

Augmentative and Alternative Communication for use in a sailing boat

The purpose of this project is to develop a method of communication for use in a sailing dinghy with someone who uses Augmentative and Alternative Communication (AAC)

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Introduction

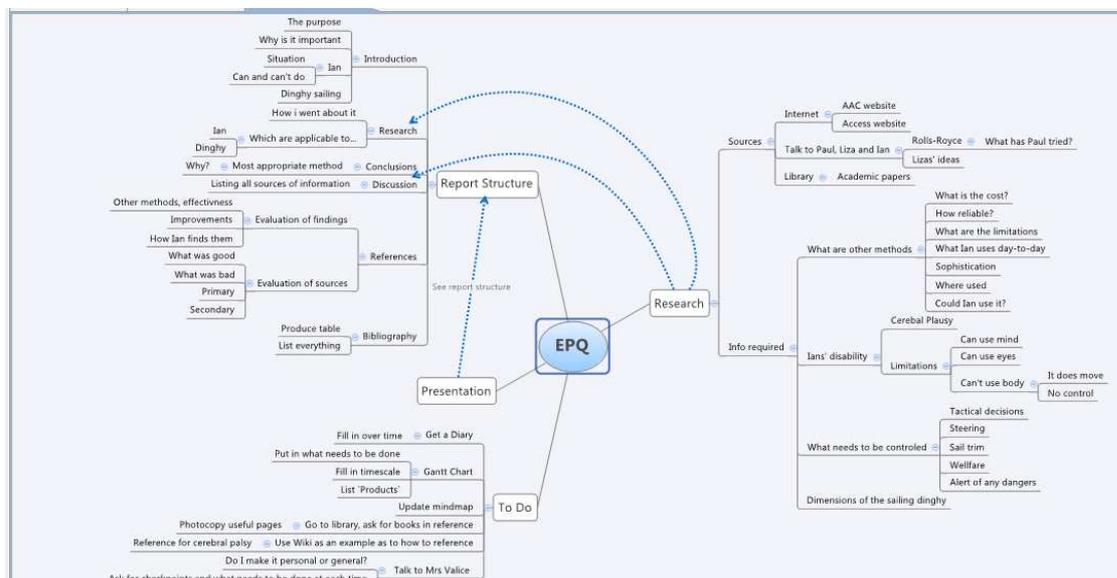
The purpose of this project is to develop a method of communication between the helm and crew on a small sailing dinghy (Access 303) when one of the sailors is disabled and can only communicate using augmentative and alternative communication (AAC). Augmentative and alternative communication is the general term for an assortment of different methods to communicate, due to speech impediments or being unable to talk. Examples of this are sign language and eye pointing.

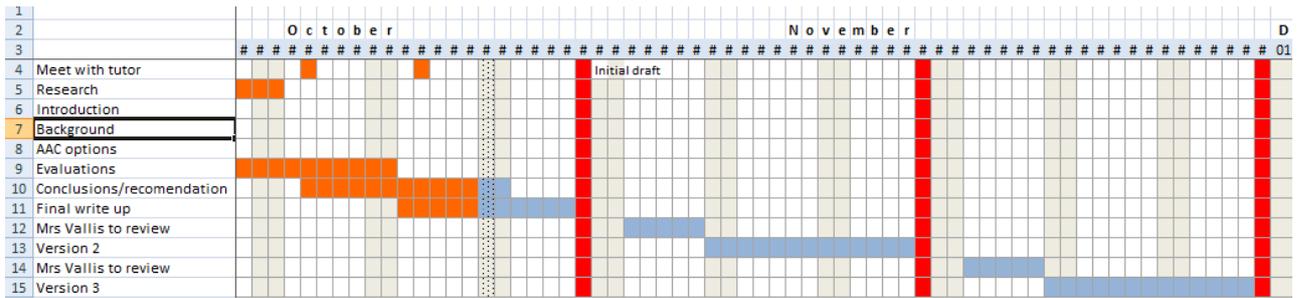


This project is important to me because I sail with my friend Ian, aged 14, who has cerebral palsy. We are currently National champions two years running in the Access 303, however, existing AAC techniques are not designed with sailing in mind and so currently it is difficult for me to understand what Ian wants me to do. I would therefore like Ian to be able to communicate with me using a better method so that he can have more involvement in the boat.

Approach

To plan my work approach and manage my time I made a list of things that needed to be done. I then constructed a gantt chart to give myself deadlines.





For research, I have the use of many sources, including Ian’s family, other disabled sailors, the internet, academic papers on AAC and suppliers of AAC equipment to find the most suitable method. I also looked at what Ian uses on a day-to-day basis around his home, both electronically and manually. I then considered which method was most suitable to be adapted for use in a dinghy and then set about developing a new AAC system for us to use when sailing and racing.

Sailing with Ian

Ian

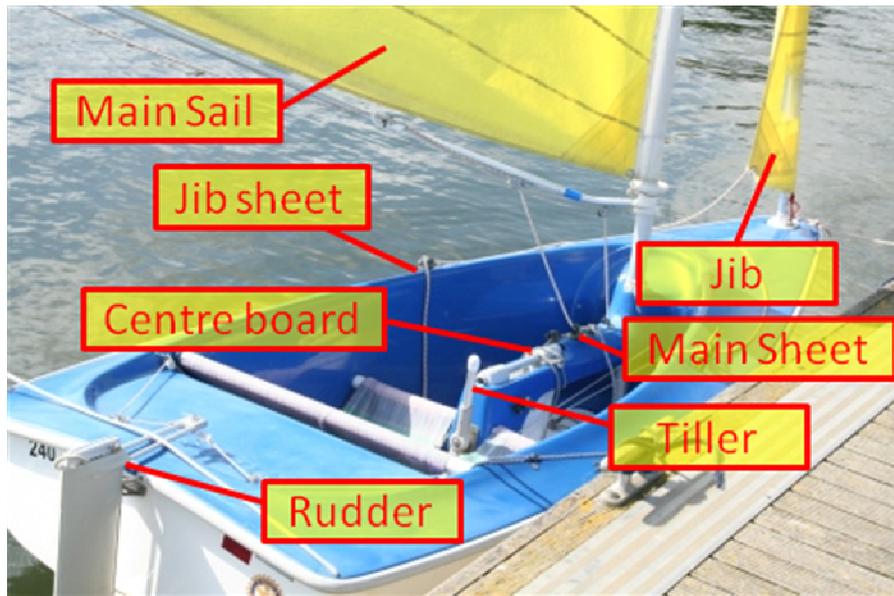
I started sailing with Ian in August 2011 after we met at my sailing club. Ian has Cerebral Palsy and is therefore unable to sail by himself. Cerebral Palsy is a condition that affects muscle control and movement. It is usually caused by an injury to the brain before, during or after birth. This results in a range of physical disabilities and varies from person to person. Children with cerebral palsy have difficulties in controlling muscles and movement as they grow and develop. In Ian's case, he is unable to control any of his body movements as well as being unable to talk. In effect the motor control centre which connects his brain to his muscles is "jumbled". As a result, messages from the brain aren't translated properly making Ian's movements random and uncoordinated. Ian can, however, control his eyes and hearing as well as having very good mental ability. He can also make some sounds. Ian's parents, Paul and Liza, have developed approaches to communications that utilise this and do enable Ian to interact with others. They do this using a technique known as Augmentative and Alternative Communication (AAC).

AAC is an umbrella term for different methods of communication when people struggle or can't talk. Each AAC is specific to the user. It can be both un-aided and aided and can use a range of devices to help communicate. Aided AAC is where there is some sort of device, high or low tech, that helps people to communicate, whereas unaided is done solely through body or eye movements.

Ian uses eye movements to communicate utilising both aided and un-aided techniques. In the past Ian has tried various different methods of communication, from stickers to I-pads. Ian is currently using a computer at home which follows his pupils using an infra-red signal sent by a camera which bounces off his retina. This enables Ian to communicate with other people as the computer talks what Ian is writing with his eyes. It is, however, hard for Ian to use as it requires a lot of effort. He also uses 'yes/no' stickers on his wheelchair which is easy for him to use and he can take anywhere, allowing people to ask him basic questions and for him to give a yes/no response by looking at the appropriate sticker. He also uses a book which has special symbols so that he can make sentences by looking at the appropriate sticker, however, when sailing Ian can only use un-aided methods as at current, all aided methods are not suited to sailing. This therefore limits his communications to "yes" and "no" answers, making communication on a boat difficult. Furthermore, Ian and I sit next to each other, making it hard for me to see his eyes.

The Access sailing dinghy

The Access dinghy is a small two handed boat designed so that anybody can sail, however, it is specifically designed for the disabled. The boat is designed around stability and easy use of the controls. The helm and crew are low in the boat giving it a lower centre of gravity which, together with a large heavy keel, ensures it does not capsize. Unlike most boats the helm and crew sit side-by-side in the boat facing forwards. A lever in-between them controls the rudder and enables either of them to steer. The other controls are the main sheet that controls the main sail and the jib sheets that control the jib (the smaller sail).



The design of the Access enables people with a range of disabilities to sail. Options are:

- Sail on own with no aids. Able bodied but wheelchair bound people can sail as there is no need to move around the boat
- Sail on own with aids. A range of technologies such as the sip and puff method
- Sail with a buddy, some control for example they can only steer
- Sail with buddy, giving direction (how Ian and I sail, however, I want Ian to be able to give more instructions)

There are regular races organised for the Access class and I race with Ian – we currently are the National champions for the 2-hander 'buddy' class.

The racing is set, depending on venue, with either a triangular, trapezoid or occasionally windward/leeward course, and our Nationals are generally a trapezoid. When going upwind, as you can't go straight into the wind you must tack upwind which is sailing at 45 degrees to the wind and turning through it to get to the windward mark. Each race lasts for approximately 45 minutes. There are usually 6 races in an event over 2 days.

Requirements for AAC in a dinghy

As Ian is able to know when to tack and get on the laylines (the minimum distance you have to be from the wind whilst still being able to make it to the mark) I'm hoping to develop a method which enables him to communicate with me so he can tell me when to tack, as well as other important things such as where the other boats are, or if he needs to go in. This therefore gives him a more enjoyable experience and participation (as well as taking a lot of the pressure off of me). In Ian's case it would be very difficult to develop a system for him to control the boat directly so my aim is to develop AAC methods to enable him to communicate with me more effectively.

In order to establish the requirements, I spent time discussing options with Ian and his parents. We came up with the following list of requirements:

- It must be affordable
- The method must be robust and waterproof (if using electronics)
- It must be able to fit in a boat
- Easy for Ian to use
- Easy to see, from the other persons perspective, what Ian is asking for
- Easy to learn
- Preferably adaptable to other boats if Ian wishes to change class
- Enable the communication of a range of commands including
 - when to tack
 - steering the boat, e.g. changing course
 - when to reef
 - sail adjustment: tighten/ease sails
 - stop/finish

The approach I took was to evaluate available AAC techniques and consider which could be used by Ian and applied to a sailing dinghy.

AAC options available today

There are a variety of methods available for those who use AAC that can make their lives easier and give them “a key to mental freedom” (Brown C.). These methods are categorized by two main titles, aided and unaided communication. Unaided AAC is the use of body and eye movements. Aided AAC is then categorized again into low and high technology. Listed below are the main AAC options available. For each, I have assessed the suitability for use by me and Ian in our Access dinghy. I have done this by evaluating how well they meet the requirements listed above.

Unaided

Unaided AAC is communicating with the use of eye pointing and/or body gestures. There is no external help involved.

The advantages of this are:

- Costs nothing to use
- Will always be available to Ian when he needs it (he doesn't need to keep turning it on or off like the computers)

However:

- It limits what Ian can say to yes/no
- Whoever is communicating with him needs to guess what Ian is wanting and ask the correct question

“Yes/no” gestures

“Yes/no” eye gestures involve Ian looking right for “yes” and left for “no”. This is what I predominantly use for communication with Ian however, it can only enable him to give yes or no answers. This limits what you can ask him. It also means that you have to guess what Ian is wanting and ask him the right question.

This method could be adapted for the boat by getting Ian to look at where he wants me to go. The problems with this are that it would be a long process involved as I would have to ask several questions until I reach the right one. It will also require a lot of concentration from Ian and it will be hard for me to tell whether he will be looking out the boat or whether he wants me to do anything. Also there will only be a limited number of instructions. It is, on the other hand, completely free and can easily be set up in a boat.

Advanced gestures

Advanced gestures are methods of communication with your body movements for example, sign language. This method, although it could be adapted for sailing use and communication on a boat, is beyond Ian's capability.

“gestures can get you a cup of coffee in the morning, but they do a poor job of telling your friend about that delicious piece of cake you had the other night.” Michael Williams (1994)

Low technology

Low technology is the communication method using equipment that uses no form of electricity. This can be the use of books and picture boards. As with any product, the low technology methods have their advantages and draw backs.

The advantages of low technology methods are:

- Low cost and low repair costs
- Increases the range of communication greater than unaided methods
- Durable, no electronics so you don't need to worry about them getting wet.

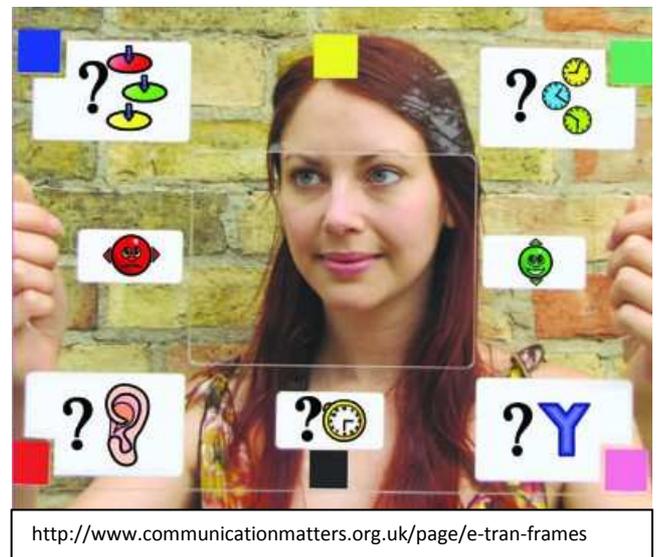
However:

- There is a limited amount of command
- It can be difficult to see what Ian is looking at (especially if you are side-by-side)

E-tran frames

E-tran frames are a basic but effective method of communication. They involve a number of symbols around a board with a gap in the middle. Someone holds the board, facing the person using AAC. The other person can then look through the gap and see which symbol they are looking at. However, there is only a limited amount of space for the symbols and it's not very effective when sitting side by side. I am also unable to hold the frame as I need both my hands to sail the boat.

It is however, possible to be adapted for sailing. It can have stickers to help Ian ask me what he wants. On top of this, I could use parts of the boat, along with the stickers as a way for Ian to be more specific in what he is asking. For example, by looking at the main and then the "sheet in" sticker, I know to sheet in on the main.



Tobii C12 with C-eye

This is a computer designed to follow the eye of the user. It follows Ian's eyes and says what Ian is looking at. It has a grid system with various phrases/words on just like most other techniques, but it also has the ability to allow people to write in their own sentences. This will then allow us to write in exactly what needs to be said for that day. It is also possible to mount the computer on a stand in front of Ian. However, this computer system is very expensive (£11,000) and not very robust.



I could develop this method for sailing by typing in the instruction Ian would need to use, for example "tack" or "bear away". To prevent water from getting in to it, I could design a special waterproof case. This, however, would be very hard to do as it still needs to be able to read what Ian's eyes are doing.

Chin switches

It is possible for Ian to use chin switches. There are chin switches that, when pushed, say certain things. There are also chin switches that can control the movement of chairs and various other pieces of equipment. They can easily be attached to Ian's chair and robust enough to survive being in a boat. However, although Ian can use them, he finds using them very hard and can sometimes hit a button randomly.

To develop them for sailing, I could programme them to say various instructions so that Ian could hit the instruction he wants. This however, limits what can be instructed to the number of chin switches available and would be hard for me to tell whether Ian hit the switch on purpose or by accident. Furthermore, as the boat is heeled over, Ian can't keep a central position within the boat.

Apple iPad

Another possible method is the I-pad. There are several apps designed for AAC, such as the app 'ClaroSpeak UK' and 'Image2talk' as well as many more. These have their own methods of AAC and it is possible to download the app to suit the needs of the user. It is also possible to get special protective cases and mounting.



How this could be adapted for sailing is by using special cases and mounts to make the I-pad waterproof and in an easy position for the user. With the app best suited to the user, it's possible to put sailing instructions into the app and use it as a method of communication on the boat.

This is, however, beyond Ian's capability but it does provide various communication methods designed for people with cerebral palsy and can be a method of communication for others.

Assessment for use in a dinghy and by Ian

This table is taking some qualitative data and allowing me to turn it into quantitative data. The methods are assessed against each of the requirements for use in a sailing dinghy and graded 1-5, 1 being the worst and 5 being the best. The method with the highest score is the most recommended.

Option	Affordable	Robust	Easy to fit in boat	Easy use	Easy to learn	Adaptable	Total
Eye-pointing	5	5	5	1	1	3	20
Gestures	5	5	5	1	1	3	20
E-Tran	4	3	4	5	4	5	25
Ian's book	4	4	3	2	3	5	21
Tobbi C12 with C-eye	1	2	3	5	5	5	21
Chin switches	4	5	3	1	3	5	21
I-pad	2	3	3	1	4	3	18

Developing an AAC method for use on our Access dinghy

From the results above, I can see the most effective method of communication is the E-tran frames. This came out on top because it is relatively easy to use and can be adapted to suit the needs of the user. It is also cheap and can be adapted to suit sailing. It is robust enough to survive knocks from both Ian and the boat and if it does break it can be easily replaced or fixed. However, when using E-tran frames, the people involved need to be facing each other, whereas Ian and I sit side by side and I also need to be able to look out the boat. On top of this I need to be able to use my hands rather than holding the E-tran frame.

Idea for “mirror assisted eye-pointing”

To resolve these problems, I came up with the idea of using a mirror. This will enable me to see Ian’s eyes and what he is looking at, whilst sitting next to him. Surrounding the mirror will be the E-tran frame with various sailing instructions.

Initially I emailed Liza and Ian explaining my method and asking whether it was possible. Liza then tested this with Ian, asking his Carer to sit next to him, facing a mirror, and ask him questions she did not know the answer to. They fed back that the technique worked and so I started thinking about building a prototypes we could use in the boat.

Design and build

To build this method I had three components to take into consideration: the mirror; mount and the E-tran frame.



I tried several different types of mirror to see which would be most effective. I then decided on the use of the rear view mirror from a car. This was small enough to fit in the boat, whilst being big enough for me to see Ian’s eyes. It was also flexible and could be adjusted to the correct angle. I got this from a car breakers yard for £10. I used a camera mount to attach the

mirror to the boat. The mount had two adjustable parts to it, with a clamp at the bottom and a camera mount at the top. This therefore enabled Ian and I to attach the mirror to the boat and then adjust the angle of the mirror to suit us both.

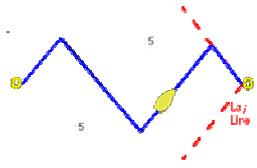
For the E-tran, I created some symbols to use and laminated them to protect them from the water. Once laminated, I cut a hole in the centre to allow them to go around the mirror and make it easier to attach the laminate to the mirror.



I initially started with four symbols which are shown below:



Finish/Head in!



Tack



Something else!



Cold



The end result fitted securely to the boat.

I had a quick test with Ian to make sure we could see what was going on. This was successful as I could easily see which symbol Ian was looking at, however before we launched and tried this method on the water Ian was confident that we could use a frame with eight stickers: tack, head up, bear away, sheet in, sheet out, something else, stop/finish, cold.





Results

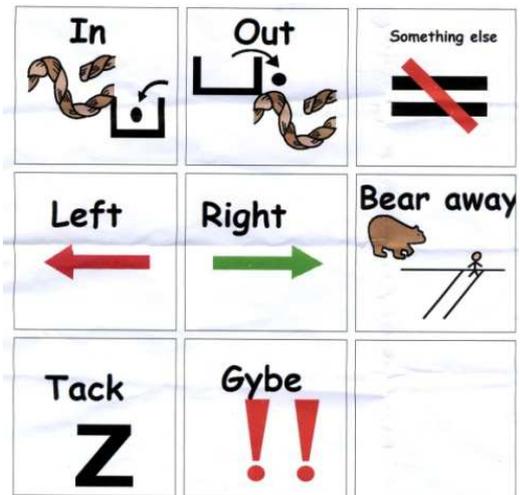
Once on the water, I checked everything was stable and then set Ian a course to sail around some buoys, whilst I kept my focus on the mirror and the sails rather than the direction of the buoy. Ian then successfully steered us around the course by calling each tack using eye pointing and the E-tran. We predominantly focused on the tack commands, but also developed the use of head up/bear away commands as well. We repeated this several times, each time becoming more efficient than the last. Overall we used a total of four commands effectively: tack, head up, bear away, Stop/finish.

The mirror was held in place securely and there was little disruption from the wind. It was angled so that it was easy for us both to see what was going and was comfortable for both of us to use. On top of this, the E-tran frame and mirror were small enough that they didn't disrupt the sails or get knocked by them though the tacks and gybes. Furthermore, I was able to continue focusing on what Ian was asking of me, whilst keeping my head out of the boat.

Next steps

Improvements to the design

Overall, the method worked well. When we got back in, I asked Ian how he thought it went and asked him to email me with more details about what he thought worked well and what didn't. Ian and Liza's email was very encouraging and they said "Really impressed with E-tran frame mirror combination. Low tech still has an important place in providing solutions. Ian was pleased with it and felt it worked". As a result of this email, Ian is working on new symbols which he understands – shown on the right. This is because it is like learning a new language, but it is easier for him to learn if he makes it. Also I am working on protecting Ian more, as on occasion, his legs hit the mount which was painful and uncomfortable. Furthermore, I can increase our vocabulary by putting stickers around the boat as well as the E-tran as the mirror enables me to see which part of the boat Ian is looking at.



We plan to develop the system and use it when we are sailing in 2013. It will definitely enable Ian to be more involved with sailing and get more enjoyment the competition of racing.

Conclusion/recommendation

My aim was to develop a system for someone who uses Augmentative and Alternative Communication so that they have more involvement in sailing. By adapting two techniques, a mix of eye pointing and E-tran frames, I have managed to come up with a new technique of communication that can increase the enjoyment of sailing further which I have called “mirror assisted eye-pointing”. It is a cheap and robust technique, easy to learn, and can be adapted for any situation. As an early prototype, this method has increased Ian’s involvement in sailing so the project has been a success.

In addition, whilst undertaking this project, Ian and I have met many people and this has resulted in increasing sailing opportunities for both of us and inspired us to go further with our sailing. We are currently considering a plan to sail our boat across the English Channel.

I now understand more about how Ian communicates making it easier for Ian and I to sail together.

I would recommend this method for others with a similar situation as it can be easily adapted for many uses.

Furthermore, this method can also be adapted to fit a wheelchair, allowing the user to communicate to the person pushing the wheel chair whilst moving, rather than having to stop and see what the problem is.



APPENDIX

References

Title and description	Publication date	Author	Link
Wikipedia description of AAC	2012 (last modified)		http://en.wikipedia.org/wiki/Augmentative_and_alternative_communication
Augmentative & alternative communication: supporting children & adults with complex communication needs (3rd ed.)	2005	Beukelman, D. R.; Mirenda, P	Paul H. Brookes Publishing Company. ISBN 978-1-55766-684-0
What is Augmentative and Alternative Communication? An Introduction		Sally Millar and Janet Scott	http://www.acipscotland.org.uk/Millar-Scott.pdf
Alternatively Speaking Vol. 1	1 April 1994	Williams, Michael	ISSN 1075 3982
Communication Matters web site Good list of AAC techniques			http://www.communicationmatters.org.uk/
Good definition of AAC			http://uk.dynavoxtech.com/conditions/cerebral-palsy/communication/what-is-aac/
E-Tran frames			http://www.communicationmatters.org.uk/page/e-tran-frames
iPad AAC apps			http://appsforaac.net/
My Left Foot	1990	Brown C.	
Royal Yachting Association Sailability – responsible for organising sailing for the disabled in the UK			www.rya.org.uk
Access Class Association			www.accessclass.org.uk
Communication Matters – organisation that develops AAC techniques			www.communicationmatters.org.uk