Which ultrasound system do I need? FAQ

HARDWARE QUESTIONS

Q: *Can you outline the difference between the different systems?*

A: We offer two versions of hardware which are called EchoB and Micro. Both of them have the option of including a special port that allows audio to be precisely synchronised.

	EchoB (sync)	EchoB (no sync)	Micro (sync)	Micro (no sync)
Accurate audio alignment	✔	X	✔	X
CE and FDA approved	X	✔	X	✔
# probe elements	128	128	64	64
Image quality	See appendix	See appendix	See appendix	See appendix
Additional required components	PStretch, external soundcard & microphone	None	PStretch, external soundcard & microphone	None
Typical frame rate	56-89Hz	56-89Hz	61-119Hz	61-119Hz
Software that can be used with system	AAA & SonoSpeech	AAA & SonoSpeech	AAA & SonoSpeech	AAA & SonoSpeech
PC requirements	I5/i7 processor 1.8GHz min. 4 USB ports Windows.	I5/i7 processor 1.8GHz min. 1 USB port Windows.	I5/i7 processor 1.8GHz min. 4 USB ports Windows.	I5/i7 processor 1.8GHz min. 1 USB port Windows.
Size	165x125x62mm	165x125x62mm	106x105x21mm	106x105x21mm
Weight incl. 1 probe	2.2kg	2.2kg	0.6kg	0.6kg
Power requirement	Mains only	Mains only	USB3 (or mains)	USB3 (or mains)
Microconvex probe	5-8MHz 10mm radius 156 degree FOV FDA & CE cert.	5-8MHz 10mm radius 156 degree FOV FDA & CE cert.	5-10MHz 10mm radius 150 degree FOV CE cert. only	5-10MHz 10mm radius 150 degree FOV CE cert. only
Convex probe	2-4MHz 20mm radius 104 degree FOV FDA & CE cert.	2-4MHz 20mm radius 104 degree FOV FDA & CE cert.	2-4MHz 20mm radius 92 degree FOV CE cert. only	2-4MHz 20mm radius 92 degree FOV CE cert. only
Convex probe			4-8MHz 20mm radius 92 degree FOV FDA & CE cert.	4-8MHz 20mm radius 92 degree FOV FDA & CE cert.
Convex probe			2-4MHz 60mm radius 92 degree FOV CE cert. only	2-4MHz 60mm radius 92 degree FOV CE cert. only

Q: *What does the PStretch do?*

A: PStretch is a small pulse stretching unit. The sync port on the ultrasound system produces a pulse at the instant that each image is formed. Each pulse is only a few micoseconds in duration. This is

not long enough to register on a soundcard recording at less than 96kHz. The PStretch extends the duration of the pulses so that they can be recorded at 22kHz. The PStretch is powered via USB.

Q: *Can I use an EchoB probe with the Micro system or vice versa?*

A: No. Only probes designed for the make and model of system will work with that system. In general, probes from any other system will not work with either the EchoB or Micro.

Q*: I have a research system and my PC only has 2 USB ports. Can I use a USB hub?*

A: Yes but it must be able to supply enough power for all the connected devices. It is best to connect the ultrasound directly to a USB3 port and use a hub for the Soundcard, PStretch and USB license key.

Q: *Can I do research with a clinical system?*

A: Yes. You can use AAA with a clinical system to analyse your ultrasound images. The acoustic signal will only be approximately aligned. Good enough to find the segment you are interested in but not if your study involves the timing between articulatory and acoustic events or if you need to be sure of analysing a segment midpoint.

Q: *Can I convert my clinical system to a research system or vice versa?*

A: The synchronisation port cannot be added or removed after initial purchase. It is possible to purchase AAA software which will allow data recorded on the clinical system to be analysed.

Q: *Can I use a Mac?*

A: A mac can be used but it must boot into Windows operating system. MacOS is not supported. Some Windows emulators can be used but it is not recommended while recording.

SOFTWARE QUESTIONS

Q: *What is SonoSpeech?*

A: SonoSpeech is a software interface for either the EchoB or Micro systems. It records audio and ultrasound simultaneously. It also provides a simplified display with features that have been requested by clinicians to help in the provision of speech therapy. For example it allows markers and contours to be superimposed on top of the live ultrasound image. Refer here for further information:
https://strathprints.strath.ac.uk/63372/8/Cleland_etal_2018_Ultrasound_technology_for_optimising_the_treatment_of_speech_disorders.pdf

Q: *Must I purchase AAA or SonoSpeech software to use the EchoB or Micro?*

A: No. The EchoB and Micro systems come with default software called “Echowave II”. Echowave II is a standard ultrasound interface which does not allow speech acoustics to be recorded simultaneously. Nor does it provide ultrasound speech data that can be easily analysed. It can, however, be used to provide live display of the moving ultrasound image. Support for this software is limited.

Q: *Is SonoSpeech a part of the Micro or EchoB?*

A: Sonospeech is an optional software interface designed for speech therapy (or pronunciation training). It works with both EchoB and Micro hardware.

Q: *Does SonoSpeech work on its own?*

A: You can playback any recordings that have been made using EchoB or Micro systems but for live feedback you need one of these hardware systems to be connected to the PC.

SYSTEM CONFIGURATION

Q: *What portions of the systems are we able to mix and match?*

A: You can mix and match just about everything but EchoB probes only work with EchoB and Micro probes only work with Micro.

Q: *What is the difference between a research system and a clinical system?*

A: A research system is essentially an EchoB or Micro with a sync port added. This addition invalidates the medical device certification. So if CE or FDA approval is essential for your institution this option is not possible.

Q: *Which items make research systems, and which make clinical systems?*

A: To take advantage of the sync port a recommended research system includes:

- Ultrasound unit with sync port
- At least one probe
- PStretch (so that the sync signal can be recorded on a soundcard)
- Audio bundle (including external soundcard and microphone)
- AAA software (so that tongue contours can be fitted automatically and compared)
- UltraFit headset (to stabilise the probe relative to the head)

The clinical system does not need a PStretch unit. To keep the cost low and make connecting it easy a recommended clinical system includes:

- Ultrasound unit without sync port
- At least one probe
- SonoSpeech software (optional but strongly recommended)
- UltraFit headset (optional)
- External microphone (optional)

Note: PC [not supplied] also required and it must have a soundcard.

Q: *What system do you suggest for a University clinic whose primary purpose is clinical use but also wishes to collect data?*

A: If your research questions do not hinge on accurate relative timing of acoustics and ultrasound then purchase one of the clinical systems plus the AAA software (you will get a SonoSpeech license free with each AAA license). The micro is more portable, does not need to be plugged into the mains and less expensive with very similar image quality. If timing is important to your research then you would be better to purchase one of the systems with sync port. In that case if money is tight you

could purchase the ultrasound with sync plus SonoSpeech to start with then when more money is available, add the AAA software and the PStretch and Audio bundle later.

PERFORMANCE

Q: *What is the difference between EchoB and Micro in terms of data collection and image quality?*

A: The image quality is approximately the same for both systems. The EchoB is based on 128 element probes while the Micro uses 64 element probes. Normally the larger number of elements would allow sharper beamforming but the newer Micro electronics seems to compensate. The EchoB probes have a fractionally wider field of view. 156 vs 150 degrees for the microconvex and 104 vs 92 degrees for the convex. See Appendix A for example images.

Q: *The images look quite grainy. Can they be made smoother with clearer edges?*

A: Image quality is often a subjective thing. By processing the raw underlying data, it can be made to look more pleasing to the eye and emphasis certain features but in doing so does not necessarily have more information. Typically the algorithms that have been designed by ultrasound companies to smooth out speckle rely on frame averaging. This works well for still images but for dynamic sections of speech data it blurs the movement. So care is needed. Frame averaging can be applied in AAA without affecting the underlying data.

Q: *What is the frame rate?*

A: The frame rate is not set independently. The frame rate arises from three factors.

1. The depth setting. Lower depth = faster frame rate.

2. The field of view e.g. 80% maximum field of view uses 80% scanlines and so increases the frame rate

3. A gross scanline density. For the Micro there is a choice of 64 or 128 scanlines for 100% field For the EchoB the lowest setting is 128 and is why the EchoB generally has slower frame rates for similar depth and field of view.

Q: *How long can recordings be?*

A: AAA and SonoSpeech can handle recordings of a couple of minutes duration although we recommend keeping them shorter than that to make it easier to find the bit you are interested in. There is also a continuous direct-to-disk recording mode where you can keep recording for an hour or more, as long as you don't run out of disk space. It chops the recording up into a series of overlapping recordings where you get to choose the length of these sub recordings and the amount of time by which they overlap.

Q: *Can I try EchoB and Micro before I buy?*

A: We can't loan you a system but you can use the software and see the quality of the data that you will get from the systems. Go to www.articulateinstruments.com/downloads where you will find an installer for AAA. There is a demo project included with some samples. Another separate demo project which has further examples of Micro and EchoB data with automatically splined data is available at www.articulateinstruments.com/Micro%20EchoB%20samples.zip Unzip it and then use the File|open project… menu in AAA to select and open it. You will find a video tutorial describing

the splining process here:
http://materials.articulateinstruments.com/AAA%20tutorial%20videos/Spline fitting subtitled.mp4

and you can try it out for yourself.

Q: *Can I try SonoSpeech before I buy?*

A: Yes. Although you can only view pre-recorded data (not live data) you can try out features like adding markers on top of the moving ultrasound image. Go to www.articulateinstruments.com/downloads where you will find an installer for SonoSpeech.

You can also view a short video of SonoSpeech being used for therapy.

https://www.dropbox.com/s/vjew5iekg8rxwa5/SonoSpeech%20cleft%20intervention%20example.mp4?dl=0

ULTRAFIT HEADSET

Q: *Should I get the UltraFit headset or the aluminium one?*

A: UltraFit is cheaper, lighter, much more comfortable, fits a wider range of heads (bigger and smaller) and has a similar performance under typical usage. If you are willing to put up with a high degree of discomfort, it is possible to get the aluminium headset to grip the head more tightly and provide greater stability but in practice no-one ever does this.

Q: *Is the UltraFit headset entirely plastic?*

A: By default it comes with steel nuts & bolts because they won't wear out. For an additional 40GBP we can provide A nylon bolt and knob kit or you can specify this kit instead of the default steel kit.

Q: *What age range does the UltraFit headset fit?*

A: It is designed to fit the largest adults and children as young as 4.

Q: *I want to use the ultrasound system for visual feedback and not research. Do I need the headset?*

A: It is not essential if you are teaching highly contrastive tongue shapes like front vs back articulation. But it is tricky to hold the probe steady in the right position and holding it slightly off the midsagittal plane can produce very different tongue shapes to the true midsagittal shape. You can get double humps or double edges as the beam crosses a grooved midline.

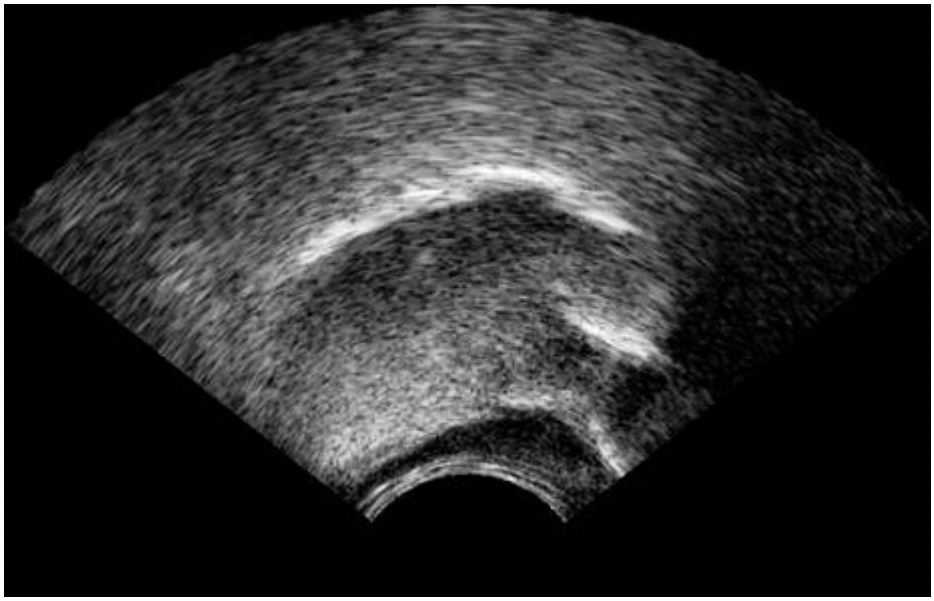
Q: *Does the UltraFit have a mounting for a camera?*

A: Yes. An adjustable arm and camera can be purchased separately. The camera can be mounted in profile or be front facing and is positioned at sufficient distance to capture the lower half of the face.

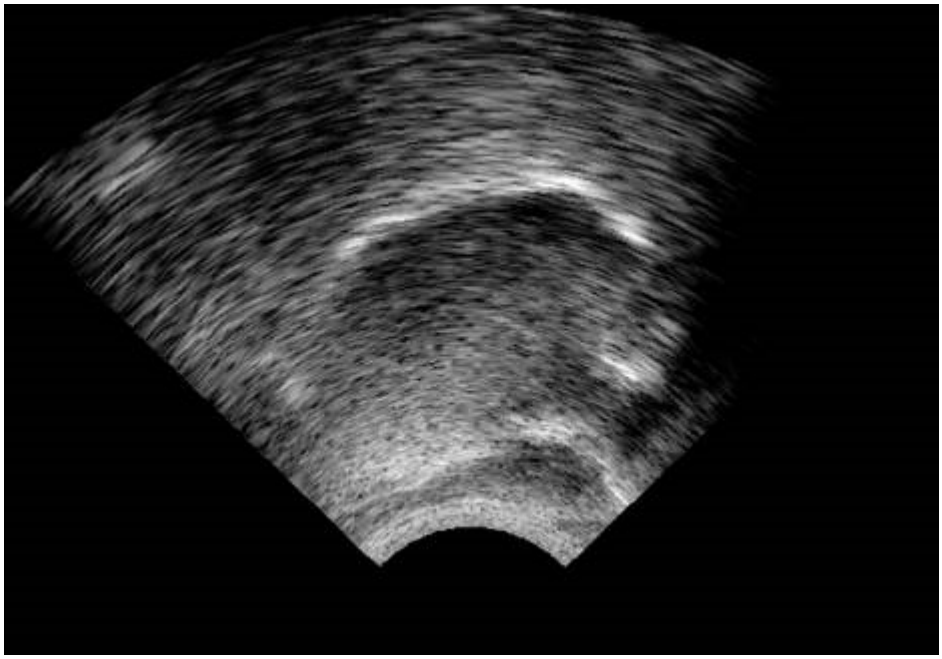
APPENDIX A

Image quality will vary due to

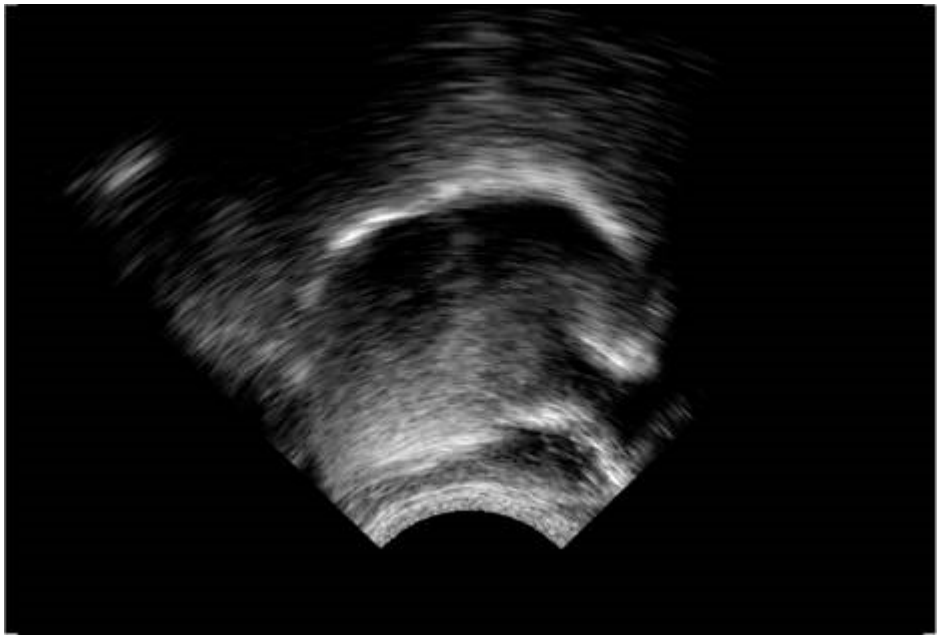
- Number of scanlines
- Image processing e.g. frame averaging
- Probe frequency (lower frequency is grainier but brighter especially at depth where you may see nothing at all if the frequency is too high)



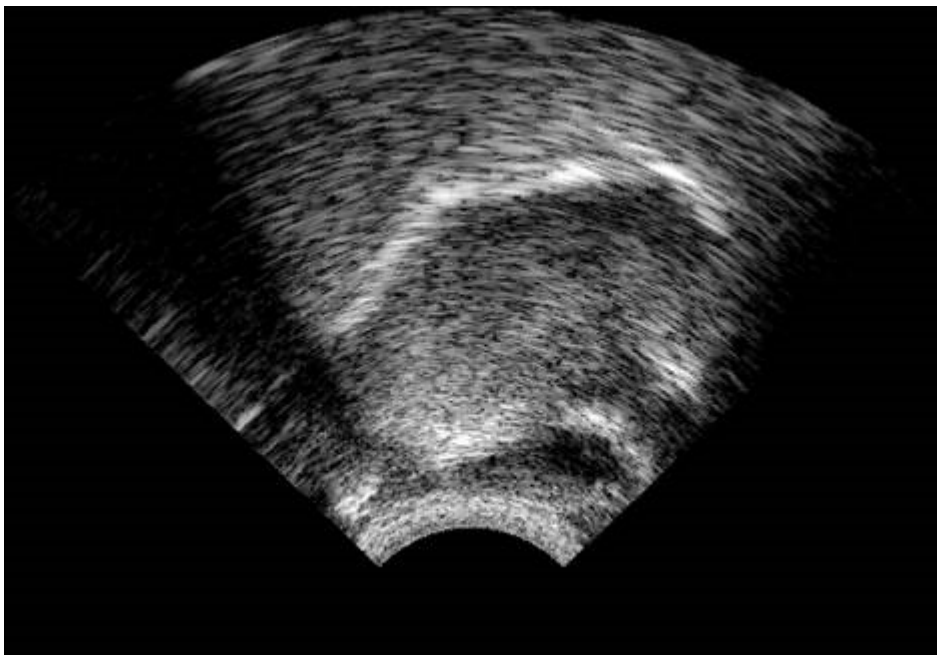
EchoB 127 scanlines; 60.3 frames per sec; Field of view 103 degrees



Micro 64 scanlines; 81.2 frames per sec; Field of view 92 degrees



Micro 64 scanlines; 81.2 frames per sec; Field of view 92 degrees with frame averaging



Micro 128 scanlines; 40.8 frames per sec; Field of view 92 degrees

Download videos to see difference between 2MHz and 4MHz setting

https://www.dropbox.com/s/ahi5di3pz178i3s/Micro4MHz.mp4?dl=0

https://www.dropbox.com/s/12wjpdh9b7xdj36/Micro2MHz.mp4?dl=0

Download videos to see difference between EchoB and Micro

https://www.dropbox.com/s/1zra77cjoi8r5wp/Micro%20Price.mp4?dl=0

https://www.dropbox.com/s/jyvbc8yhhkj9c3g/EchoB%20Price.mp4?dl=0