - there are way too many of them to isolate in the draft I have.

… and typically show up every (what - second or two? - what % of the time?).  I’d probably show this data as a point cloud rather than barbed wire, but you and Mike can decide.

You need a conclusion or something to this section that sums everything up - I’d say something like that this sensor is somewhat poor, especially compared to vision or human touch - as such, this may not be the best example of a practical application, but may be appropriate under some circumstances (e.g., in murky water, where they actually use things like this).  Tests were also limited, but indicated that users obtain between ??% and ??% accuracy in identifying simple objects during trials that last ?? min each.  You could also play with your signal-to-stimulation mapping as well - .e.g, playing with your vibration range, linearity, filtering, etc.  All of this could be tuned and optimized better, I’m sure, and a better sonar could be used too.  At least these plots show something of what you’re presenting to people through the vibration channel.

On pg. 53, I’m not sure what defines a session, and what’s the feedback that you give people.  You should be explicit here.

The horizontal axis in Figs. 46, 47, etc. should be labeled.

In your ‘smell explorations’ you should cite work in Ambient Media - perhaps the classic Ishii, Wizneki, etc. paper.  Smell is a good example of this.  There has been a ton of work in presenting smells in ubicomp, chi, IEEE sensors, etc. - cite some kind of survey or a set of illustrative papers here.

On pg. 64, don’t use ‘successful’ in the tile, per my above suggestion.

On pg. 68, cite a paper for DoppelLab, probably SciAm July (see our publications website).

Pg. 70 - I’m glad you put in this table.  In the top bullet, say ‘reasonable’ accuracy, not ‘high’ accuracy.  You don’t get a high accuracy here.  At bottom, don’t say ‘Glass Infrastructure’ since nobody knows what that means.  Say perhaps ‘Specific Locations’.

In your ‘Research Questions’ section, I mentally choked a ton of times - many more than I write below.  This section really needs a good rewrite that you have to do working closely with Mike.  It’s important as it points out the way your data is leveraged.  I trust Mike here.  But here are the quick comments:

- You talk about vibration on the first page and said it was good for analog data, but you didn’t try other modes, or give a metric as to how good.  Say this properly - your research didn’t show this.

The last sentence on pg. 72 is just dead wrong.  Would you give up your vision for any of your gizmos?  Hell no!  So don’t even hint at it!  What you should do instead is talk about how when nature does this and gets it right, it definitely supersedes vision in niches where other modes of sensing are appropriate.  Talk about and cite bats, for example - also dolphins.  We went over that a lot in class last spring and there’s a lot on the website including articles you can point at.

Top of next page ‘one over the other’ what ‘one'?  Later, don’t use the word ‘prove’ - don’t use it anywhere!

Later down, ‘very successful’ - hell no!  Don’t say that.

Next page  - ‘high level of accuracy’ - no you have nothing like this in the work you show here.  Don’t say this.

The last paragraph on pg. 74 is inappropriate.  There was no success here.  Only experiences that gave some rough indications.  Put this correctly.

Next page - ‘The Uniform’ ?  What is this?  You mean a wearable suite?  Say this appropriately and define it in the text.

On pg. 76, you have visual output too, which will be used for this kind of thing.  You have an argument why we don’t want to do this, but it will indeed happen, and is happening with AR.  You should say something about how visual will also be used in the right way for augmentation, at least until we have the implants.

OK, I read fast from there…

Be careful with ‘Contributions’ on pg. 94 - I don’t necessarily agree that they’re contributions.  They are more ‘Indications’ or something.  I have issues with your use of ‘accurately’ ‘good results’ and ‘were able to differentiate’ in the top few paragraphs.  Your systems aren’t accurate, your results aren’t really good for most of your tests, and they were able to differentiate only at a 70% or so level in many cases.  Qualify your results appropriately everywhere here.

Ditto for your ‘conclusions’ section.  Some sentences are wild - e.g., ‘The sense of vision is overused and it uses too much of the brain’s capacity’ - what do you really mean here?  You could say something like ‘Existing mobile user interfaces take too much of the user’s attention as they are based primarily on immersive visual experiences’.  Fix this whole section this way.  And don’t use the word ‘proven’ anywhere here- pull back.  You did some work, but it doesn’t justify your strong conclusions.

OK - I’ll wait until I get an email from Mike saying the thesis is up to his muster for signing, then I’ll sign.